2015-2036

MMM – City Wide Integrated Public Transport Plan

Annexure i

INTEGRATED
PUBLIC
TRANSPORT
NETWORK

MMM IPTN Team
09 September 2019
Revision 6.0

MANGAUNG
AT THE HEART OF IT ALL

Content

I Traffic Impact Study

I.1 Traffic Impact Study - Maphisa/Moshoeshoe Corridor

QUALITY REVIEW

Client Reference: Contract No.: C447

GladAfrica Reference: Project Number 127

Project Name: Integrated Public Transport Network (IPTN)

Report Heading: **Phase 1 Trunk Route Traffic Assessment Report for the Integrated Transport Network Project, Mangaung Metropolitan Municipality,**

Compiled by: Adrian Brislin Pr.Eng. Signature: _____ Date: 20 Aug 2018

Reviewed by:Leon Van Genderen Signature: _____ Date: 20 Aug 2018

Released by: Sarel Oberholser, Pr Eng. Signature: _____ Date: 20 Aug 2018

I, **Adrian Brislin Pr.Eng**., author of this traffic Assessment report, hereby certify that I am a professional traffic engineer (**Registration number: 980355**) and that I have the required experience and training in the field of trafrfic and transportation engineering, as required by the Engineering Council of South Africa (ECSA), to compile this traffic report and I take full responsibility for the content, including all calculations, conclusions and recommendations made therein.

Signature: _____

Received and accepted by a duly authorised representative of the client

Client representative name: Abednigo Lekale

Signature:_____ Date: _____

Client representative name: Steve Rapulungoane

Signature:_____ Date: _____

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Nomenclature

CBD	Central Business District
IPTN	Integrated Public Transport Network
MMM	Mangaung Metropolitan Municipality
NMT	Non-Motorised Transport
V/C	Volume / Capacity Ratio
LoS	Level of Service
QB	Quality Bus
UA	Universal Access

1 INTRODUCTION

This report only looks at the Phase 1A section up to the Harvey and Rhodes Avenue as the section closer to the Central Business District and the Intermodal Facility will be modelled and assessed under the O.R. Tambo Route. The O.R Tambo bus route will be the next implementable section of the IPTN.

We have also only looked at a 5 year traffic horizon in our evaluation, since the purpose was to evaluate the initial Quality Bus operation which is to operate in early 2019. The route had to be evaluated with initial minimum requirement bus stations so that no immediate land acquisition would be necessary for construction to proceed. However, the 10 year horizon bus volumes (30 buses per hour) have been used and integrated with the 2023 traffic. Also, after 5 years the feeder services for both Phase 1A and Phase 2(Route via Dr Belcher Road) will also be in operation, which will change the traffic distribution of both private and public transport.

Furthermore, the Waaihoek Bridge Option is highly unlikely to materialize in the next 5 years, this being another reason to only model as far north as the Rhodes Avenue intersection along Harvey Road.

2 PURPOSE OF THE REPORT

The purpose of this Traffic Assessment report following the "*Phase 1a and 1b Status Quo Traffic Assessment*" and reports, is to provide more detail on the actual traffic modelling of the key route sections, with recommendations regarding access management, the speed humps/pedestrian crossings along the route and the refinement of station positions given the road network characteristics.

This Traffic Assessment report consists of the following:

1) Model the existing Phase 1 route conditions
2) Identify current route bottlenecks and how these should be upgraded
3) Determine for which bus stations the bus can stop in the route roadway, as the final station requirements need land acquisition, but the bus operations should commence as quickly as possible
4) Refine the final station positions based on surrounding land-use and road network characteristics
5) Optimize the route access requirements and remove unnecessary speed humps/pedestrian crossings currently in place
6) Model the future traffic conditions with the Quality Bus (QB) stopping and intersection upgrades in order to verify future traffic operating conditions
7) Summarize the forecast traffic operations and achieved bus and mixed traffic speeds
8) Make final route upgrading recommendations

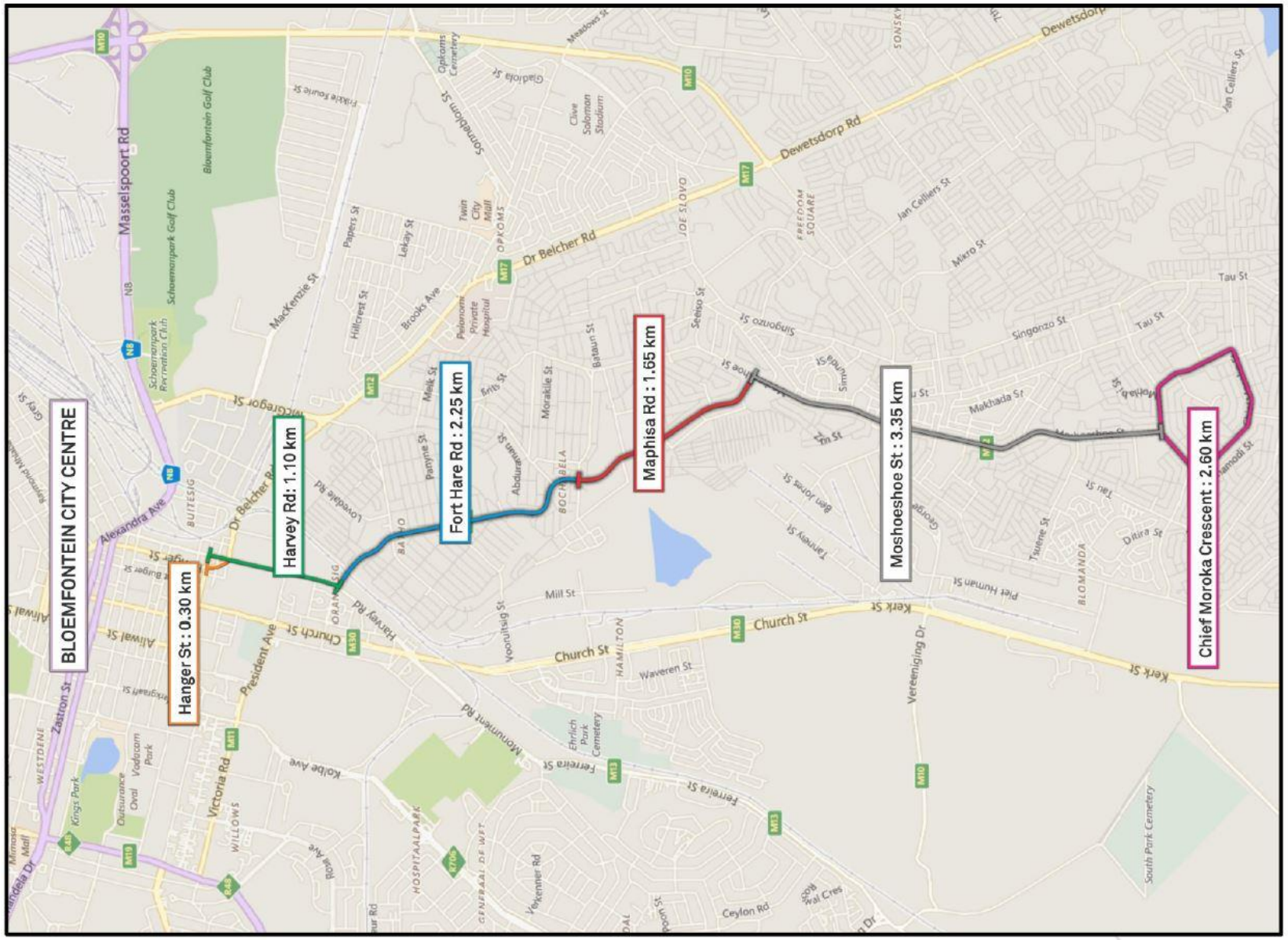

Figure 1: Sectional layout of the Phase1 trunk route for the Quality Bus

3 PHASE 1 IPTN TRUNK ROUTE CHARACTERISTICS AND OBSERVATIONS

The Phase 1 trunk route has some distinct sections with homogenous road cross-section and traffic operating conditions. These are shown in Figure 1 below and can be described as follows from south to north:

- Chief Moroko Crescent ring road which will be the clockwise turnaround loop (2,6km long and a single lane per direction with several speed humps and surrounded by residential areas and schools)
- Moshoeshoe Street from Chief Moroko to Maphisa Road intersection (3,35km long with 2 lanes per direction with either painted or curbed median island) This is construction Phase1c.
- Maphisa Road from Moshoeshoe Street to Mtyobile Street (1,65km long in total with three lanes per direction and curbed median island from Moshoeshoe to Maibamolotsha and 2 lanes per direction from Maibamolotsha to Mtyobile.) This is construction Phase1a
- Fort Hare Road from Mtyobile Street to Harvey Road (2,25 km long with 2 lanes per direction separated mainly by a painted median) This is construction Phase1b.
- Harvey Road from Fort Hare Road to Fort Street (800m long with 2 lanes per direction with a curbed median)
- Hanger Street from Fort Street to proposed intermodal transfer facility (300m long as a 3-lane one-way urban street)
- Reverse direction via Harvey Street directly to Fort Street intersection (300m long as a 3-lane one-way urban street)

The traffic counts used for the assessment comprised 2016, 2017 and 2018 intersection turning counts, which were all brought up to date to 2018 values. The diagrammatic volumes are depicted in **Annexure A**

4 2018 TRAFFIC MODELLING AND EVALUATION

The Level of Service (LoS) depends on the traffic delays at the intersection, either due to low capacity on the approaches, or due to inadequate signal timings for signalized intersections. LoS A represents the best operating conditions with minor or no delays while LoS F represents the worst operating condition with serious delays. Delays of less than 55, 50 and 35 seconds for signalized, roundabout and stop sign control intersection respectively are deemed acceptable as it is not lower than LoS D. The delay criterion for LoS is shown in Table 1.

Level of Service	Control delay per vehicle in seconds (d)		
	Signals	Roundabout	Stop Sign Control
A	$d \leq 10$	$d \leq 10$	$d \leq 10$
B	$10 < d \leq 20$	$10 < d \leq 20$	$10 < d \leq 15$
C	$20 < d \leq 35$	$20 < d \leq 35$	$15 < d \leq 25$
D	$35 < d \leq 55$	$35 < d \leq 50$	$25 < d \leq 35$
E	$55 < d \leq 80$	$55 < d \leq 70$	$35 < d \leq 50$
F	$80 < d$	$70 < d$	$50 < d$

Table 1: Level of Service (LoS) definitions for traffic evaluation.

4.1 MODELLING ASSUMPTIONS

1) The future traffic growth on the corridor will be taken up by an increase in Quality Bus patronage. However, the future model has effectively assumed a 2.5%p.a. growth rate for 5 years

2) The posted speed limit of the trunk route is 60 km/h except the Chief Moroko Crescent which is traffic calmed with a recommended speed of 40 km/h. This loop was not modelled.

3) The TRANSYT model was broken up into separate sections coinciding with the construction sub-phase designation of c, a or b travelling from south to north. The current signal timings were used for the existing analysis. Only the key intersections have been modelled.

4) The Fort Hare section was modelled to include up to the Harvey Road and Rhodes Avenue intersection.

5) It was not deemed necessary to model the Central Business District (CBD) section between the Rhodes Ave intersection and the Intermodal interchange as there are very few significant improvements that could be made. This section was nevertheless observed for its travel time during the peaks.

6) It was also deemed unnecessary to model the Chief Moroko Crescent as this is essentially a residential street with stop controls and speed hump/pedestrian crossings making it a traffic calming zone. This characteristic should nevertheless be maintained and therefore only travel times were observed.

4.2 RESULTS OF 2018 TRAFFIC EVALUATION

The detailed TRANSYT output of evaluation results is shown in **Annexure B.** These results have been summarized below and have been shown diagrammatically on the next pages.

4.2.1 Moshoeshoe Section- Chief Moroko to Maphisa

All intersections are operating at Level of Service (LoS) A and LoS B, with the odd stop control intersection operating at LoS C on the side road. An exception is the 3-way stop at Mamani, for which the poor LoS is for the main road traffic along Moshoeshoe. It was observed that very few motorists actually stop on Moshoeshoe, which is very dangerous for crossing pedestrians and the side road traffic.

The average speed for this section of the modelled network is 34 km/h for existing traffic conditions

4.2.2 Maphisa Section- Moshoeshoe to Mtyobile

All intersections are operating at LoS A and LoS B, with the odd stop control intersection operating at LoS C on the side road. The exception to this is the 2-way stop control at the Mtyobile intersection itself and the Maibamolotsha 3-way stop control, for which the critical approach operates at LoS F during the AM peak and LoS D during the PM peak. Notable also at this 3-way stop was that many motorists did not actually stop as is legally required.

The average speed for this section of the modelled network is 37 km/h for existing traffic conditions

4.2.3 Fort Hare Section- Mtyobile to Harvey/Rhodes

At the Fort Hare/Hamilton intersection during the morning (AM) peak the east approach right-turn and south approach through movement is presently operating at LoS F.

At the Fort Hare and Harvey intersection during the AM peak and afternoon (PM) peak the right-turn movement from the south is operating at LoS E/F.

At the Harvey /Rhodes intersection during the AM peak the right-turn movement and the straight-left movement from the west is operating at LoS E/F.

The average speed for this section of the modelled network is 19 km/h for the AM peak existing traffic conditions.

The results of the overall intersection LoS are shown in the following 10 diagrams.


Existing LoS
Legend
AM Peak
PM Peak
C
B
C
B
E
C
Rhodes Ave
Mannion Rd
Cross Rd
Kotze St
Falck St
Fort Hare Rd
Gemsbok St
Ngyaruya Rd
Hamilton Rd
Jeordan St
Xaba St
Rabulane St
Mohaleni St
Dispensary St
Mochera St
Lovedale St
Segeneco St
Lavers St
Khumalo St
Tona St
Kerk St
Krause St
Wakely St
Rancken St
Thepe St
Phathane St
Masenya St
Google Earth
N


Existing LoS
Legend
AM Peak
PM Peak
C
C
Cook Ln
Namane St
Diape St
African Rd
Makgothi St
Fort Hare Rd
Kosi Rd
Panyane St
Gonyane St
Choane Rd
Mooki St
Moiloa St
Motsumi St
Maphikela St
Makgatho St
Gabashane St
Jabavu St
Makoniiso Straat
Molokoane St
Thema St
Manabane St
Google Earth
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N
300 m


Existing LoS
Legend
AM Peak
PM Peak
A
A
Park St
Parkview St
Gabashane St
Dingaan St
Mkuhlane St
Nyokong St
Maleleka St
Morakile St
Sefotlhelo St
Molatedi St
Mathambo St
Mtyobile St
Fort Hare Rd
Isoal St
Taaibosch St
Google Earth
© 2018 AfriGIS (Pty) Ltd
Image © 2018 DigitalGlobe
300 m
N


Existing LoS
Legend
AM Peak
PM Peak
F
D
D
F
Mathambo St
Mtyobile St
Tsoai St
Kabane St
Maphisa Rd
Google Earth
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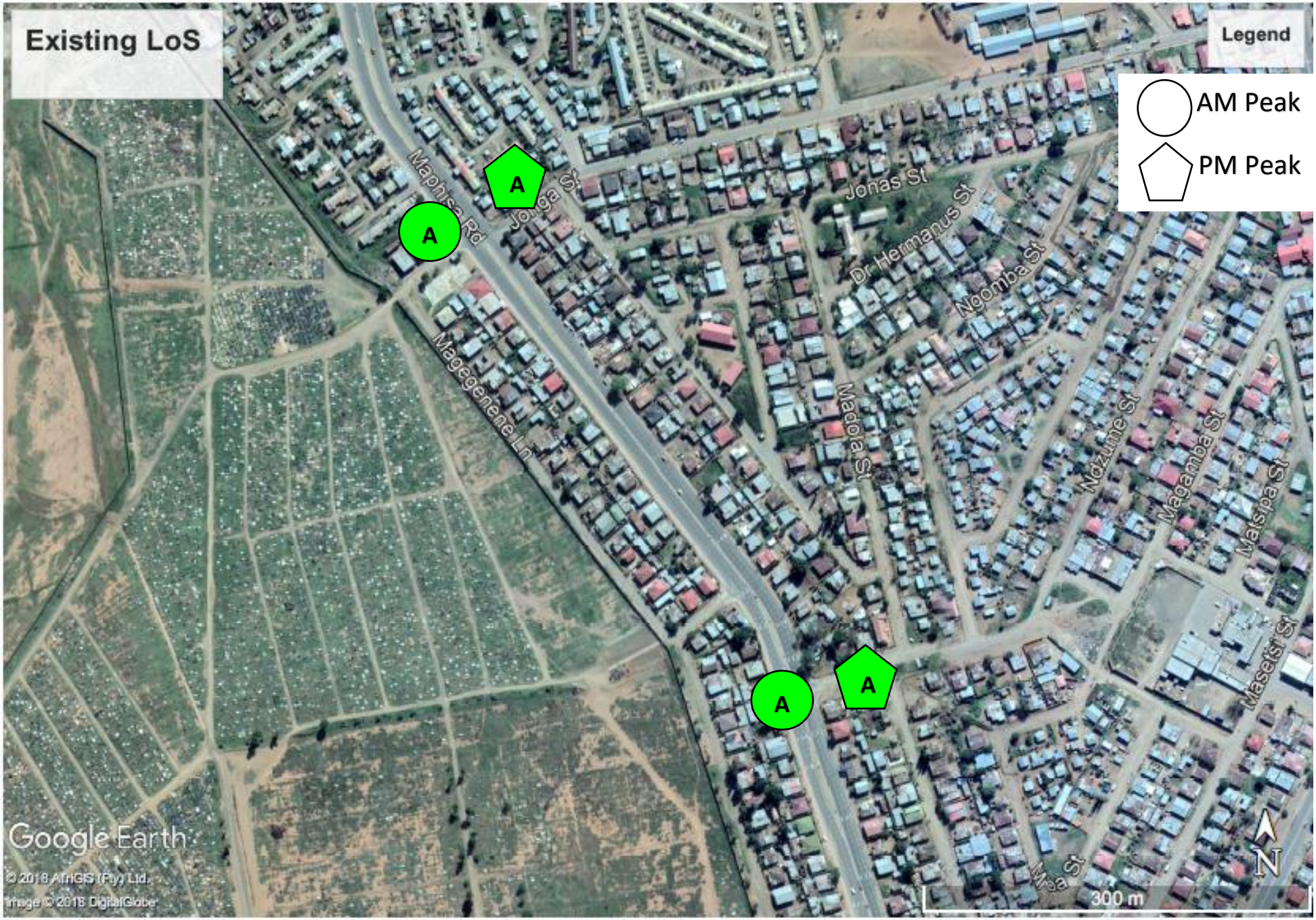
Image © 2018 DigitalGlobe
200 m
N


Existing LoS
Legend
AM Peak
PM Peak
A
A
A
A
Maphisa Rd
Jonga St
Jonas St
Dr Hermanus St
Ngomba St
Magegenene Ln
Madola St
Nozuma St
Magamba St
Maisipa St
Masetsi St
Mesa St
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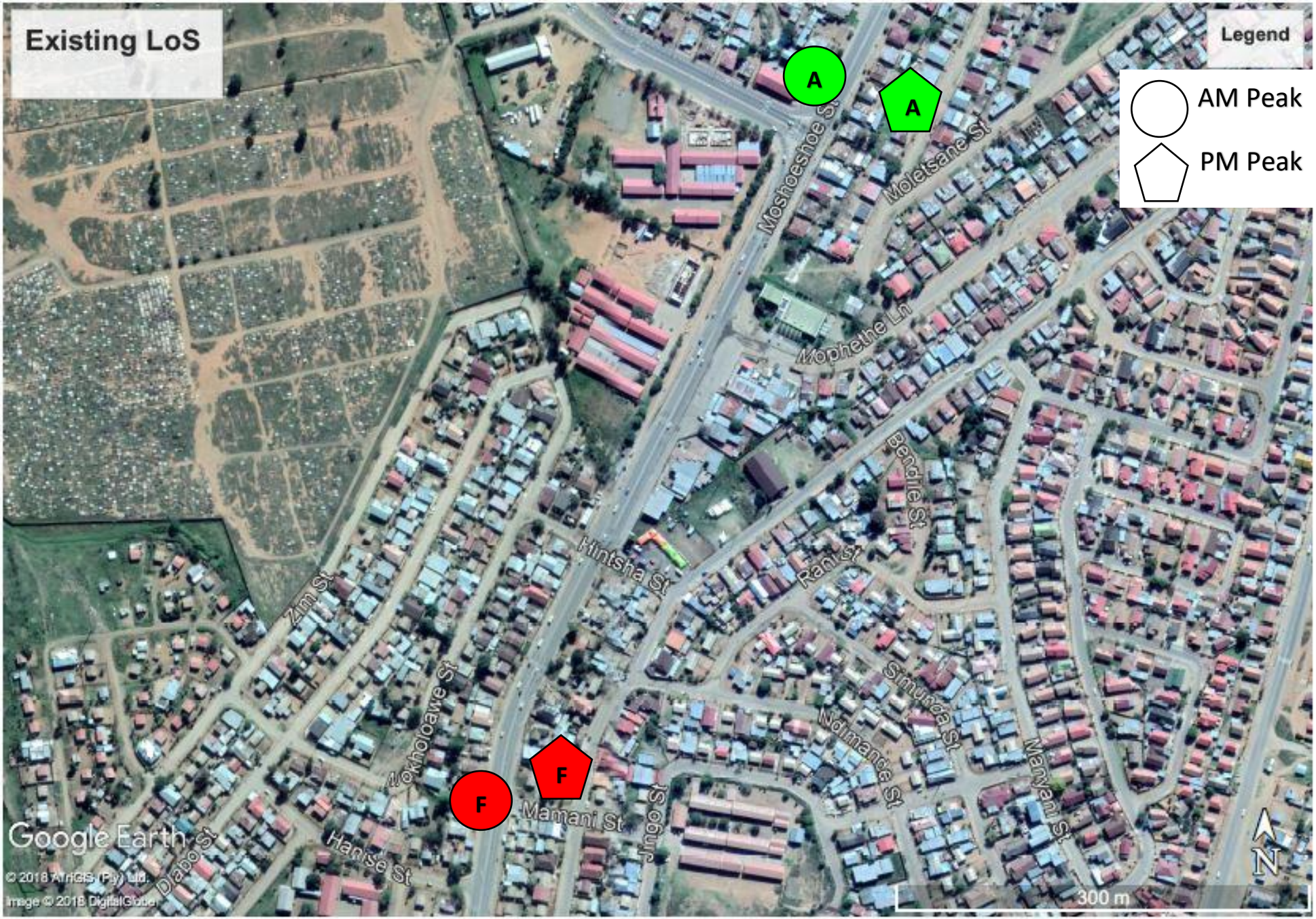
Existing LoS
Legend
AM Peak
PM Peak
A
A
F
F
Moshoeshoe St
Moletsane St
Mophethe Ln
Bendile St
Rani St
Hintsha St
Zim St
Mokholoane St
Mamani St
Simunda St
Ndimande St
Maryan St
Hantse St
Dabo St
Google Earth
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300 m
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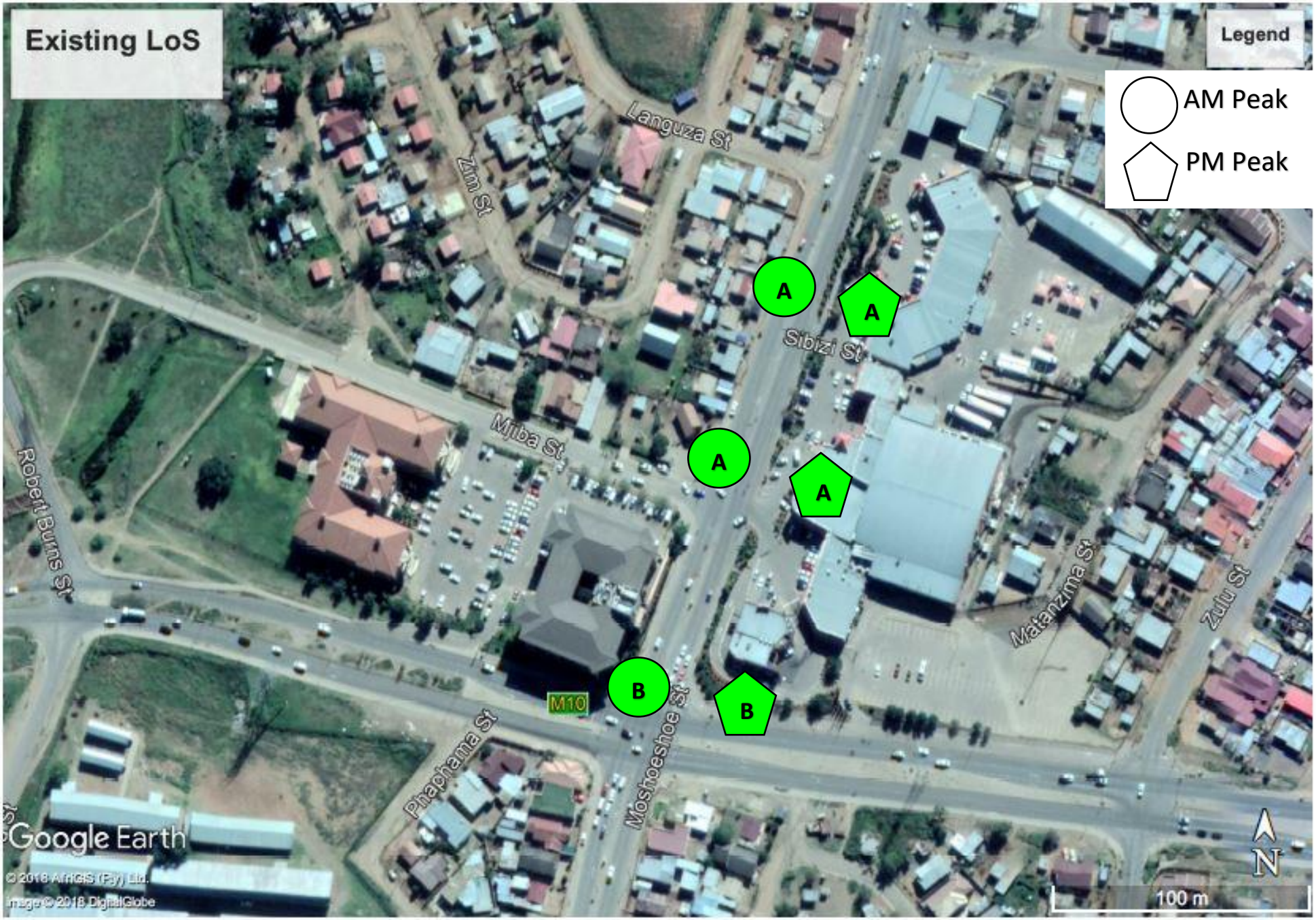
Existing LoS
Legend
AM Peak
PM Peak
Languza St
Zim St
Sibizi St
Mjiba St
Robert Burns St
Matanzima St
Zulu St
Phaphama St
Moshoeshoe St
M10
A
A
A
A
B
B
Google Earth
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N
100 m


Existing LoS
Legend
AM Peak
PM Peak
C
B
A
A
A
A
A
A
Khampepe St
Thakalekoala St
Tsekeletsa St
Motsekoa St
Romolehe St
Kamohi St
Thulo St
Moshoeshoe St
Mesenene St
Sefatsa St
Malefane St
Makhaola St
Lebitsa St
Motseki St
Molatole St
Google Earth
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200 m
N


Existing LoS
Legend
AM Peak
PM Peak
A
A
A
A
A
A
Molatole St
Thoko St
Machogo St
Maleta
Monze St
Leballo St
Seboko St
Makhaola St
Setatsa St
Lehasa St
Monirime St
Maseka St
Motloli St
Makhonofane St
Mokhutle St
Mosheeshoe St
Matlakhoe St
Mantsopamakhetha St
Mananeng St
Tau St
Tsuene St
Google Earth
© 2018 AfriGIS (Pty) Ltd.
Image © 2018 DigitalGlobe
200 m
N


Existing LoS
Legend
AM Peak
PM Peak
A
A
B
B
Rabai St
Mosiane St
Molawa St
Tsuene St
Molete St
Zanaheng St
Mohlabi St
Seheri St
Kgabushoane St
Tinapane St
Moshoeshoe St
Banyane St
Kgaie St
Phale St
Chief Moroka Crescent
Logabane St
Google Earth
200 m
N

5 PROPOSED CHANGES TO 2018 ROUTE FOR IPTN OPERATIONS

The following intersection upgrades which are deemed necessary for the future satisfactory Phase 1 Trunk Route traffic operations based on the existing evaluation above are listed below:

a) Intersection of Harvey Road and Rhodes Avenue- maintain existing slip lanes, but introduce a dual N-S right-turn phase on Harvey Road for all times of the day

b) Intersection of Harvey Road and Fort Hare Road- extend the south approach right-turn from 60m to at least 100m in length. Provide a short 4th signal phase for traffic from the south during the PM peak. Repaint the east approach two right-turn lanes.

c) Intersection of Fort Hare Road and Hamilton Road- remove the left slip lane from the south-west corner and replace with a 40m long exclusive left turn. Add an additional short right-turn lane from the east approach to cater for this high turn movement.

d) The 3-way stop at Maphisa and Maibamolotsha should be converted to stop control on the side road. The right turn lane and left slip lane on Maibamolotsha is to be retained. Although tested this intersection does not warrant signalization.

e) The right-turn lane from the north at the Moshoeshoe/Maphisa intersection and the one from the south at the Moshoeshoe/Tsuene intersection, should be converted to a single exclusive right-turn lane for better traffic operations.

f) Signals are warranted and should be implemented at the intersection of:

- Maphisa and Mtyobile
- Moshoeshoe and Mamani
- Moshoeshoe and Tsuene (to facilitate a bus /taxi transfer facility- Station 005)

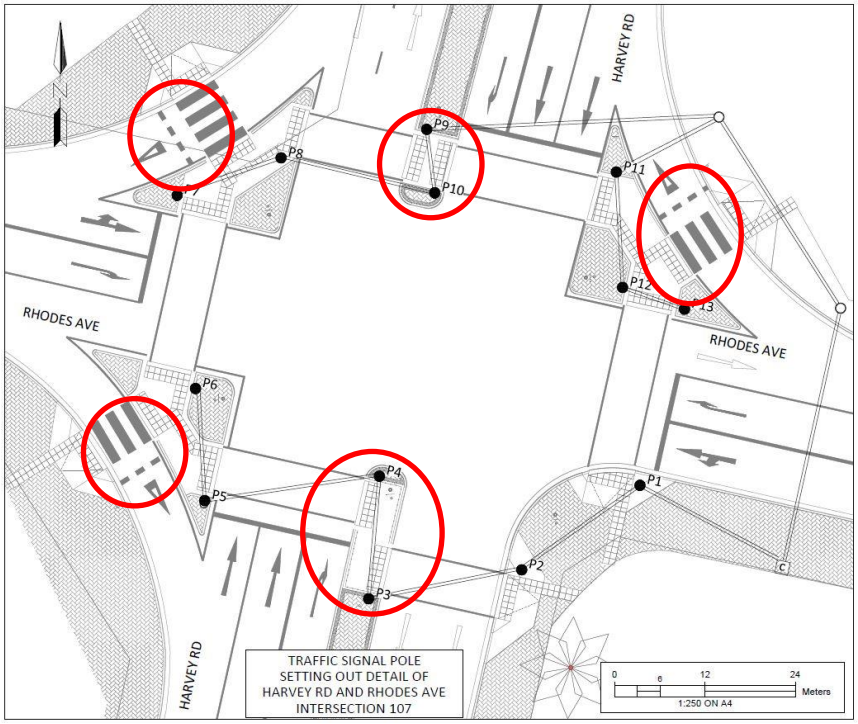


Figure 2: Proposed upgrade of the Harvey and Rhodes Avenue intersection

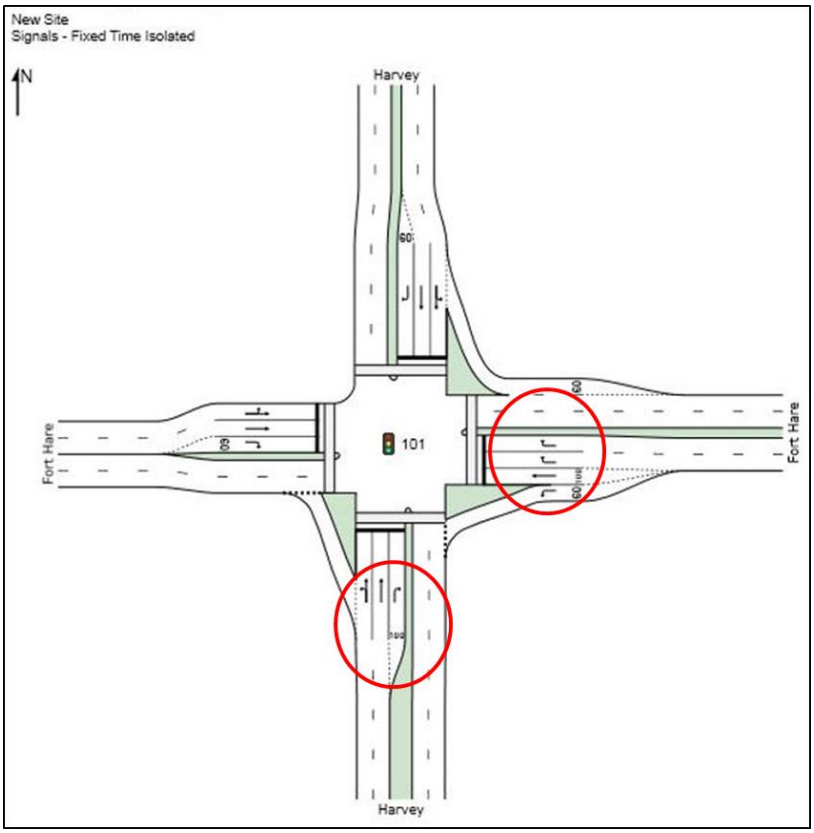


Figure 3: Proposed upgrade of the Harvey Road and Fort Hare intersection

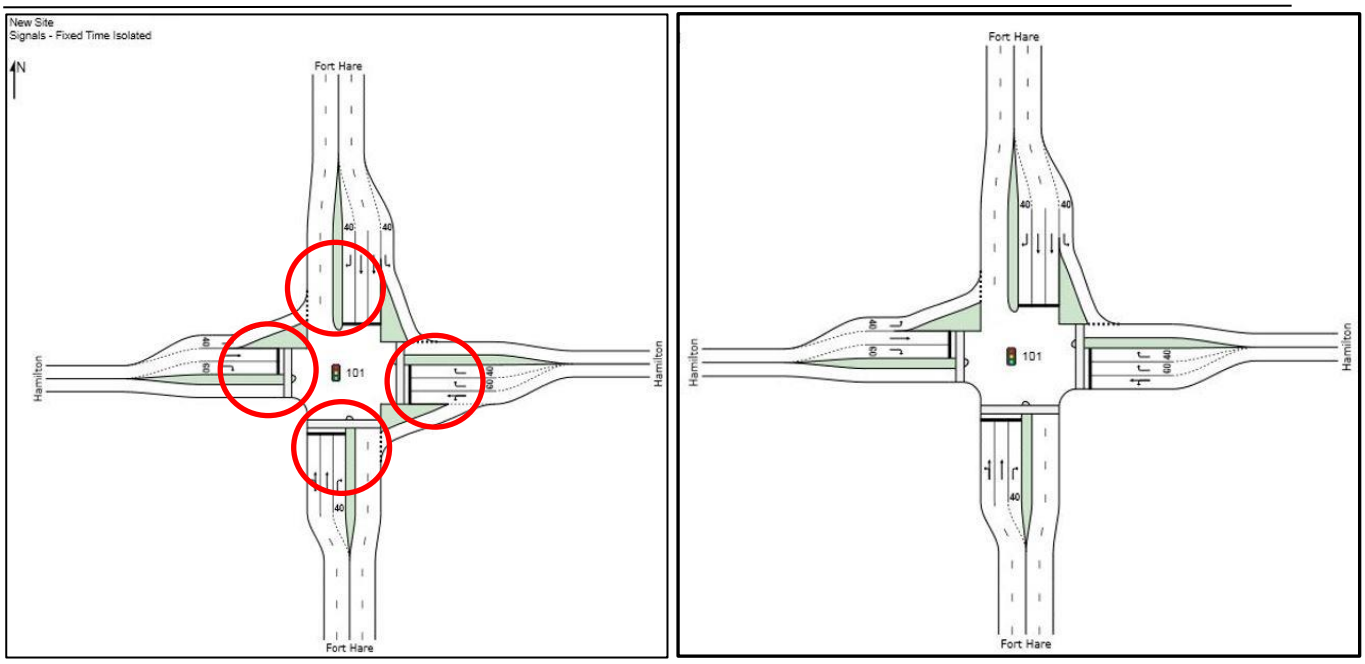


Figure 4: Two alternative proposed upgrades of the Fort Hare and Hamilton intersection (RHS preferred)

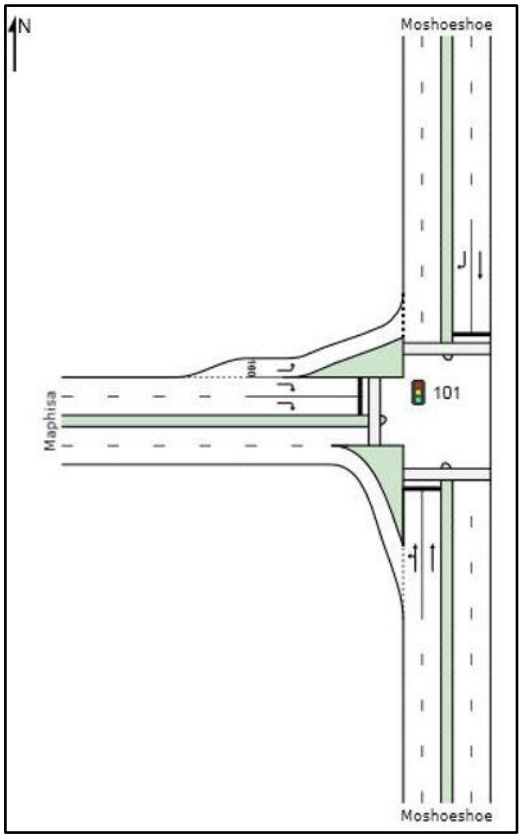


Figure 5: Proposed changes to the Maphisa/Moshoeshoe intersection

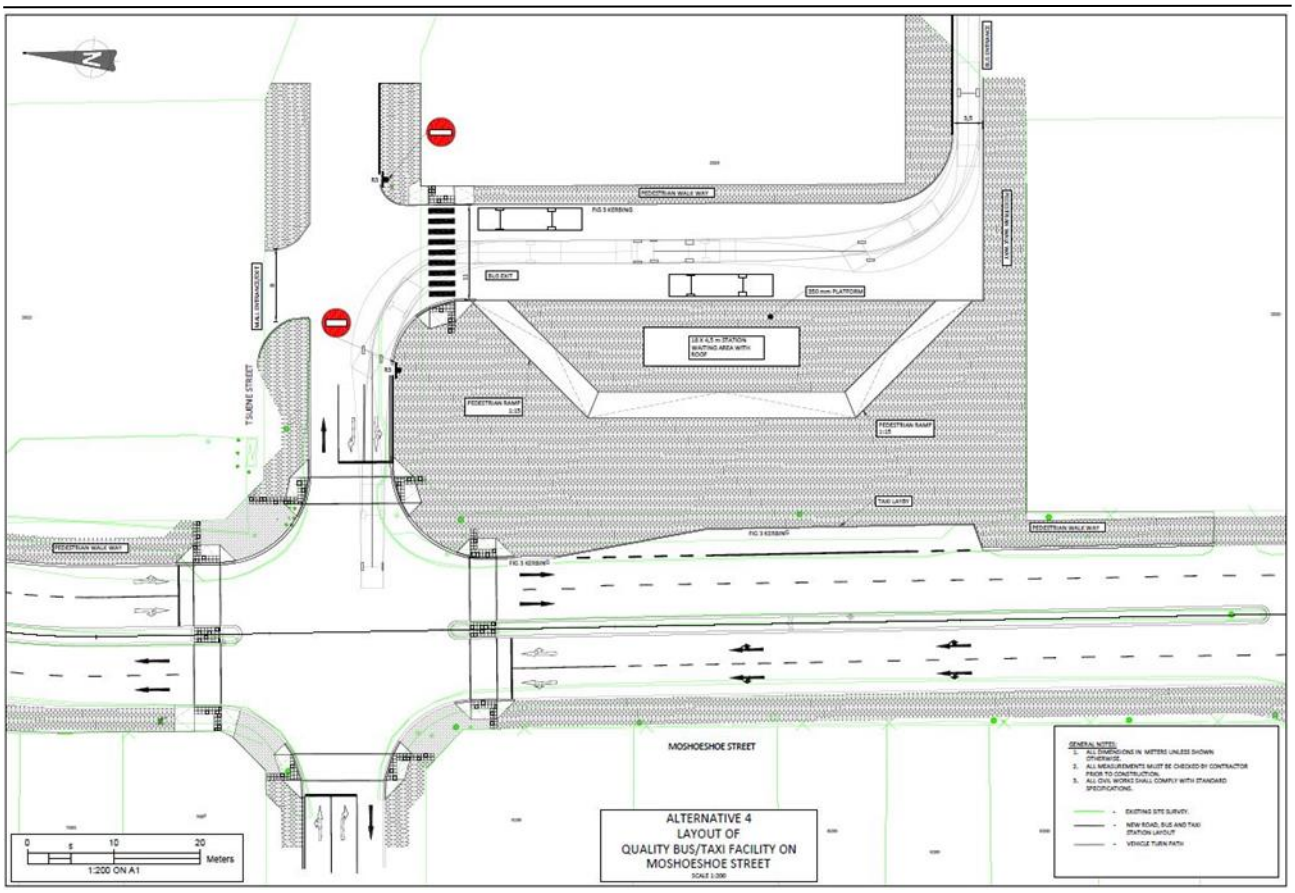


Figure 6: Proposed Transfer Facility for Station 005 and layout of the Moshoeshoe and Tsuene traffic signal

6 BUS STOPPING AND REFINEMENT OF STATION POSITIONS

6.1 BUS STOPPING IN TRAFFICKED LANE

It has been conservatively assumed that the single lane capacity is 1000 to 1100 vehicles per hour per lane (vph/lane) so that when the bus stops in the leftmost lane, then all traffic other mixed traffic can pass on the adjacent lane.

The section of Fort Hare southbound from Hamilton to Mtyobile is close e to 1000vph in the peak and therefore, the bus can stop in the lane. This is the same for the northbound and southbound directions for the whole of the Maphisa section with 2 lanes per direction. The peak volume of 1300vph on the section of Moshoeshoe Street northbound between the M10 and Maphisa is only this high during the AM peak, but a layby is nevertheless required for any stations in this section. The link volumes can be confirmed in the diagrams located in **Annexure A**. The key sections and characteristics have been summarized in Table 2.

Lanes/dir	Main Road	Cross 1	Cross 2	Highest Peak Volume (vph) NB	Highest Peak Volume (vph) SB	Station Treatment for Bus stopping NB	Station Treatment for Bus stopping SB	Free Flow Speed Limit	Peak Operating Speed (km/h)	Distance
2	Harvey	Fort Hare	St Andrews	1850	1350	Must be layby	Must be layby	60km/h	20	1,4
2	Fort Hare	Mtyobile	Harvey	1175	1090	Must be layby	Must be layby	60km/h	20	2,25
2	Maphisa	Ndzume	Mtyobile	1050	560	Can stop in left lane	Can stop in left lane	60km/h	37	
3	Maphisa	Moshoeshoe	Ndzume	830	480	Can stop in left lane	Can stop in left lane	60km/h	37	1,65
2	Moshoeshoe	M10	Maphisa	1275	960	Must be layby	Can stop in left lane	50km/h	34	
2	Moshoeshoe	Chief Moroka	M10	925	800	Can stop in left lane	Can stop in left lane	50km/h	34	3,65
1	Chief Moroka			600	600	Can stop in left lane	Can stop in left lane	40km/h	25	2,6

Table 2:Description of Phase 1 route section with lane configuration and 2018 volume characteristics

6.2 REFINEMENT OF BUS STATION POSITIONS

The latest operation plan for the IPTN services has determined the passenger demand for the Phase 1 Trunk Route and this has been simplified to a peak future passenger demand of 400 passengers per hour per station. The approximate position of the stations has been determined by considering the surrounding land-use (schools, municipal services, residential or retail) as well as the minibus-taxi stopping activity in the same particular area.

Now that it has been determined at which stations the bus can stop in the leftmost lane of the roadway, this exercise was only a refinement of the station position.

A map of the Phase 1 Trunk Route with station positions and allocated numbers is shown in Figure 7 below.

In the details following the A station designation refers to the northbound direction station and the B designation refers to the southbound station direction.

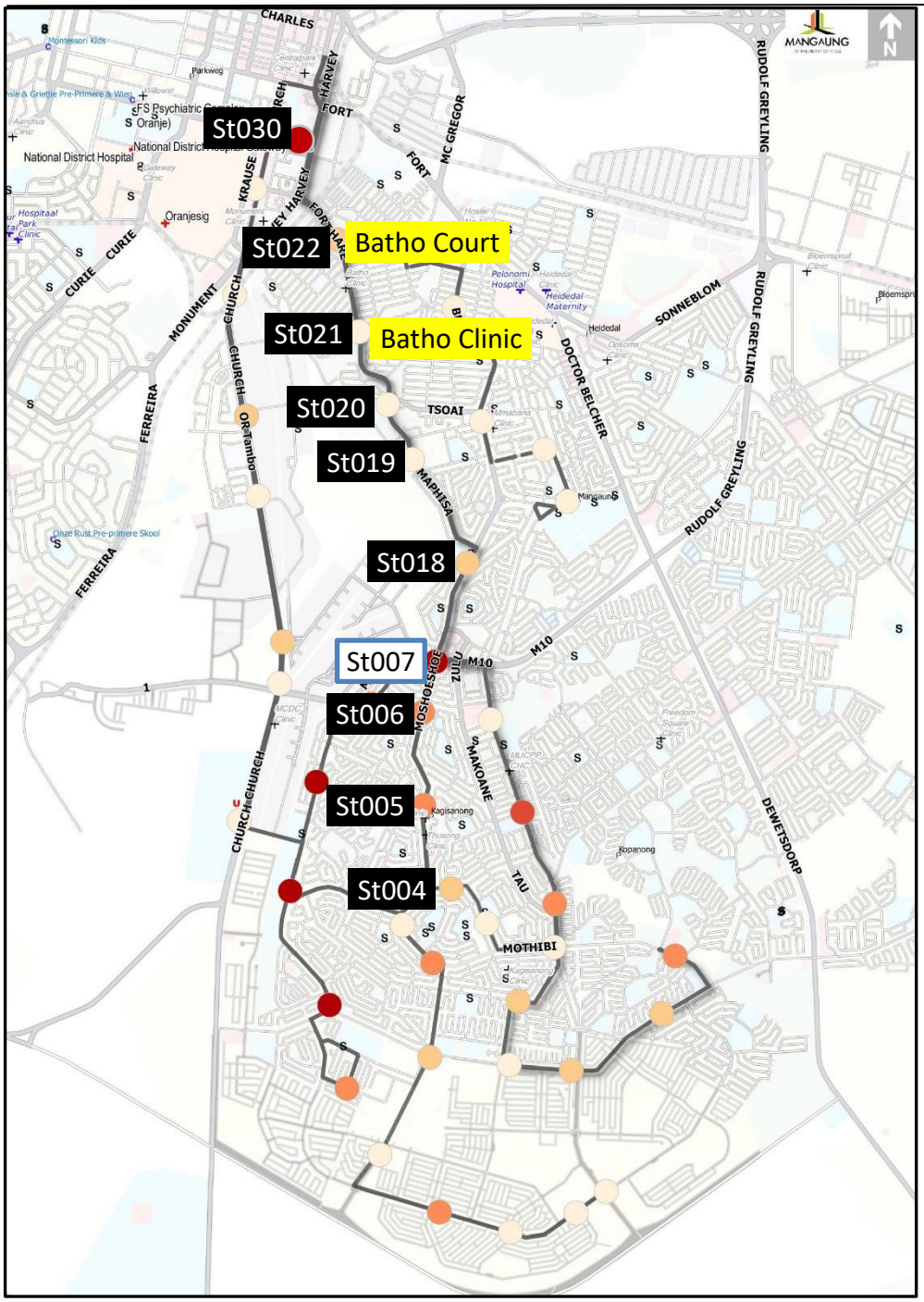


Figure 7: Phase 1 Trunk Route and Station locations

6.2.1 Station 030 (Power Station)

Station 030 (Power Station)- requires land acquisition and therefore cannot be implemented now or very soon.

6.2.2 Station 022 (Batho Court)

Station 022 (Batho Court)- near Hamilton intersection- the bus can stop in leftmost southbound lane, but a layby should be constructed on the western side walkway.

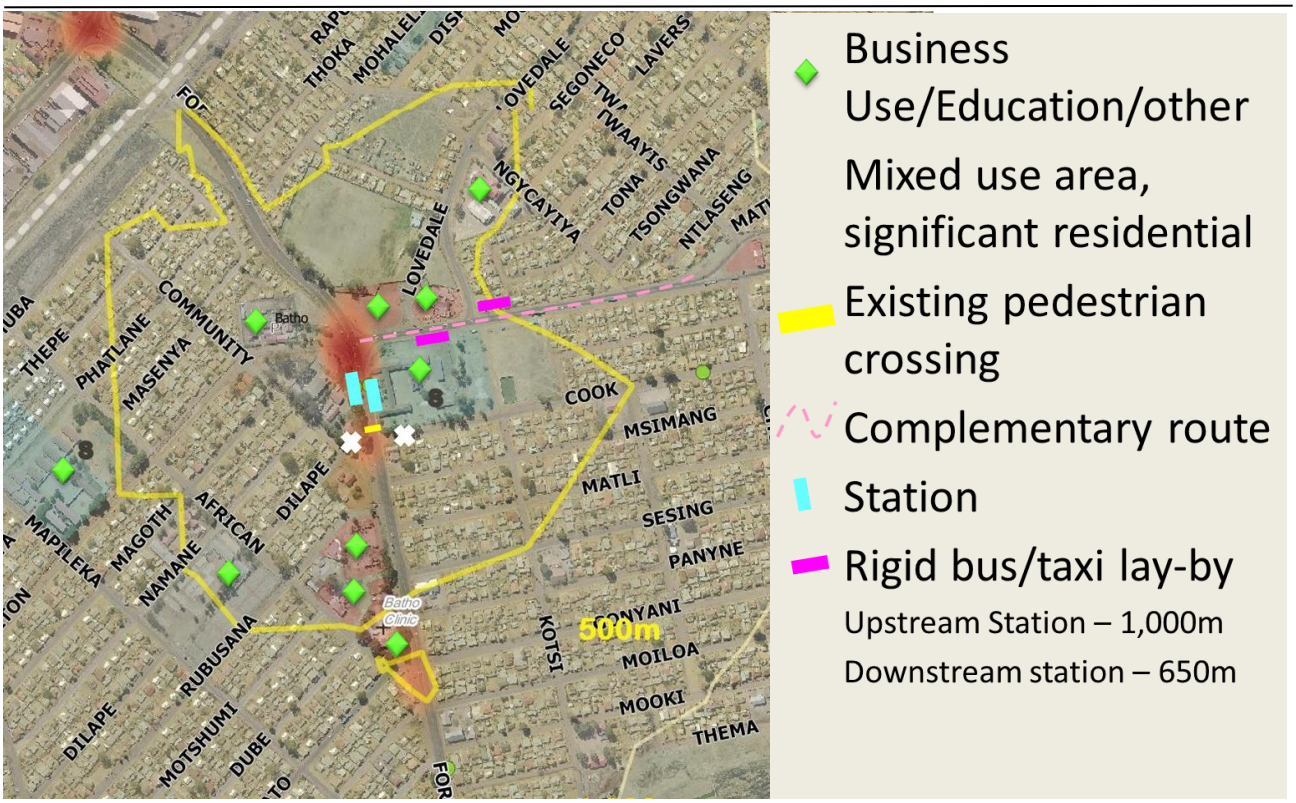


Figure 8: High order station positioning of Station 022

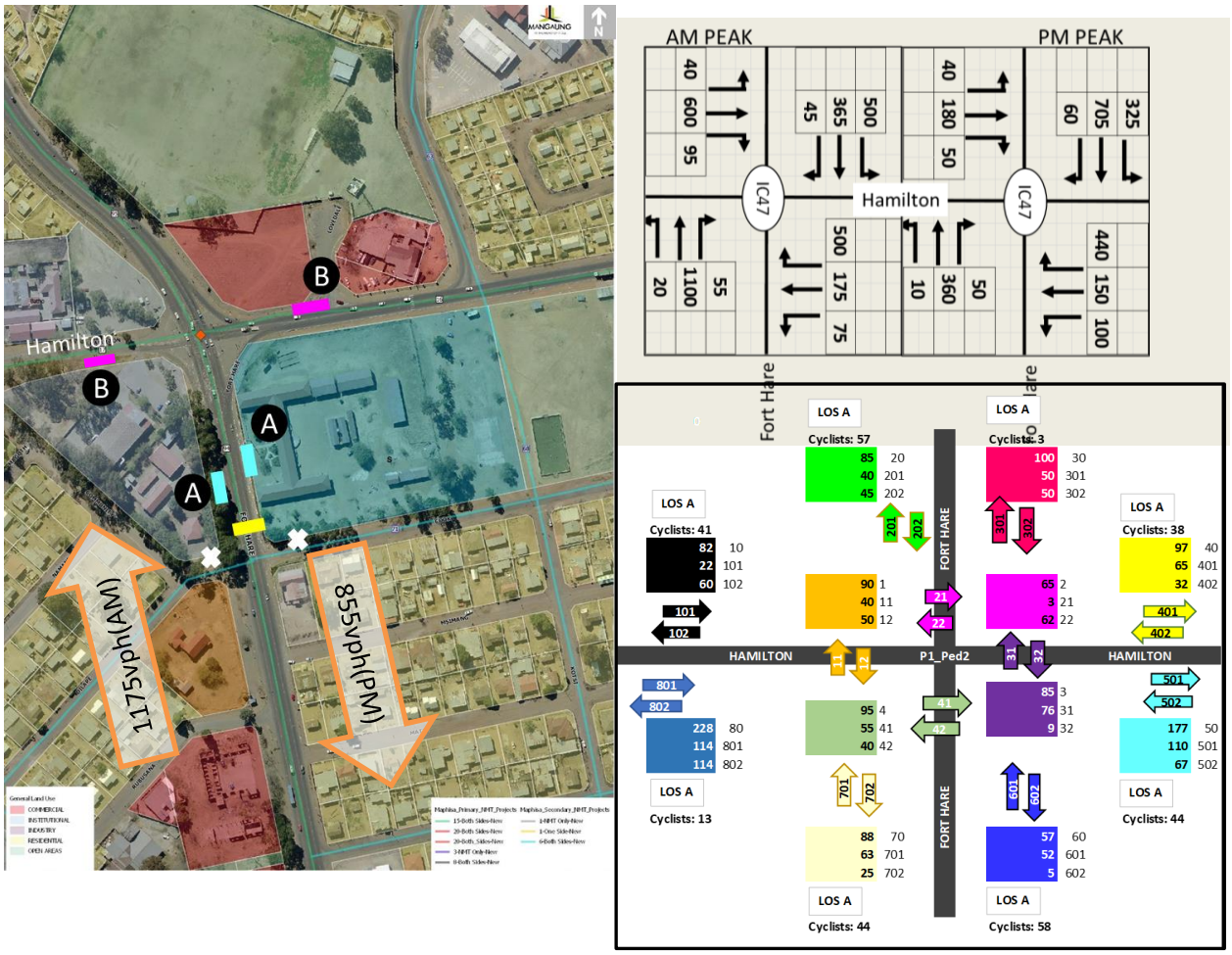


Figure 9:Traffic Volumes & Pedestrian count input (Station 022)

The peak pedestrian volumes shown in Figure 9 can be summarized as follows:

- Movement 41 &42 (across south side of Fort Hare) = 380 pedestrians per hour
- Movement 11&12 (across Hamilton on west side) = 360 pedestrians per hour
- Movement 21 &22 (across Fort hare north side) =260 pedestrians per hour
- Movement 31&32 (across Hamilton on east side) = 340 pedestrians per hour

It has been proposed to cater for 3 pedestrian movements on all except the northern side. This means that the south crossing of Fort Hare could be as much as 640 pedestrians per hour. In such a case the west and east crossing of Hamilton Road could well be reduced significantly. An area of $5m^2$ is the minimum area required to accommodate the waiting pedestrians per cycle on either the median island or slip lane traffic island to achieve no worse than LoS D.

The peak traffic volumes indicate that the south-west slip lane is not justified at all and it is proposed to remove it. This has also been proposed since the south-west corner is the busiest from a pedestrian viewpoint. The peak volumes also indicate that the south-east located slip lane is not really justified either as the traffic evaluation of removing both southern slip lanes still provides a satisfactory level of service for the intersection.

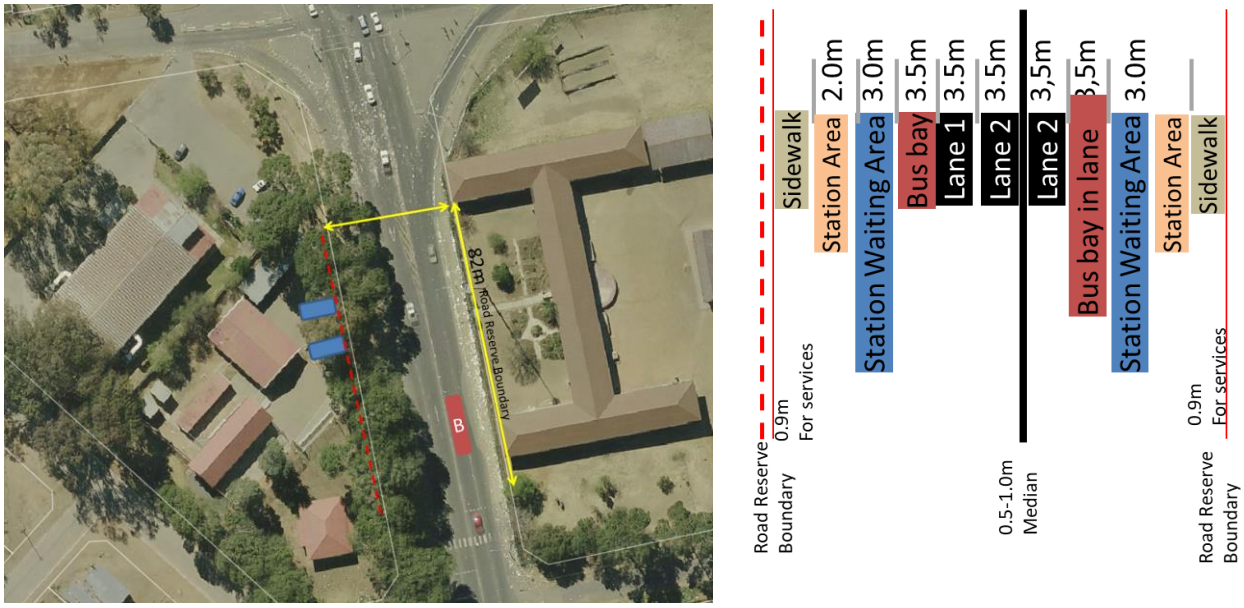


Figure 10: Proposed change in Fort Hare Road cross-section to accommodate Station 022A and Station 022B

Figure 11: Streetview photo of Station 022A location on west verge of Fort Hare Road and that of Station 022B on opposite side of the road

6.2.3 Station 021 (Batho Clinic)

Station 021 (Batho Clinic)- should be located at the existing road closures of Mahabane Street (West) and Mooki Street (East) with the waiting area located within the closed street roadway and the bus can stop in the leftmost lane for both directions. There are already long bus laybys at these locations already.

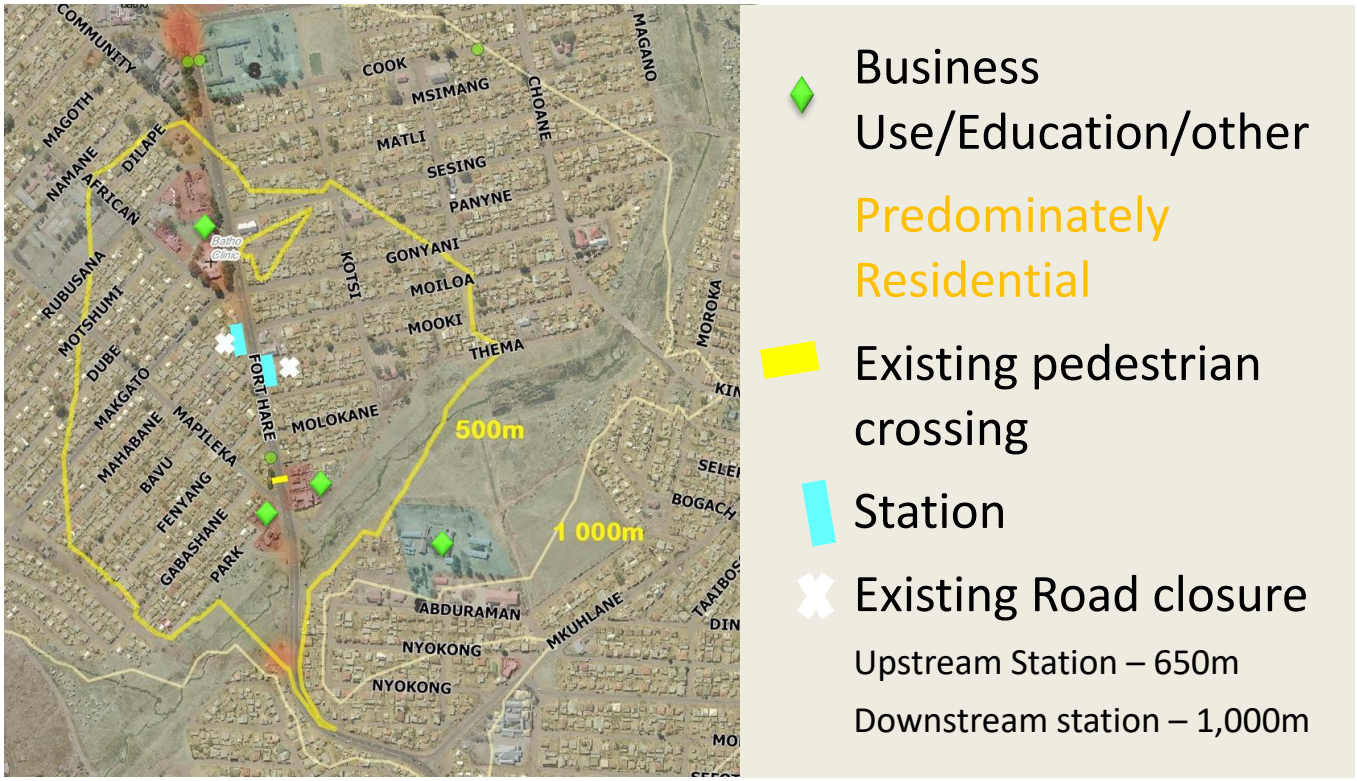


Figure 12: Refinement of Station 021 position opposite proposed road closures and in lane bus stopping

Figure 13: Street-view of existing road closures and proposed Station 021A and Station 021B respectively

6.2.4 Station 020 (Botchabela)

Station 020- there is sufficient road reserve width on the west side for a layby to be constructed and the bus could stop in the leftmost lane on the eastern side opposite the existing road closure of Kabane Street. The waiting area could be located within the closed street roadway. (See Figure 14 and 15)

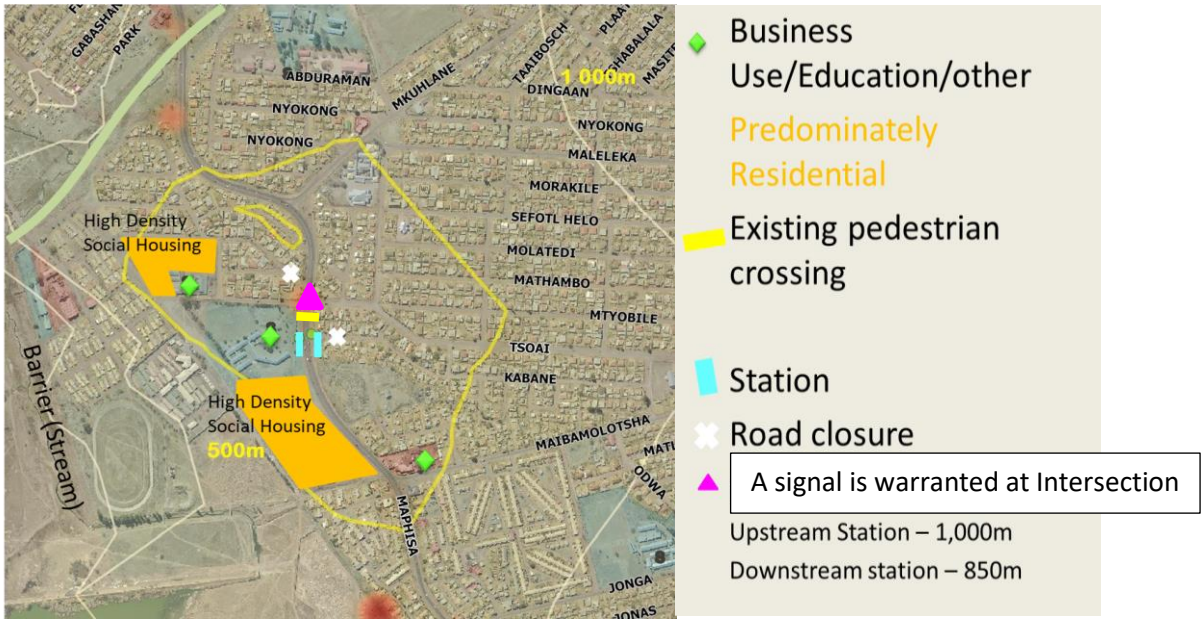


Figure 14: Refined position of Station 020 using the roadway for buses to stop

Figure 15: Streetview of proposed locations of Station 020A and 020B respectively where use needs to be made of some of the existing bus laybys to accommodate the passenger waiting area.

6.2.5 Station 019

Station 019- the intersection of Jonga Street is very important as the main access to the cemetery. The two direction stations should be placed on either side of this intersection on Maphisa Road. This means north of the Cemetery access on the west and south of Jonga Street on the east side. (see Figure 16 and 17)

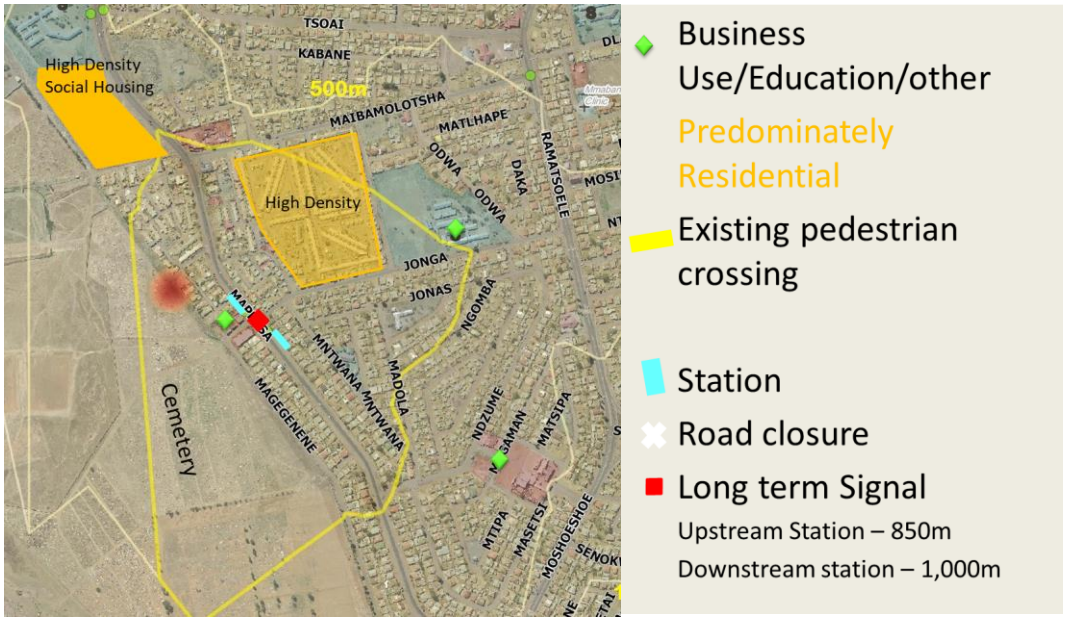


Figure 16:Station 019 should be located on either side of Jonga/Cemetery access intersection

Figure 17: Streetview northbound for station 019A and southbound for station 019B both north of and south of the Jonga intersection respectively

The Jonga/Maphisa intersection signalization is not yet warranted, but this may be considered for a funeral peak or needs to be monitored for possible re-evaluation after a couple of years.

6.2.6 Station 018

Station 018- for the northbound station, the bus can stop in the third leftmost lane near the school entrance on Maphisa Road. A site visit has however determined that the sidewalk is currently raised by 0,6 m already and is only approximately 2m wide. This effectively leaves no space for waiting passengers. It is therefore proposed that Station 018A be placed at an alternative position opposite the location of Station 018B. The southbound station should be located on Moshoeshoe Street opposite the vacant corner in front of the Library, although the bus can comfortably stop in the leftmost of the 2 lanes. The final station location is shown in Figure 18 and 19.

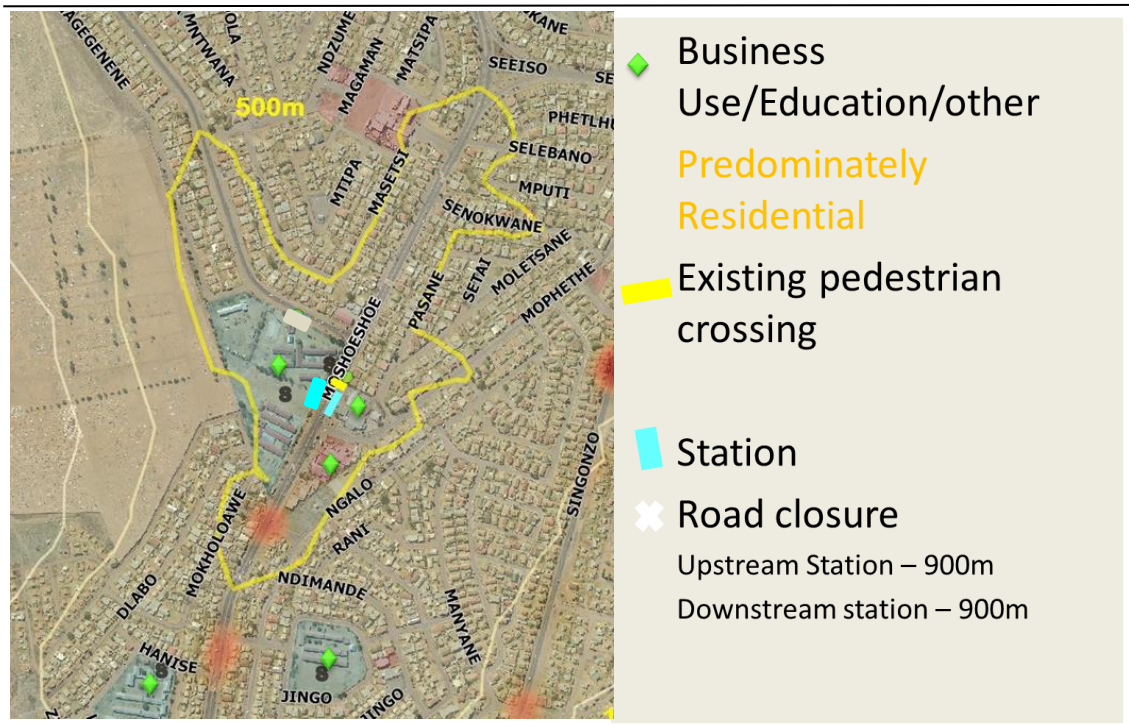


Figure 18: Station 018 with two directions placed on Moshoeshoe Street

Figure 19: Proposed location for Station 018A and 018B for the northbound and southbound respectively

6.2.7 Station 007

Station 007 –since the peak traffic volume southbound allows for the bus to stop in the lane, the waiting area needs to be placed in the shopping centre landscaped area (see Figure 20). It is perceived that the landscaping has actually been constructed within the road reserve. For the northbound station it was at first proposed to close the extension of Piet Human Street for the northbound station. However, a closer physical site inspection has revealed that this will not be possible because Piet Human becomes a one-way west at its western end and passes over a bridge which can only carry less than 5 tons.

This effectively means that this road cannot be closed at its eastern intersection with Moshoeshoe Street. If we assume that the bus can use the street to stop in we can, however, still accommodate the waiting area and sidewalk on the north-west corner for the northbound station since it is presently an open publicly used wide corner.

Since the peak AM peak volume is 1100vph, allowing the bus to stop in Moshoeshoe Street is considered to be acceptable.

The final position of Station 007 is shown in Figure 19 and 20 below.

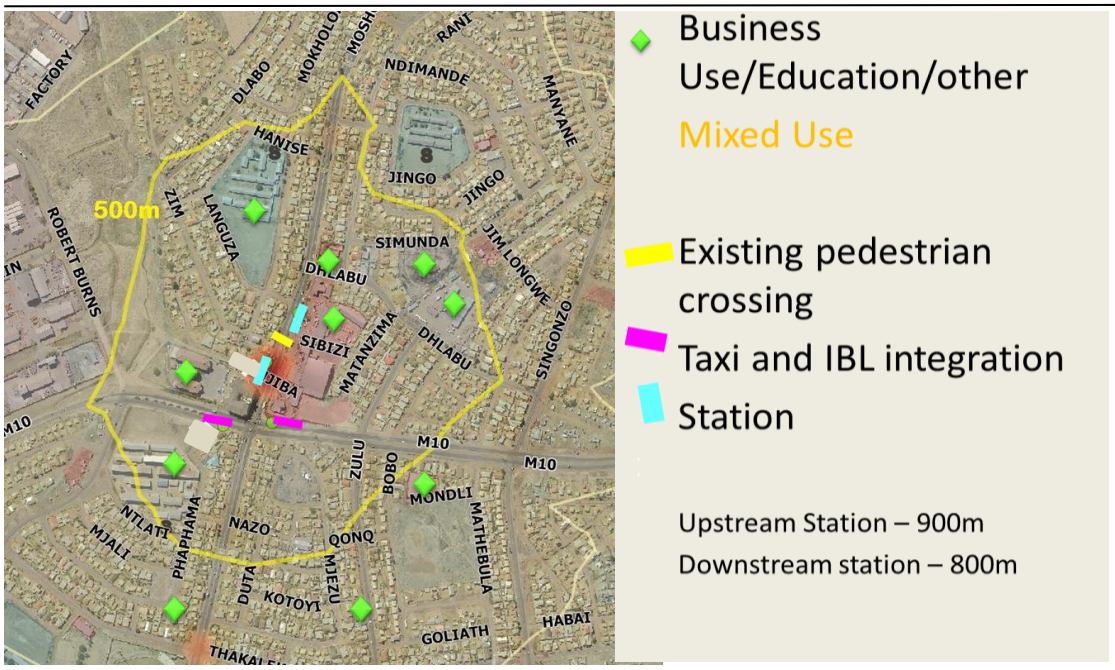


Figure 20: Proposed final position of Station 007 with buses stopping in the leftmost lane

Figure 21: Streetview of proposed Station locations for Station 007A and Station 007 B respectively

6.2.8 Station 006

Station 006- since the peak volumes are reasonably low, the bus can stop in Moshoeshoe in both directions and it was pertinent to place the two stations on either side of a midblock signalized (push-button controlled) pedestrian crossing. This will replace the current two speed humps /crossings on this stadium section. (see Figure 22).

Figure 22: Outdated street-view photo with position of Station 006A and Station 006B respectively north and south of a new signalized midblock pedestrian pushbutton-controlled crossing

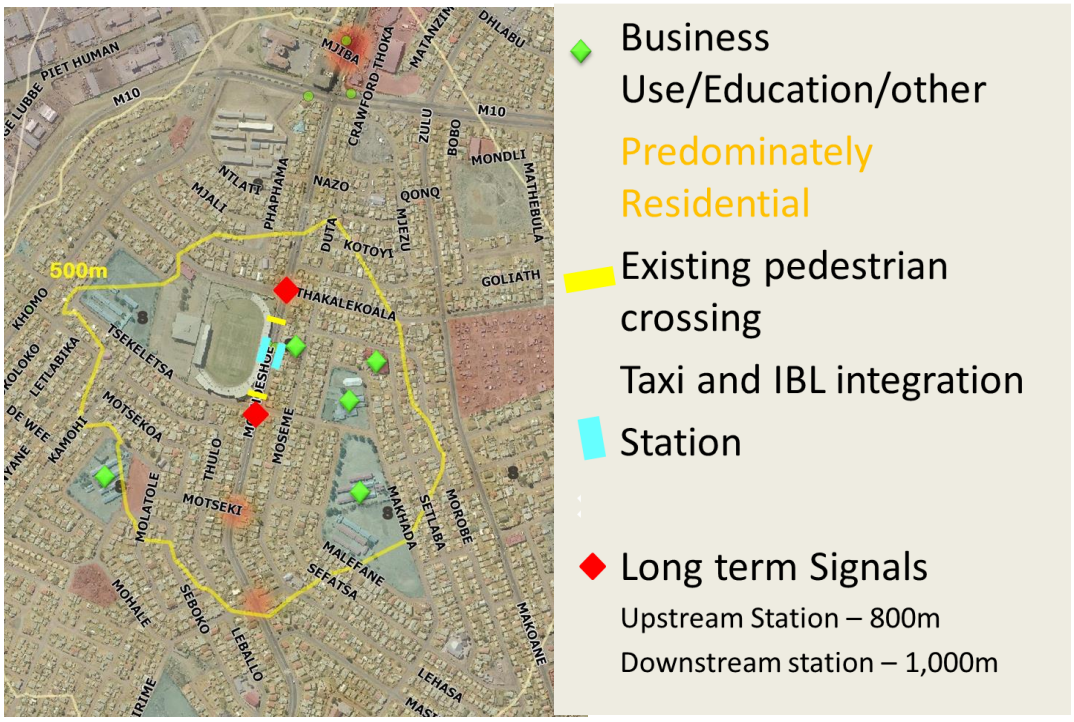


Figure 23:Proposed final location of Station 006 opposite the sport stadium to be placed north and south of a new midblock signal pushbutton-controlled pedestrian crossing.

6.2.9 Station 005 Bus/Minibus-taxi Transfer Facility

Station 005 - since this will be a transfer station it was deemed necessary to explore alternatives for this station. Four alternatives were evaluated and it was decided that Alternative 4 best fitted the requirements that needed to be accommodated, with a traffic signal at Moshoeshoe/Tsuene, without the need for a U-Turn at the Tsuene/Moshoeshoe intersection. (as per Alternative 1)

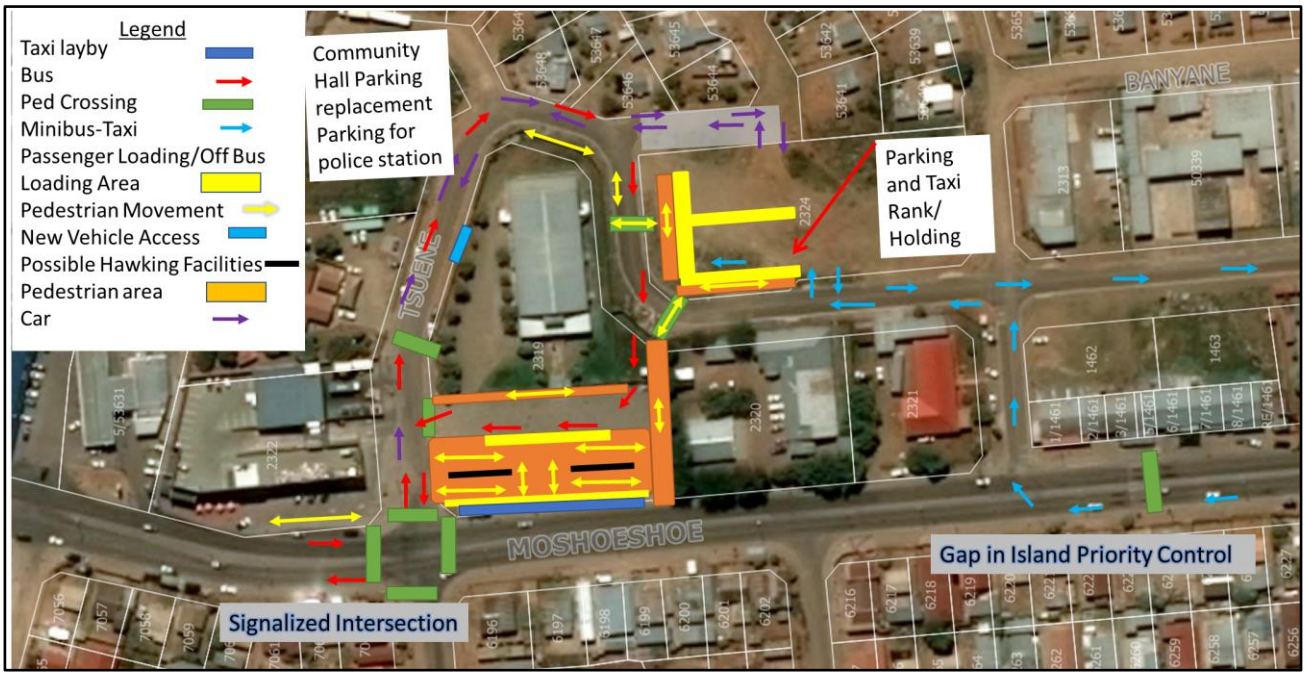


Figure 24:Alternative 4 Concept with the use of separate Bus and Taxi facilities in close proximity

The key element was to use the off-street land parcel available for the Bus Station and significant pedestrian area. The minibus-taxi feeder drop-off and pickup is separate from the bus station. The area as indicated would be designed for taxi ranking/holding and overflow Municipal Hall/shopping centre parking. For the southbound minibus-taxi movement a layby facility has been provided. It has therefore been arranged so that the passengers share a transfer/waiting location. The traffic signal at the Tsuene intersection is to allow the buses and other traffic to enter the Moshoeshoe traffic timeously. This signal will therefore also create gaps in the traffic for the minibus-taxis to turn right into the unnamed side street depicted with blue arrows.

Unfortunately, an opportunity to create a pedestrian link under the trees (yellow pathway) from the shopping centre to the bus/taxi transfer station cannot be executed since this pathway now falls within the Police station property and is completely fenced off. A yield controlled midblock pedestrian crossing will nevertheless need to be provided to cater for this pedestrian demand across Tsuene Street opposite the Police station.

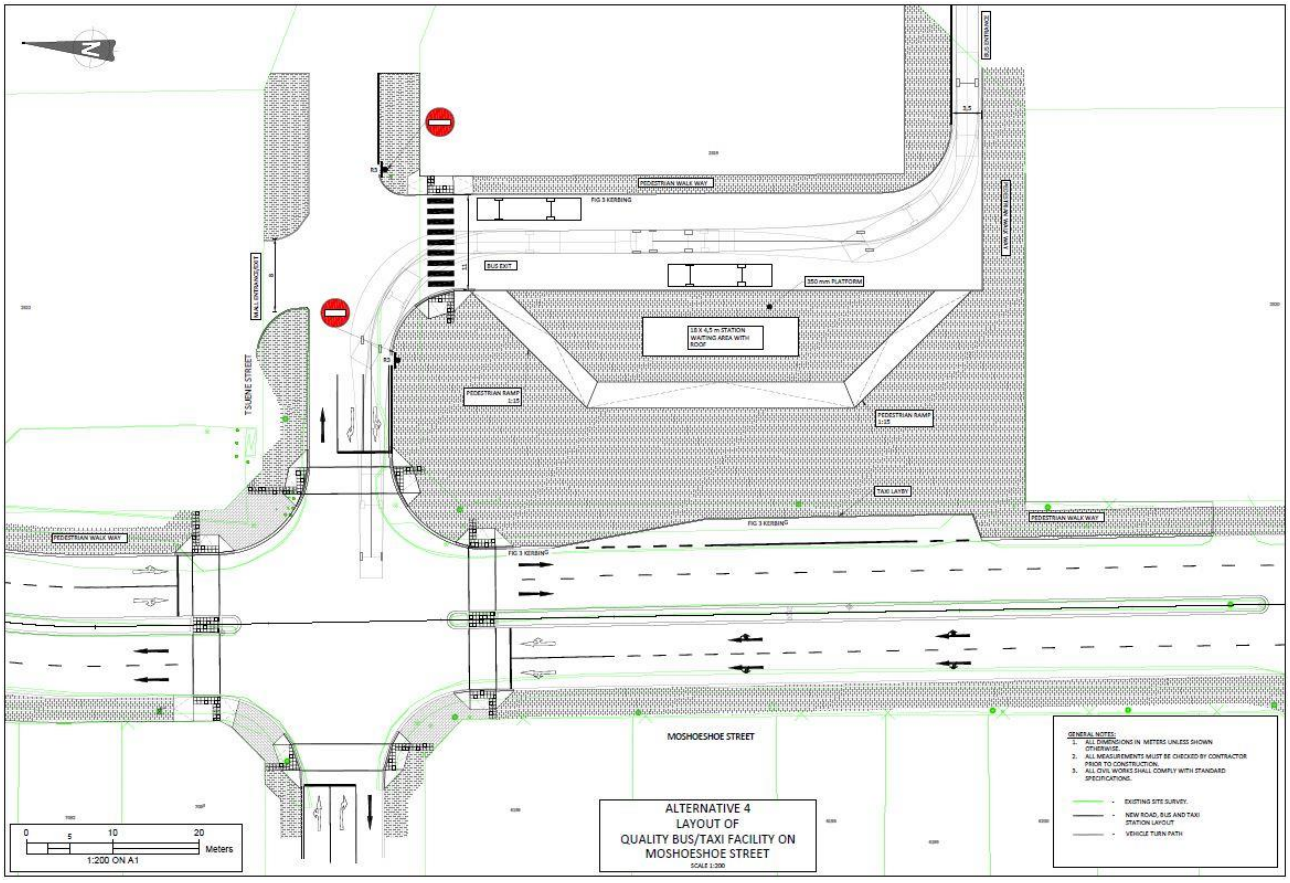


Figure 25: Concept layout of Alternative 4 along Moshoeshoe.

It should be noted that 4 Alternatives were considered, but the above describes Alternative 4 which was chosen as the recommended option.

Alternative 1

Alternative 1 proposes to place the southbound station off-street in an open paved property on the south-east side of the Moshoeshoe/Tsuene intersection. A plan has therefore been made to signalize this intersection to create a safe U-turn opportunity for the minibus-taxis (by the introduction of a northbound only signal phase with protected flashing green right-turn phase) to dock at one side of the transfer station. The concept layout plan of the Alternative 1 proposal is shown below. Unfortunately, the U-Turn was seen as a safety disadvantage of the Alternative.

Figure 26: Proposed Alternative 1 context layout of Transfer Station 005

The detailed concept layout is shown in Figure 25. It must be clarified that the minibus-taxis will not reverse into Moshoeshoe Street and will only be having to yield to the other bypassing minibus-taxis.

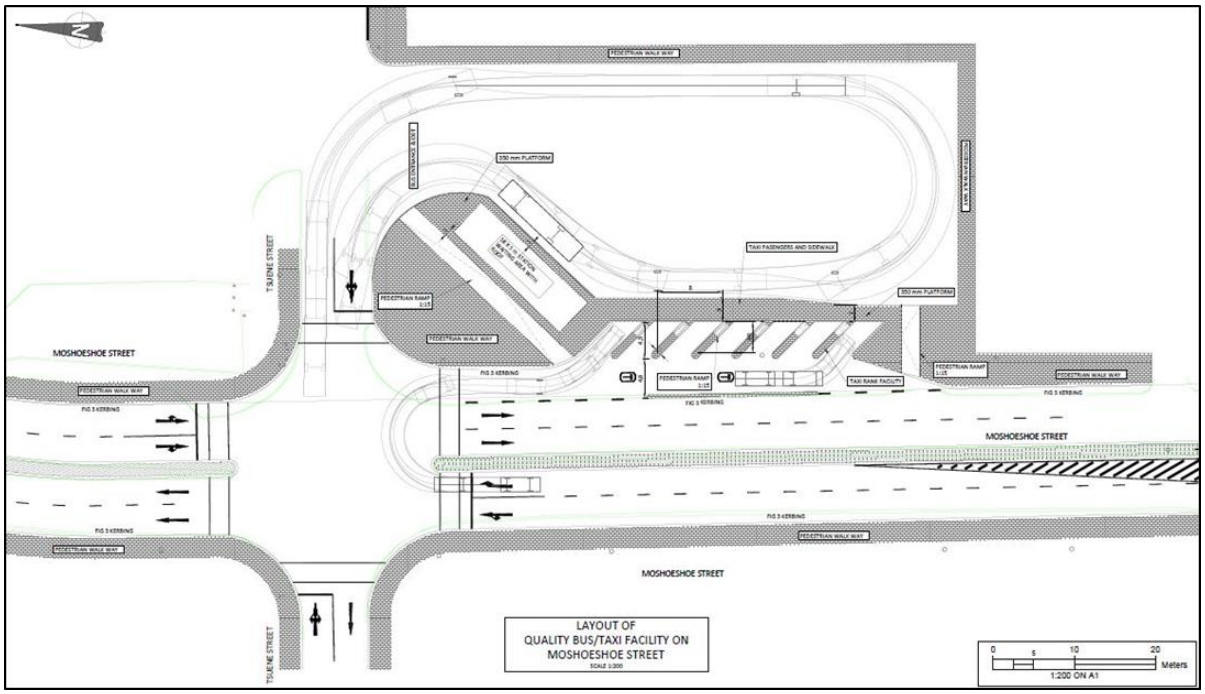


Figure 27: Proposed Alternative 1 Layout of Bus/taxi transfer station

Alternative 2

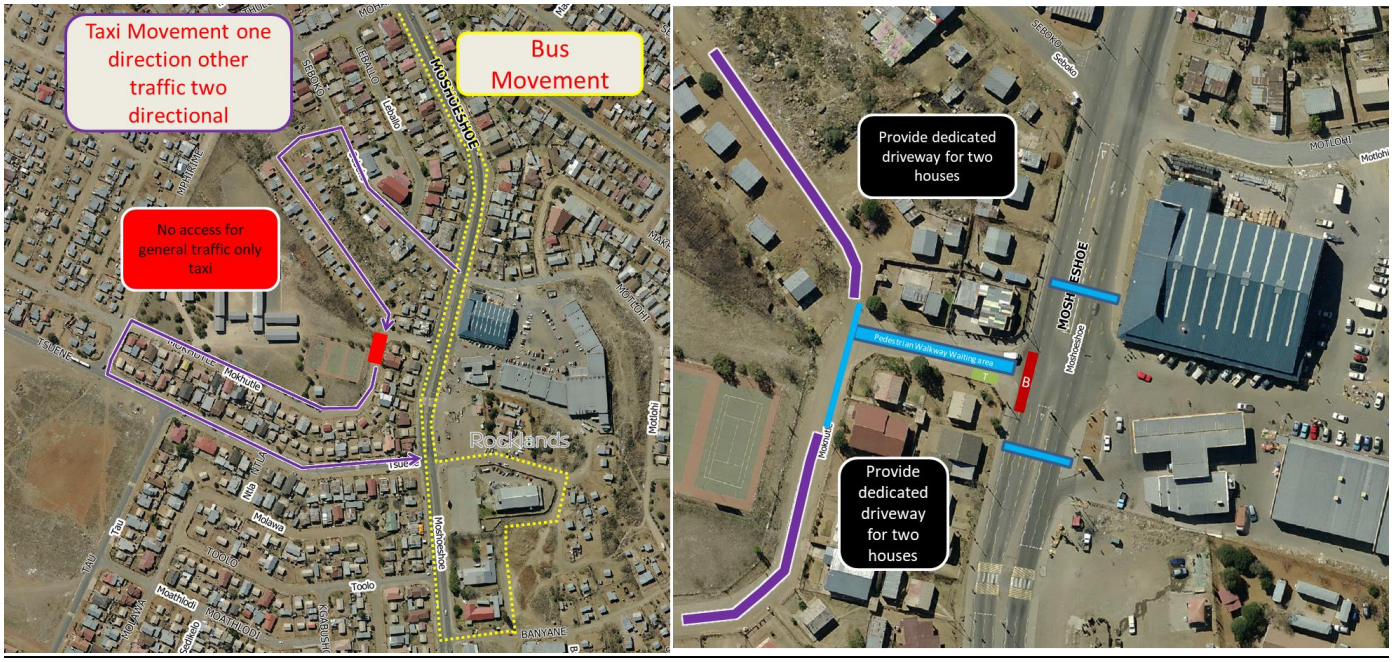


Figure 28: Alternative 2 proposal for transfer Station 005

This alternative unfortunately has a passenger transfer disjoint (50m displacement) between the Quality Bus service on Moshoeshoe Street and the taxi stop on Zim Street. Therefore, the facility is not perceived as a single unit station facility and therefore ranks lower than Alternative 1.

Alternative 3

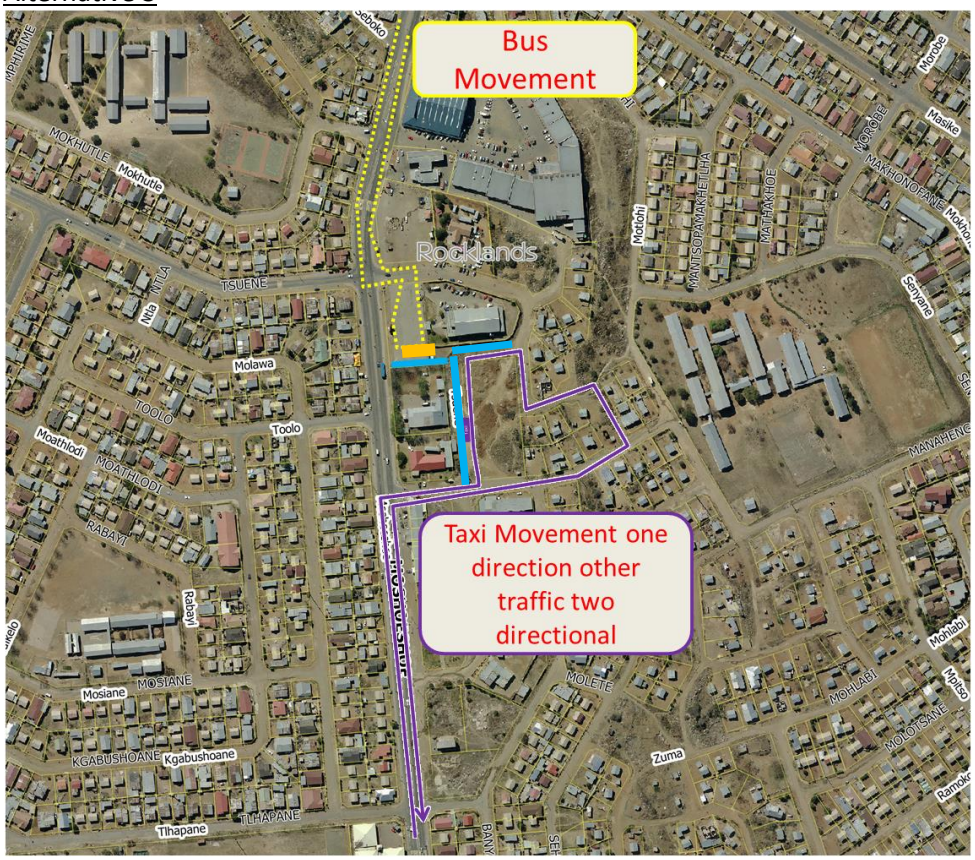


Figure 29: Alternative 3 proposal for transfer Station 005

This proposal would be preferred over Alternative 2, if any element of Alternative 4 cannot be accommodated. It is a good alternative since the minibus-taxi and bus operations are separated. This Alternative was further developed into Alternative 4, which accommodates the best elements of Alternative 1 and Alternative 3, with the most recent implementable assumption, whereby the bus can enter the paved bus loading area from the east through the property which is adjacent to the Municipal Hall. This property houses an air quality metering station which is entirely feasible to move to the corner of the Municipal Hall site.

With regards to Station 005A northbound, it has been proposed to close the unknown street between Moshoeshoe Street and Zim Street (see Figure 24 above), however for the first phase of the trunk route implementation, since Station 005B is the route endpoint and turn-around, a northbound station is strictly not necessary. This would however enhance the long-term operation when Station 004 along Chief Moroko Crescent is implemented.

6.2.10 Stop 004 on Chief Moroko Crescent

Station 004- since the concept is for the bus to turn around on the route via the Chief Moroko Crescent circular roadway and volumes are very low, it is proposed that 3 stops be placed alongside the roadway at strategic pedestrian crossing positions and then just stop in the roadway whilst passengers board or alight.

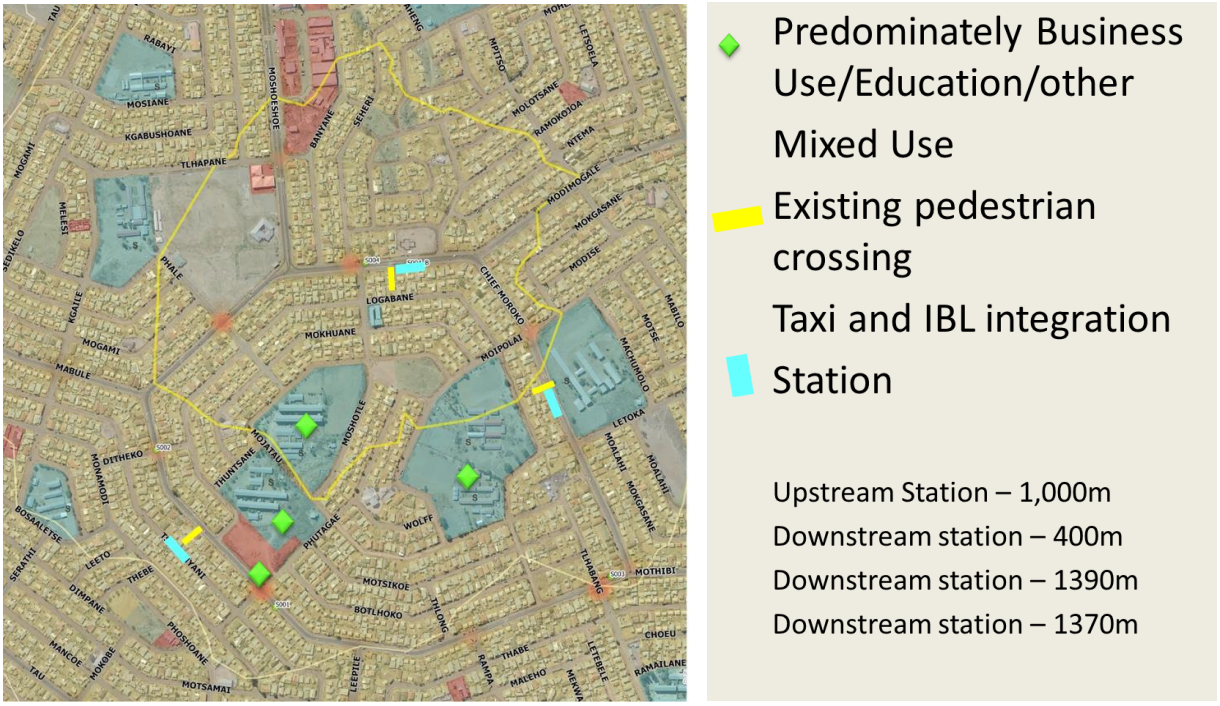


Figure 30: Proposed stops of Station004 to be placed around Chief Moroko Crescent at key pedestrian crossing locations

7 RATIONALIZATION OF ACCESS AND SPEED HUMPS/PEDESTRIAN CROSSINGS

7.1 RATIONALIZATION OF ACCESS ALONG TRUNK ROUTE

The primary objective of this access rationalization exercise was to raise the hierarchy of this Class 4b route to be more appropriate as a trunk bus route, yet nevertheless, to attempt to maintain the local township nature of the surrounding area and the access to it. This has been achieved by replacing full access local side road intersections with left-in-left-out (LILO) access, which at least removes all right-turn movements at these locations so that the median can be closed at these selected points. In many cases the current road cross-section with a painted median or median island effectively creates LILO accesses already. It is understood that the introduction of LILO access might promote the need to perform a U-turn movement, rather than deviate within the residential area. This was considered and a safe design which facilitates an exclusive right turn lane in addition to the two through lanes has been proposed at such potential locations. Again,there are already such LILO locations which will be retained.

One road closure is proposed. This closure and the existing closures are mainly to best accommodate the stations and might be located too close to major key intersections. The location of the proposed closures and proposed left-in-left-out (LILO) accesses are shown in the tables below. The objective was to remove some of the many median gaps and right-turn movements across the trunk route.

Phase		Intersection	Status	Distance to the next junction before LILO/ closure	Distance to the next junction after LILO/closure
1B Fort Hare Road	1	Hamilton Street	Access	148	468
	2	Cook Street	LILO 1	62	
	3	Msimanga Street	LILO 2	39	
	4	Rubusana Street	LILO 3	30	
	5	Matli Street	LILO 4	62	
	6	Sesing Street	LILO 5 Already	64	
	7	Panyane Street	LILO 6 Already	63	
	8	Gonyane Street	Access	193	193
	9	Mahabane Street	Closed Already		-
	10	Mooki Street	Closed Already		-
	11	Makohliso Street	Access	24	117
	12	Fenyane Street	LILO 7	34	
	13	Molokoane Street	LILO 8	59	
	14	Unknown	Access	48	48
	15	Maphikela	Access	25	102
	16	Parkplein Street	LILO 9	27	
	17	Thema	LILO 10	50	
	18	Park Street	Access	176	176
	19	Unknown	Access	305	305
	20	Mkuhlane Street	Access	108	511
	21	Unknown	LILO 11 Already	70	
	22	Unknown	LILO 12 Already	333	
	23	Mtyobile Street	Access	430	430

Table 3: Fort Hare Road section- Proposed access management proposals, 12 LILOS

Phase		Intersection	Status	Distance to the next junction before LILO/ closure	Distance to the next junction after LILO/closure
1A- Maphisa Road	24	Kabane Street	Closed Already		-
	25	Maibamolotsha Street	Access	24	359
	26	Unknown	LILO 13 Already	57	
	27	Unknown	LILO 14 Already	101	
	28	Unknown	LILO 15 Already	37	
	29	Unknown	LILO 16 Already	75	
	30	Unknown	LILO 17 Already	65	
	31	Jonga Street	Access	343	439
	32	Unknown	LILO 18 Already	96	
	33	Ndzume Street	Access	255	255
	34	Unknown	Access	200	200
	35	Moshoeshoe	Access	154	154

Table 4: Maphisa Road section, proposed access management proposals; 6 current LILO's

Phase		Intersection	Status	Distance to the next junction before LILO/ closure	Distance to the next junction after LILO/closure
1C Moshoeshoe Street	36	Mophetho Lane	Access	185	185
	37	Hintsha Street	Access	207	207
	38	Mamani Street	Access	60	60
	39	Hanise Street	Access	205	205
	40	Dhlabu Street	Access	59	59
	41	Languza Street	Access	64	64
	42	Access to shopping	Access	74	74
	43	Mjiba Street	Access	95	95
	44	M10	Access	174	174
	45	Nazo Street	Access	175	232
	46	Mjevu Street	LILO 19	57	
	47	Thakalekoala Street	Access	240	240
	48	Tsekeletsa Street	Access	215	215
	49	Motseki Street	Access	201	201
	50	Mohale Street	Access	80	80
	51	Masike Street	Access	216	216
	52	Motlohi Street	Access	75	196
	53	Unknown	Closed 1	121	-
	54	Tsuene Street	Access	120	120
	55	Toolo Street	Access	62	62
	56	Unknown	Access	160	265
	57	Tsuene2 Street	LILO 20	105	
	58	Tlhapane Street	Access	225	225
	59	Chief Moroka Crescent	Access		

Table 5: Moshoeshoe Street access management proposals; 1 road closure and 2 LILOs

Only one (1,8%) access road has been proposed to be closed to vehicular traffic. The number of LILOs already in place or proposed to be implemented is 20 (35%). The effective spacing between right turn opportunities across the median changes from 126m to 193m. This is not considered overly intrusive but bus stations have been facilitated at the road closures and right-turn movements (gaps in the curbed/painted island), some of which are unsafe /unnecessary, which will improve traffic flow and operations along the trunk route.

The detailed layouts of the one road closure and 20 LILO access roads are shown in detail in **Annexure C**. The vehicle diversion and detour caused by these proposals can easily be evaluated in the five layouts spread throughout the route. The proposed exclusive right-turn facilities have also been depicted to make potential U-turns, possibly generated by the LILO access changes, as safe as possible by providing exclusive right-turns.

7.2 SPEED HUMPS/PEDESTRIAN CROSSING NECESSITY EVALUATION

It would seem that at some stage in the past several speed humps and/or yield controlled midblock crossings were introduced along the route. It was observed that some of these humps are severe, requiring their negotiation at 10-20 km/h. In several cases the speed humps have incorrectly been provided with zebra crossing markings, whereas no warning signage for a midblock crossing has been provided. It was possibly felt necessary to introduce these to calm the speed along the route since several sections had recently been upgraded to wide 2 lane boulevards with central median. In the case of Maphisa Road, 3 lanes per direction exist on half this section length.

Some 7 out of 22 speed humps/pedestrian crossings have been removed and either replaced with safe signalized pushbutton crossings at a more convenient location in relation to public transport activity, or where found to be unsafe from a geometric alignment viewpoint. (sight distance). The results of the evaluation performed is shown in Table 6 below. The existing pedestrian crossing speed humps positions are shown in Figure 28.

Phase	Description	Distance to next ped crossing	Reason	Location	Comments
1B	Midblock ped crossing 1	145	Tuck shop, Butchery and panel beaters		Update road markings and signage
	Midblock ped crossing 2	90		Bridge	Remove since 1 & 3 very close
	Midblock ped crossing 3	167	Tavern and Tuck shop		Update road markings and signage
	Midblock ped crossing 4	162			Remove
	Midblock ped crossing 5	120	Access for the community on western side		Update road markings and signage
	Midblock ped crossing 6	98			Remove because dangerous (no adequate sight dist.)
	Midblock ped crossing 7	71	Tuck shop		Update road markings and signage
1A	Pedestrian signal 05	100	Primary school	16m from Int.	Remains signalized. Update road markings and signage
	Midblock ped crossing 8		Primary school		Remove. Signalized ped crossing can be used.
1C	Midblock ped crossing 9	158	School and library		Update road markings and signage
	Midblock ped crossing 10	201	School and clinic		Update road markings and signage
	Midblock ped crossing 11	195	Day care centre and school		Remove. Mamani intersection to be used for crossing
	Midblock ped crossing 12	700	School		Remove. Mamani intersection to be used for crossing
	Midblock ped crossing 13	238	School		Update road markings and signage
	Midblock ped crossing 14	146	Stadium		Remove. Replace 14 and 15 with signalized crossing
	Midblock ped crossing 15	214	Stadium		Remove
	Midblock ped crossing 16	199	School		Remains signalized
	Midblock ped crossing 17	189	School		Update road markings and signage
	Midblock ped crossing 18	175	Bottle store		Update road markings and signage
	Midblock ped crossing 19	390	School and shopping centre		Reamin in position but road markings must be clear
	Midblock ped crossing 20	272	Tuck shop and liquor store		Update road markings and signage
	Midblock ped crossing 21		Post office and library		Update road markings and signage

Table 6: Results of speed hump/pedestrian crossing analysis

It is recommended that all speed humps be replaced where advised, with properly constructed and bus friendly speed humps and pedestrian speed tables.

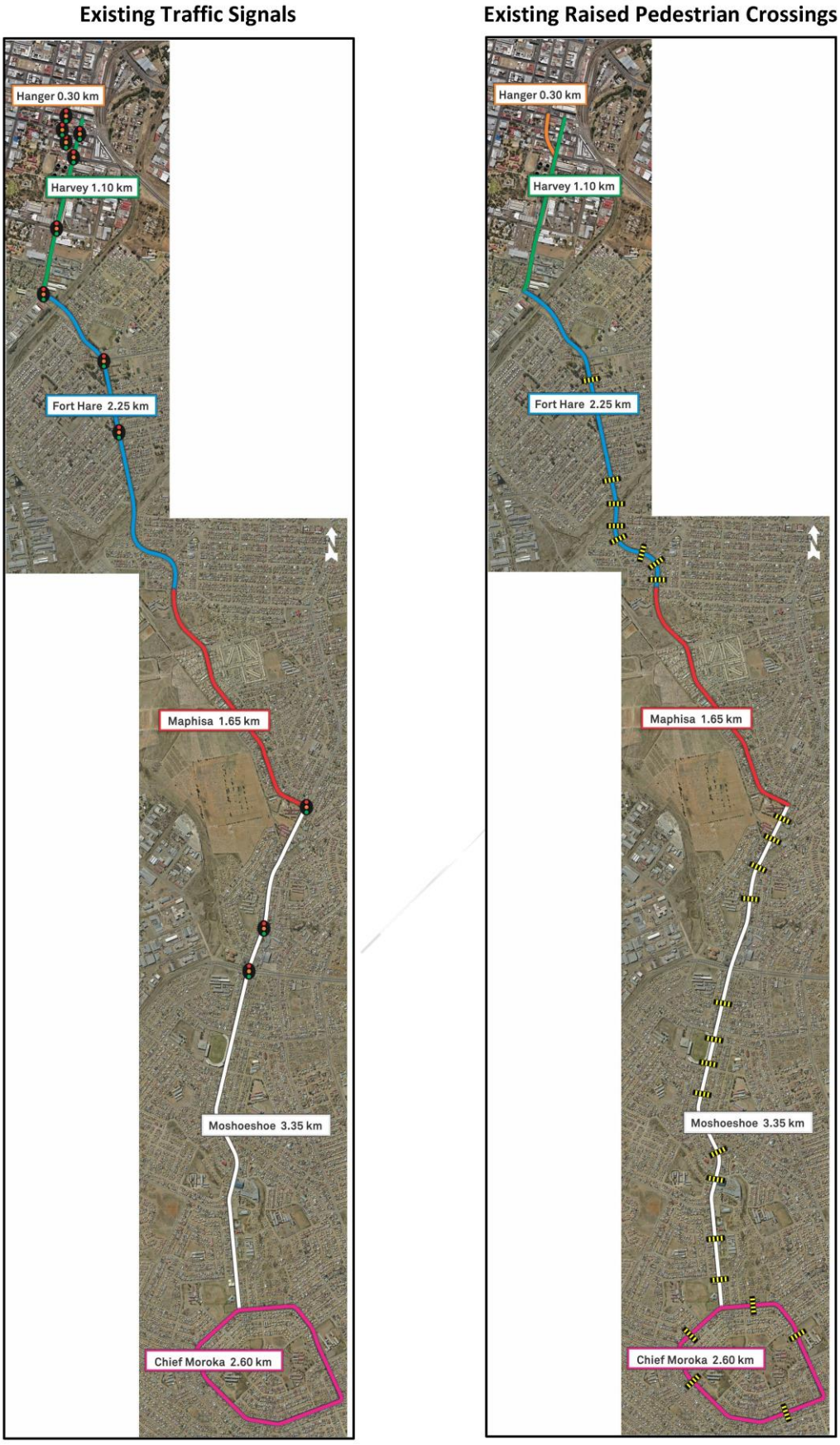


Figure 31: Location of existing pedestrian speed humps and signalised intersections

8 2023 FUTURE TRAFFIC EVALUATION

8.1 MODELLING ASSUMPTIONS

- The future traffic growth on the corridor will be taken up by the increase in Quality Bus (QB) patronage. However, we have modelled the traffic flows including all minibus-taxis. This means that effectively we have modelled a future volume which translates to a 2,5% p.a. growth rate for 5 years.
- The posted speed limit of the trunk route is 60k m/h except the Chief Moroko Crescent which has a traffic calmed recommended speed of 40 km/h. The Chief Moroko loop was not modelled.
- The TRANSYT model was broken up into separate sections coinciding with the sub-phase construction designation of A, B or C. The optimized and coordinated signal timings have been assumed as implemented.
- All the intersection upgrades and signalization as proposed were modelled to be in place.
- The long-term bus frequency of a bus every 2 minutes or 30 buses per hour was used in the TRANSYT future modelling. The service will start with a bus every 3minutes or 20 buses per hour.
- Future maximum peak station passenger demand is 400 passengers per hour which translates to 14 passengers per bus. The operations plan forecast corridor peak passenger demand is 1940 passengers per hour.
- The total bus dwell time was calculated using 1,4 seconds per passenger (two loading doors with on board tagging) plus 5 second deceleration and acceleration. This resulted in a dwell time of 25 seconds in the peak direction and 15 seconds in the off-peak direction.
- The minibus-taxis to be removed from the route was 117 taxis per hour in the peaks.

Items	Phase 1A Mafora Central
Pax per day	13,700
Fleet	23
Fleet: Approximate Number of Taxis to be used as feeders	59
Pax per bus per day	594
Peak Hour Pax	1,940
Distance	10.0
Round Trip Time	52.2
km/bus/day	171.9
Taxis to be removed	117
Unverified Taxi Fleet	222

Figure 32: Extract from The MMM IPTN Operations plan for Phase 1 trunk route

8.2 RESULTS OF 2023 FUTURE TRAFFIC EVALUATION WITH QB

The detailed section, intersection by intersection evaluation results are shown in **Annexure D**. Any intersections with signal control were optimized and co-ordinated with a cycle of 90 seconds for the AM peak and PM peak. The off-peak is anticipated to run at a 60 second cycle as with the rest of Bloemfontein CBD.

8.2.1 Moshoeshoe Section- Chief Moroko to Maphisa

All intersections are operating at LoS A and LoS B, with the odd stop control intersection operating at LoS C on the side road. The worst turn at any intersection is operating at no worse than LoS C. An exception is the east approach of the Takalekoala intersection, however, as the traffic volume experiencing this high delay is low, a traffic signal is not warranted.

The average speed for this section of the modelled network is 30 km/h for future traffic conditions

8.2.2 Maphisa Section- Moshoeshoe to Mtyobile

All intersections are operating at LoS A and LoS B, with the odd stop control intersection operating at LoS C on the side road. The worst turn at any intersection is operating at no worse than LoS C.

The average speed for this section of the modelled network is 33 km/h for future traffic conditions

8.2.3 Fort Hare Section- Mtyobile to Harvey/Rhodes

The Fort Hare and Gonyane, Hamilton, Harvey and Rhodes intersections do not operate worse than LoS C during the peaks, with the worst turning movement operating no worse than LoS D.

The average speed for this section of the modelled network is up for the AM peak from 19 km/h to 24 km/h.

8.3 TRAVEL SPEEDS MODELLED AND ACHIEVED

The summary of the modelled travel speeds is summarized in the tables below.

EXISTING TRAFFIC EVALUATION

PHASE 1 ABC QUALITY BUS- Average of 2 Directions

MIXED TRAFFIC SPEED OUTPUT ACHIEVED

		AM Peak			PM Peak		
TRANSYT SECTION	**Description**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**
Phase 1 C	Moshoeshoe	3,29	34,4	0,10	3,29	34,3	0,10
Phase 1A	Maphisa	1,88	37,3	0,05	1,88	36,9	0,05
Phase 1B	Fort Hare	2,42	18,9	0,13	2,42	25,6	0,09
TOTAL		***7,59***	***27,7***	***0,27***	***7,59***	***31,4***	***0,24***

Table 7: Existing (2018) model travel speed results for all traffic

FORECAST TRAFFIC EVALUATION

PHASE 1 ABC QUALITY BUS- Average of 2 Directions

MIXED TRAFFIC SPEED OUTPUT ACHIEVED- without stops

		AM Peak			PM Peak		
TRANSYT SECTION	**Description**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**
Phase 1C	Moshoeshoe	3,29	29,2	0,11	3,29	30,1	0,11
Phase 1A	Maphisa	1,88	33,2	0,06	1,88	32,3	0,06
Phase 1B	Fort Hare	2,42	24,3	0,10	2,42	28,6	0,08
TOTAL		***7,59***	***28,2***	***0,27***	***7,59***	***30,1***	***0,25***

Table 8: Travel speed results for upgraded network for mixed traffic along Phase 1 trunk route

Note the significant increase in travel speed for the Fort Hare section during the AM peak because of the proposed intersection upgrades and effective removal of the bottlenecks.

8.3.1 Achieved Quality Bus speeds including stops.

TRANSYT is able to model the buses in a shared lane with the mixed traffic and is able to assume a stop dwell time for each station, wherever this occurs on the link. The following table shows the round-trip results for the bus speed during the AM and PM peaks.

FORECAST TRAFFIC EVALUATION
PHASE 1 ABC QUALITY BUS- Average of 2 Directions
BUS SPEED OUTPUT ACHIEVED (with Stops)

		AM Peak			PM Peak		
TRANSYT SECTION	**Description**	**Distance/ (km)**	**Qual.Bus (km/h)**	**Time (hrs)**	**Distance/ (km)**	**Qual.Bus (km/h)**	**Time (hrs)**
Phase 1 C	Moshoeshoe	3,29	20,3	0,16	3,29	24,2	0,14
Phase 1A	Maphisa	1,88	19,1	0,10	1,88	20,2	0,09
Phase 1B	Fort Hare	2,42	24,3	0,10	2,42	28,6	0,08
TOTAL		***7,59***	***21,1***	***0,36***	***7,59***	***24,2***	***0,31***

The average peak Phase 1 trunk route round trip time is estimated to be 54,5 minutes (21,9 km/h).

The Harvey/Hanger and Chief Moroko section speeds were based on actual travel times observed.

9 CONCLUSIONS

a) The Fort Hare/Hamilton and Harvey/Rhodes are currently some of the most significant bottlenecks on the route, which do require upgrading, especially for the AM peak period. If these upgrades are implemented then the traffic operations are satisfactory. These are listed in item h) and shown in Chapter 5.

b) It was established that the removal of the south-west slip lane and the removal of both the southern slip lanes for the Fort Hare/Hamilton intersection both operate satisfactorily for future traffic conditions.

c) In many cases along the trunk route stations in the future, the bus can stop in the leftmost traffic lane as the volumes along these sections do not exceed 1100vph.

d) The final position and location of the bus stations were determined from a surrounding land-use pedestrian activity analysis, combined with practical feasible locations where there is land readily available or waiting areas can be easily created by utilizing the existing side road closures.

e) The rationalization of the access side roads has increased the average spacing between intersections from 120 m to 193 m and removed a proliferation of right-turns and median island gaps to promote the Phase 1 trunk route to a higher order collector road. Nevertheless, by using LILO intersections, many of which are currently in place, access to the surrounding township is largely maintained, obviating the need for long detour routes.

f) The number of speed humps/pedestrian speed tables have been reduced, however all those with pedestrian attractors have been left or accommodated at very nearby intersections. All current speed humps and advised pedestrian crossing speed tables will all need to be reconstructed with a profile acceptable for the Quality Bus.

g) The transfer activities at Station 005 have been facilitated offsite and the Moshoeshoe/Tsuene intersection signalized. Alternative 4 of four alternatives evaluated is recommended for Station 005 with a separate bus and minibus-taxi facility. Furthermore, the proposed northbound Station 005A which potentially requires a road closure, does not have to be implemented for the initial Phase 1 trunk operations since the transfer facility is also the bus turnaround.

h) The future peak operating conditions along the Phase 1 trunk route are considered highly satisfactory if the intersection upgrades identified in the 2018 traffic evaluation and above rationalization are implemented. The following intersection upgrades which are deemed necessary for the future satisfactory Phase 1 Trunk Route traffic operations based on the existing evaluation above are listed below:

- Intersection of Harvey Road and Rhodes Avenue- maintain existing slip lanes, but introduce a dual N-S right-turn phase on Harvey Road for all times of the day
- Intersection of Harvey Road and Fort Hare Road- extend the south approach right-turn from 60m to at least 100m in length. Provide a short 4th signal phase for traffic from the south during the PM peak. Repaint the east approach two right-turn lanes.
- Intersection of Fort Hare Road and Hamilton Road- remove the left slip lane from the south-west corner and replace with a 40m long exclusive left turn. Add an additional short right-turn lane from the east approach to cater for this high turn movement.

- The 3-way stop at Maphisa and Maibamolotsha should be converted to stop control on the side road. The right turn lane and left slip lane on Maibamolotsha is to be retained. Although tested this intersection does not warrant signalization.
- The right-turn lane from the north at the Moshoeshoe/Maphisa intersection and the one from the south at the Moshoeshoe/Tsuene intersection, should be converted to a single exclusive right-turn lane for better traffic operations.
- Signals are warranted and should be implemented at the intersection of:
- Maphisa and Mtyobile
- Moshoeshoe and Mamani
- Moshoeshoe and Tsuene (to facilitate a bus /taxi transfer facility- Station 005)

i) The future bus operating speed and round-trip time was found to be realistic and satisfactory and within the Operation Plan tolerance assumptions in this regard.

10 RECOMMENDATIONS

It is recommended that the intersection upgrades, the final station positions, the access management changes and the removal of certain speed hump/ pedestrian crossings be implemented before the Phase1 trunk route Quality Bus operations commence.

ANNEXURE A –

2018 Phase 1 Corridor Traffic volumes

ANNEXURE B –

Results of 2018 Existing Traffic Evaluation

ANNEXURE C –

Depiction of position of proposed Road Closures and LILO access changes

ANNEXURE D –

Results of 2023 Future Traffic Evaluation

I.2 Traffic Impact study – OR Tambo Corridor

GladAfrica
Consulting Engineers

DRAFT OLIVER TAMBO ROUTE TRAFFIC ASSESSMENT REPORT

December 2018

INTEGRATED TRANSPORT NETWORK PROJECT

MANGAUNG METROPOLITAN MUNICIPALITY

MANGAUNG
AT THE HEART OF IT ALL

We Engineer History

QUALITY REVIEW

Client Reference: Contract No.: C447

GladAfrica Reference: Project Number 127

Project Name: Integrated Public Transport Network (IPTN)

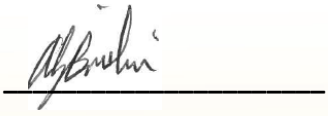
Report Heading: **Phase 1 Oliver Tambo Route Traffic Assessment Report for the Integrated Transport Network Project, Mangaung Metropolitan Municipality,**

Compiled by: Adrian Brislin Pr.Eng. Signature:  Date: 30 November 2018

Reviewed by:Leon Van Genderen Signature: _____ Date: 30 November 2018

Released by: Sarel Oberholser, Pr Eng. Signature: _____ Date: 30 November 2018

I, **Adrian Brislin Pr.Eng**., author of this traffic Assessment report, hereby certify that I am a professional traffic engineer (**Registration number: 980355**) and that I have the required experience and training in the field of trafrfic and transportation engineering, as required by the Engineering Council of South Africa (ECSA), to compile this traffic report and I take full responsibility for the content, including all calculations, conclusions and recommendations made therein.

Signature: 

Received and accepted by a duly authorised representative of the client

Client representative name: Abednigo Lekale

Signature:_____ Date: _____

Client representative name: Steve Rapulungoane

Signature:_____ Date: _____

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Annexure B – Results of 2018 Existing TRANSYT Traffic Evaluation

Annexure C – SIDRA Detailed Results of 2028 Key Intersection Evaluations

Annexure D – Results of 2028 Future TRANSYT Traffic Evaluation

Nomenclature

CBD	Central Business District
IPTN	Integrated Public Transport Network
MMM	Mangaung Metropolitan Municipality
NMT	Non-Motorised Transport
V/C	Volume / Capacity Ratio
LoS	Level of Service
QB	Quality Bus
UA	Universal Access

1 INTRODUCTION

This report assesses the Phase 1 IPTN Route along Oliver Tambo Road (old Church Street) section up to the Hanger and Harvey and Douglas Street intersection in the Central Business District close to the Intermodal Facility. Although the capacity and operations around the Intermodal facility will be evaluated, the detailed evaluation will be undertaken as part of the CBD Phase 1 IPTN route study. The O.R Tambo bus route will be the next implementable section of the IPTN.

A 10-year traffic horizon was considered in the traffic evaluation, since the purpose was to evaluate the initial Quality Bus operation which is to operate in early 2019, but a traffic growth scenario was tested to account for future land -use changes along the corridor.

2 PURPOSE OF THE REPORT

The purpose of this Traffic Assessment report is to provide more detail on the actual traffic modelling of the key route sections, with recommendations regarding access management, pedestrian crossings along the route and the refinement of station positions given the road network characteristics.

This Traffic Assessment report consists of the following:

1) Model the existing Phase 1(OR Tambo) route conditions
2) Identify current route bottlenecks/operational problems and how these should be upgraded
3) Refine the final station positions based on surrounding land-use and road network characteristics
4) Optimize the route access requirements and
5) Model the future traffic conditions with the Quality Bus (QB) stopping and intersection upgrades in order to verify future traffic operating conditions
6) Summarize the forecast traffic operations and achieved bus and mixed traffic speeds
7) Make final route upgrading recommendations

3 PHASE 1 IPTN OLIVER TAMBO ROUTE CHARACTERISTICS AND OBSERVATIONS

3.1 EXISTING ROAD HIERARCHY

The existing road hierarchy is shown adjacent and the classification of the roads under investigation can be summarised as follows:

- Hanger Street: Major Arterial
- St Andrews Street: Collector
- Harvey Road: Major Arterial
- St George Street: Collector
- OR Tambo Road bt DM Selemela & Harvey: Major Arterial
- OR Tambo Road between Harvey and Falck: Collector
- OR Tambo between Falck and St George: Activity Street
- DM Selemela Street: Collector
- David Montoedi Street: Collector
- Taelo Molosioa: Collector

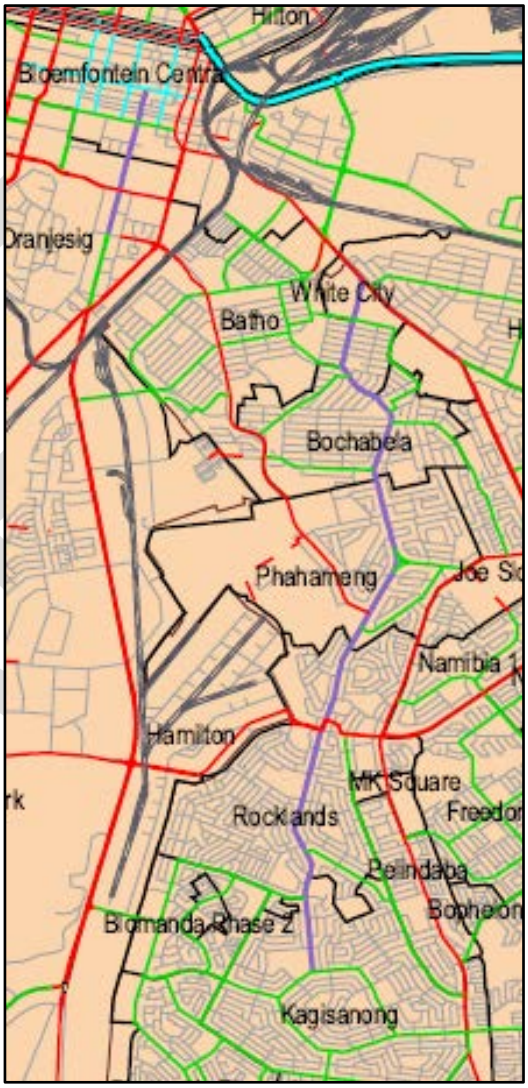


Figure 1: Extract from Bloemfontein Road Hierarchy- (Red-Arterial, Purple-Activity Street, Green-Collector)

The Phase 1 trunk route has some distinct sections with homogenous road cross-section and traffic operating conditions. These are shown in Figure 2 below and can be described as follows from south to north:

- Taelo Molosioa Street from Leepile Street to David Montoedi Street intersection (1.04 km long and a single lane per direction surrounded by residential areas)
- David Montoedi Street from Taelo Molosioa Street to DM Selemela Street (1.78 km long with a single lane per direction, surrounded on east side by residential with church and College on the western side with adjacent open land.)

- DM Selemela Street from David Montoedi Street to Oliver Tambo Road (580 m long with a single lane per direction, alongside is the Totsoletso High School, a funeral home and industrial sites closer to Oliver Tambo)
- OR Tambo Road from DM Selemela Street to St George Street (7.1km long in total with two lanes per direction and curbed median island from DM Selemela Street to Falck Street and a single lane per direction from Falck Street to St George Street)
- St George from Oliver Tambo Road to Hanger Street (400 m long with a single lane per direction).
- Hanger Street from St George Street to St Andrews Street proposed (310m long as a 3-lane one-way urban street)
- St Andrews from Hanger Street to Harvey Road (90m long as a 2-lane one-way urban street)
- Harvey Road from St Andrews Street to the proposed intermodal transfer facility back to St George in the reverse direction (300m long as a 3-lane one-way urban street)

Table 1: Road Characteristics

Road	Length	Road Reserve	Speed Limit	Cross Section	Number of Intersections
Hanger	0.31 km	16m	60 km/h	3 lanes (one way)	3
St Andrew	0.09 km	16m	60 km/h	2 lanes (one way)	2
Harvey	0.31 km	16m to 21m	60 km/h	3 lanes (one way)	3
St George	0.40 km	16m to 21m	60 km/h	1 lane per direction	2
OR Tambo	7.10 km	80m	60 km/h 80 km/h	CBD – 1 lane per direction South of CBD - 2 lanes per direction with median	5 13
DM Selemela	0.58 km	25m	60 km/h	1 lane per direction	1
David Montoedi	1.78 km	25m	60 km/h	1 lane per direction	8
Taelo Molosioa	1.04 km	28m to 30m	60km/h	1 lane per direction	3
Total	**11.61 km**				**40**

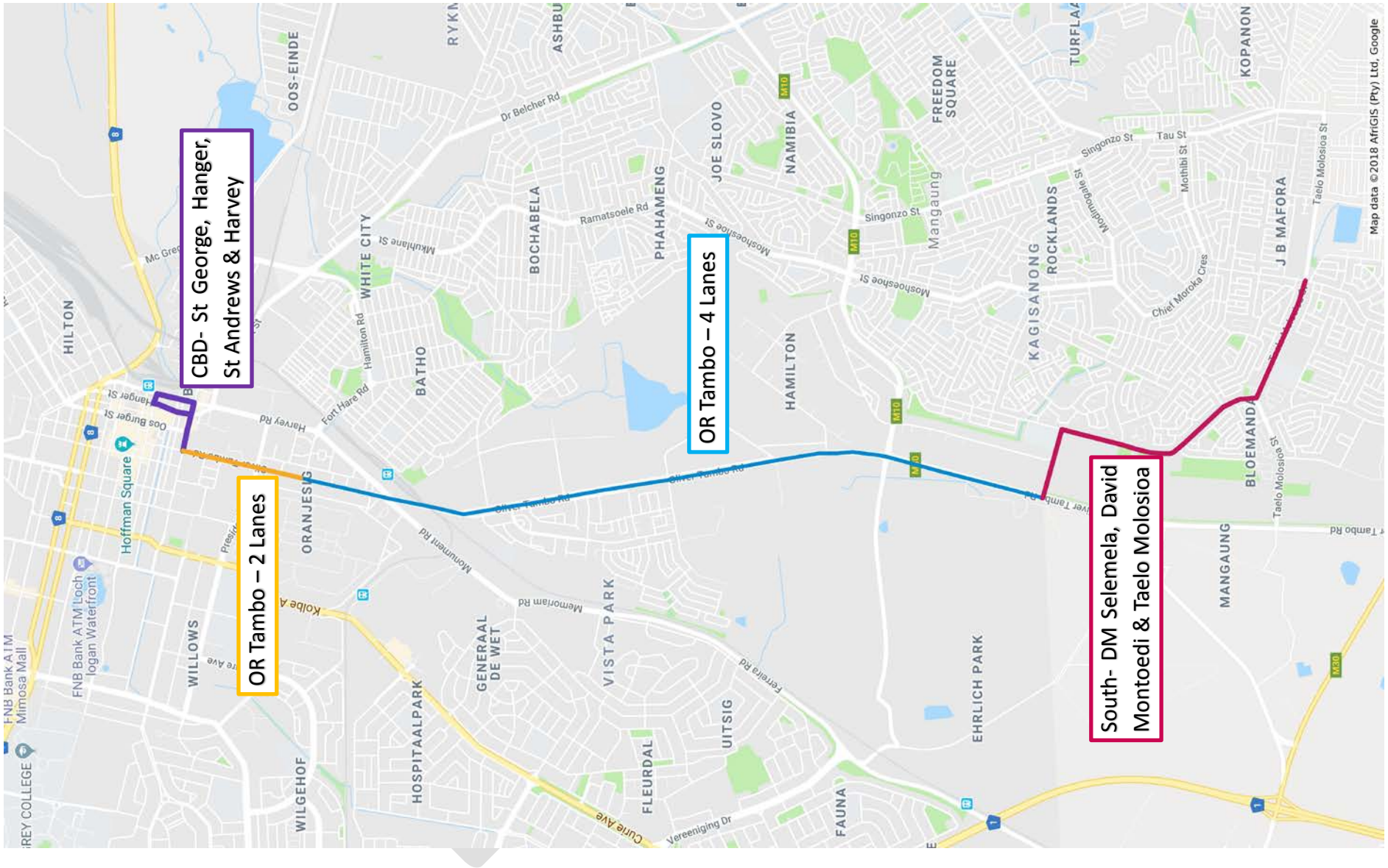


Figure 2: Sectional layout of the Oliver Tambo route for the Quality Bus

3.2 INTERSECTION CONTROL

A total of 40 intersections are located along the route with 12 intersections being currently controlled by means of traffic signals and 28 intersections are stop controlled (1-way, 2-way, 3-way and 4-way stops), The following intersections are signal controlled:

- OR Tambo Road and DM Selemela Street
- OR Tambo Road and M10
- OR Tambo Road and Vooruitsig Street
- OR Tambo and Monument Road
- OR Tambo Road and Falck Street
- OR Tambo Road and Rhodes Avenue
- OR Tambo Road and St George Street
- St George Street and Fraser Street
- St George Street and Hanger Street
- Hanger Street and St Andrews Street
- Harvey Road and St Andrews Street
- Harvey Road and St George Street

The number of intersections as well as the irregular spacing thereof increase the friction along the route which impact on the capacity as well as mobility along the route. It should be noted that the service links along Oliver Tambo road are located closely to the Oliver Tambo road and should be taken into consideration when designing of the traffic signals. The counted 2018 traffic volumes are shown in **Annexure A.**

3.3 PEDESTRIAN FACILITIES

In general, paved walkways are provided only along the northern part of the route from Monument Road into the CBD. The south part of the road does not have formal pedestrian sidewalk facilities. Pedestrian crossings (6) are provided along Taelo Molosioa Street (1), David Montoedi Street (2), Oliver Tambo Road (2) and St George Street (1).

Many of these have been placed because of a pedestrian desire line, however, we would have to check the warrants for these crossings.

4 2018 TRAFFIC MODELLING AND EVALUATION

The Level of Service (LoS) depends on the traffic delays at the intersection, either due to low capacity on the approaches, Oliver due to inadequate signal timings for signalized intersections. LoS A represents the best operating conditions with minor Oliver no delays while LoS F represents the worst operating condition with serious delays. Delays of less than 55, 50 and 35 seconds for signalized, roundabout and stop sign control intersection respectively are deemed acceptable as it is not lower than LoS D. The delay criterion for LoS is shown in **Table 2**.

Table 2: Level of Service (LoS) definitions for traffic evaluation.

Level of Service	Control delay per vehicle in seconds (d)		
	Signals	Roundabout	Stop Sign Control
A	$d \leq 10$	$d \leq 10$	$d \leq 10$
B	$10 < d \leq 20$	$10 < d \leq 20$	$10 < d \leq 15$
C	$20 < d \leq 35$	$20 < d \leq 35$	$15 < d \leq 25$
D	$35 < d \leq 55$	$35 < d \leq 50$	$25 < d \leq 35$
E	$55 < d \leq 80$	$55 < d \leq 70$	$35 < d \leq 50$
F	$80 < d$	$70 < d$	$50 < d$

4.1 MODELLING ASSUMPTIONS

1) The future traffic growth on the corridor will be taken up by an increase in Quality Bus patronage. However, the future model has effectively assumed a 1.8%p.a. growth rate for 10 years, yielding a growth factor 1.2

2) The posted speed limit of the trunk route is 60 km/h except the 3,35km of the south part of Oliver Tambo which has a speed limit of 80 km/h posted.

3) The current signal timings were used for the existing analysis. Only the major intersections have been modelled.

4.2 RESULTS OF 2018 TRAFFIC EVALUATION

The detailed TRANSYT output of evaluation results is shown in **Annexure B.** These results have been summarized below.

4.2.1 South Section- Taelo Molosioa, David Montoedi, DM Selemela and Oliver Tambo up to Hartley Street

This whole route is operating at a high level of service (LoS) with LoS A or LoS B never exceeded during both the AM peak and PM peak. The operating speed is also reasonably high since it includes a 80km/h speed limit over a large portion of the route.

4.2.2 OR Tambo Section- Gutsche-Hartley to St George

The intersection of Oliver Tambo and Harvey-Monument shows an overall LoS C during both the AM peak and PM peak with certain turning movements operating at LoS D.

The intersection of Oliver Tambo and Vooruitsig combines the adjacent service road within the traffic signal operations, so although we cannot show the concept layout with the service road, this has been accounted for in the signal timings. This intersection too operates at overall LoS C with some turning movements operating at LoS D during both the AM peak and PM peak.

The traffic evaluation also indicates poor operating conditions during especially the AM peak at the Fort and Hanger-Harvey intersection. This is mainly because of minibus-taxi misbehaviour, the main ones which can be highlighted as follows:

- The Fort east approach leftmost lane has many taxis stopping in it, thereby effectively reducing the capacity to the westbound movement to one lane only.
- The south approach left slip movement which is marked as a continuous lane into Hanger Street with 3 lanes, however because of minibus-taxi occupation of this leftmost lane of Hanger to drop passengers, the continuous lane actually functions as a give way filter since they have to move across one lane to the centre lane of Hanger Street (LoS D)

4.2.3 CBD Section- St George, Hanger, St Andrews and Harvey

a) The 2018 traffic evaluation has revealed very few capacity problems or queueing along the Oliver Tambo corridor that could not be solved by good signal co-ordination
b) For the future year traffic evaluation for 2028, in order to account for land use growth, we have assumed a 10 year average growth rate of 1,8% p.a. yielding a growth factor of 1.2.
c) To be conservative we have assumed 30 buses per hour to be running on this corridor even though the starting demand will be only 10 buses per hour.
d) In general, the IPTN route along Oliver Tambo is divided into 4 sections which are clearly shown in Figure 1 of the report, with a township section, a high speed (80km/h) section of Oliver Tambo dual carriageway with service roads, then an activity street section followed by the CBD section near the proposed intermodal Transfer facility
e) It is this last northern section where the most problems occur. There is not a capacity problem per se, but high friction is caused on Hangar Street, St Andrews Street and Harvey Road all the way back south to Fort Road intersection by the following:
    - Minibus taxi activity stopping wherever they want to drop-off or pick up a passenger(s)
    - Some deliveries on the cross streets of Douglas and Peet Avenue, but also loading directly in the Street of Hangar and Harvey on top of parking on both sides of the one way of Harvey

- Haphazard pedestrian activity who are milling around aimlessly, supporting informal Hawking stores Oliver seeking minibus taxi transport
- Although there is a signal at Hanger and Douglas St., it is not functional and there is no safe traffic control at Hanger and Peet Avenue. Just chaos and uncertainty for both driver and pedestrians alike.
- There is no intersection control at Harvey Road and Peet Avenue or Douglas Street, only the chaos and uncertainty such as mentioned above.
- The minibus taxis are holding in Douglas Street and blocking it completely to any other vehicular traffic during the off-peak.

The answer to all the above problems is reduce the number of taxis, enforce all traffic laws and create controlled intersections for safe controlled vehicular and pedestrian crossings.

5 PROPOSED CHANGES/UPGRADES TO OLIVER TAMBO ROUTE FOR IPTN OPERATIONS

The following intersection upgrades which are deemed necessary for the future satisfactory Phase 1 Oliver Tambo Route traffic operations, based on the existing evaluation as well as the future 2028 evaluation for which intersection changes are required for the purposes of a signal warrant Oliver IPTN station/pedestrian requirements are listed in **Table 3** below.

Table 3:Results of Signal Warrant Testing for Phase 1 Oliver Tambo Route Intersections

Intersection	AM/PM				
	Average delay (sec)	Volume (veh /hr /lane)	Average Queue length (veh)	Signal warranted	Comments
Taelo Molosioa & Leepile			0	No	
Taelo Molosioa & David Montoedi			0	No	
Taelo Molosioa & Simon Miya			0	No	
Taelo Molosioa & Oliver Tambo			0	No	
OR Tambo & Cemetry access	44	106	1,3	No	
David Montoedi & DM Selemela	101	393	11	Yes	
OR Tambo & Tannery	8753	86	209	Yes	
OR Tambo & Hartley	8612	119	285	Yes	But override with NO since, Side volumes too low
OR Tambo & Gutsche	12735	159	562	Yes	
OR Tambo & Goede Hoop	6018	173	289	Yes	
OR Tambo & DeWaal	224	269	17	Yes	
OR Tambo & Francken	17274	171	820	Yes	
OR Tambo & Watkey	395	23	2,5	No	
OR Tambo & Bisseaux	43	25	0	No	
OR Tambo & Papenfus	20	24	0	No	
OR Tambo & Cross	597	101	17	Yes	
OR Tambo & Goddard	121	112	3,8	Yes	But override with NO since, Side volumes too low

Intersection Signalisation is warranted when the worst 1 hour average queue > 4 (SARTSM,Vol 3)

The results above indicate that 7 intersections need to be newly signalized for the Oliver Tambo Route.

5.1 PROPOSED SIGNAL INTERSECTION UPGRADES

These will be listed from south to north and the concept layout for the intersection upgrade will be shown. Notably many of the slip lanes need to be signalized with enough of a radius to accommodate the large trucks accessing the industrial area from the service road. UA requirements also demand signalization as well as staged pedestrian crossings of especially Oliver Tambo Road and all right turn signal phasing needs to be protected right turn phases so that the slip lane and right turns do not conflict. All these layouts and signalization were tested using SIDRA for the 2028 demand and minimum green times for the side road to accommodate safe staged pedestrian crossings.

The resultant intersection upgrade was assumed to be in place for the 2028 TRANSYT model. All other intersections, not necessarily highlighted, will have to be upgraded to accommodate the UA pedestrian requirements; nevertheless, within the overarching design legislation, where it may be in conflict with UA-NTR1. Although the AM peak and PM peak will be able to run at 90 second cycles, it is highly unlikely that the off-peak could run at a 60 second cycle time, since there are 4 signal phases with some minimum green times for safe pedestrian crossing.

The detailed Movement Summary and Phasing diagrams are shown in **Annexure C.**

5.1.1 Intersection of David Montoedi & DM Selemela

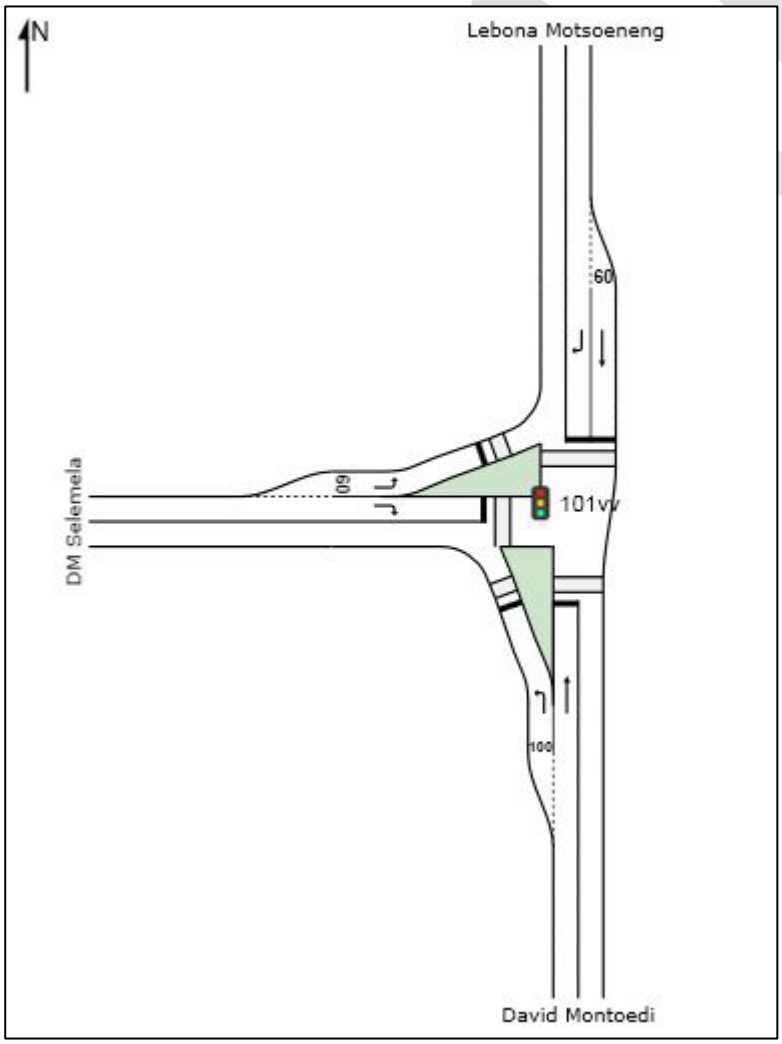


Figure 3:Upgraded concept layout of David Montoedi and DM Selemela signalized intersection

5.1.2 Intersection of Oliver Tambo & Tannery

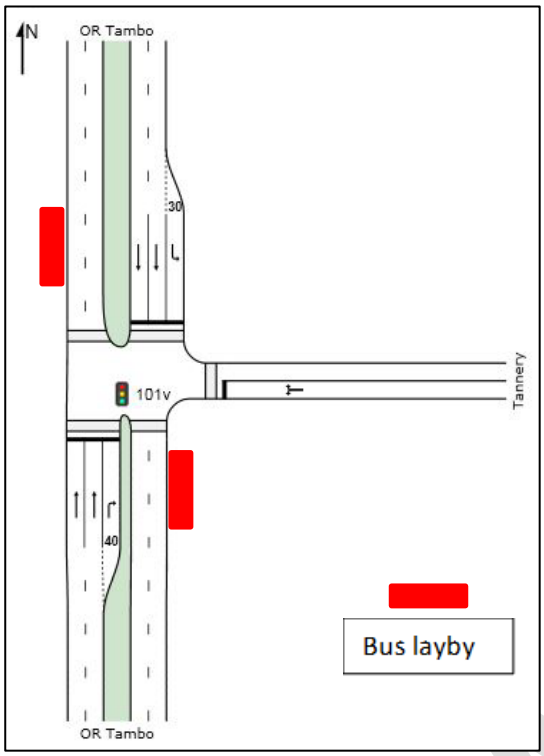


Figure 4: Upgraded concept layout of Oliver Tambo and Tannery signalized intersection

5.1.3 Intersection of Oliver Tambo & Gutsche-Hartley

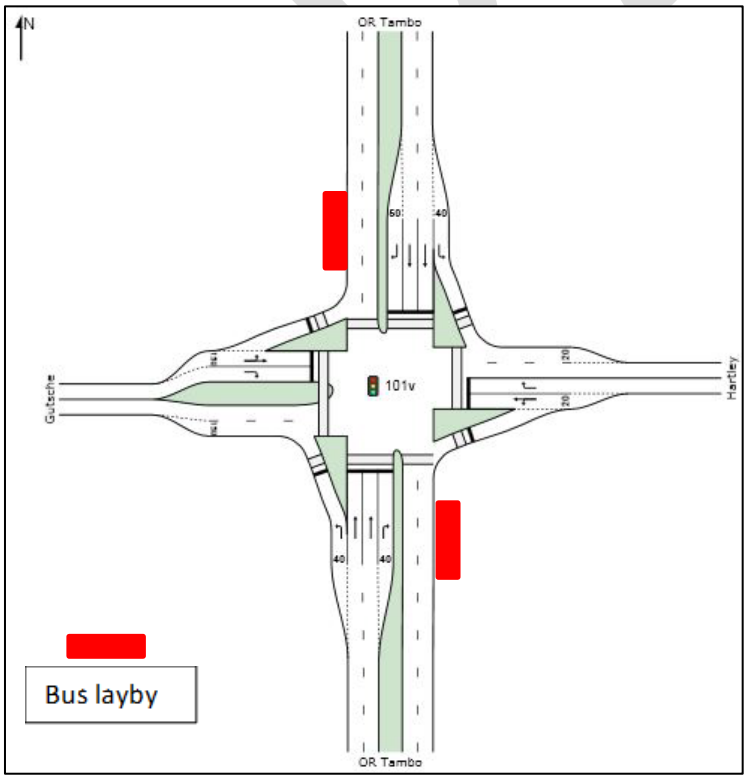


Figure 5: Upgraded concept layout of Oliver Tambo and Gutsche-Hartley signalized intersection

5.1.4 Intersection of Oliver Tambo & Goede Hoop

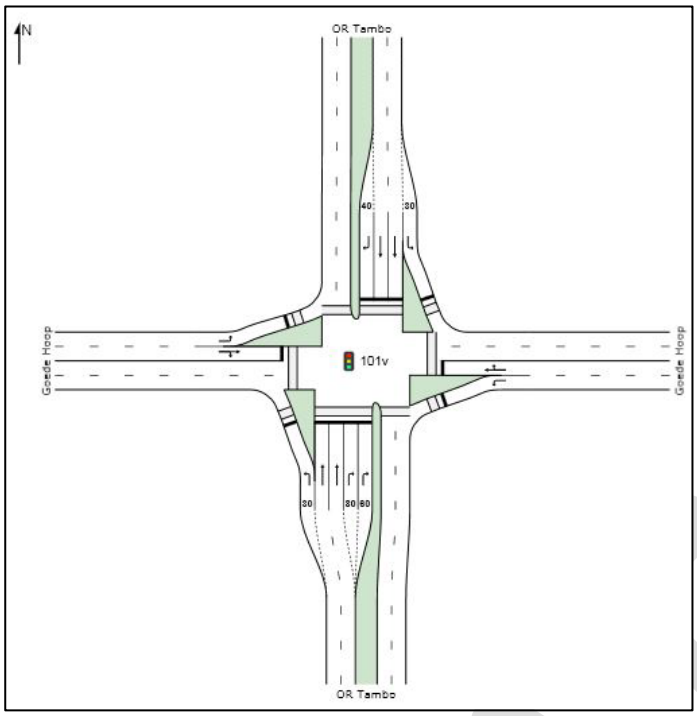


Figure 6: Upgraded concept layout of Oliver Tambo and Goede Hoop signalized intersection

5.1.5 Intersection of Oliver Tambo & De Waal

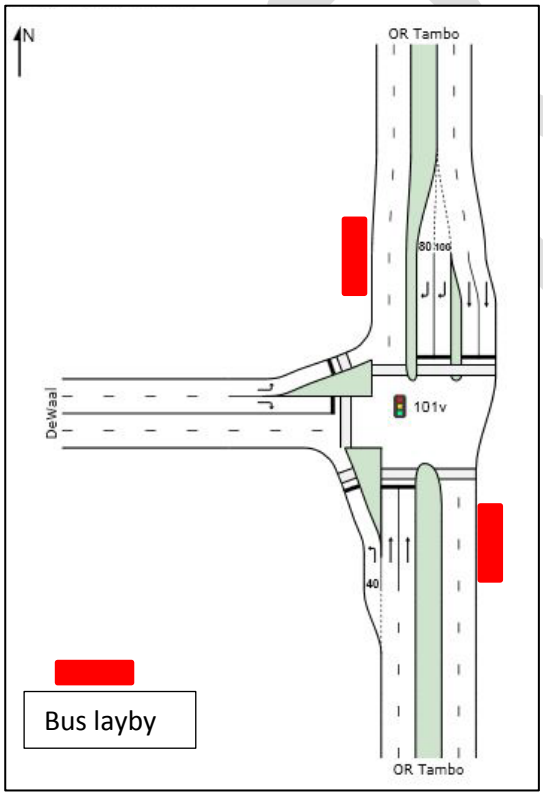


Figure 7: Upgraded concept layout of Oliver Tambo and De Waal signalized intersection

Please note the additional median separation of north approach through and right turn movements.

5.1.6 Intersection of Oliver Tambo and Vooruitsig

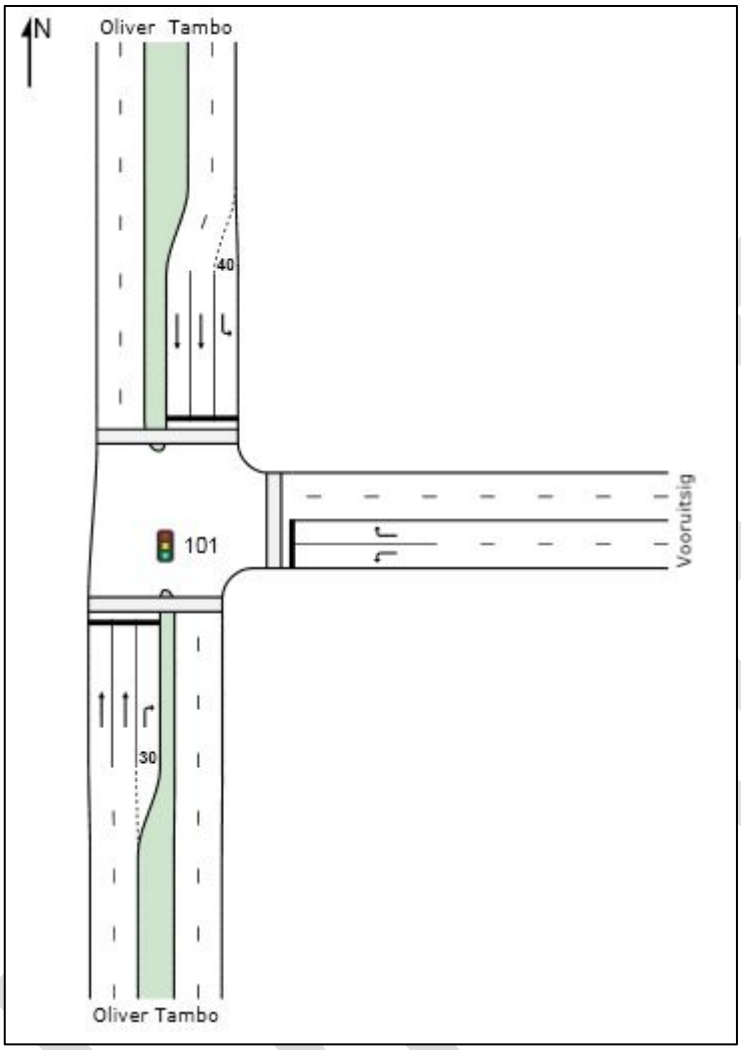


Figure 8: Upgraded intersection of

5.1.8 Intersection of Oliver Tambo & Harvey-Monument

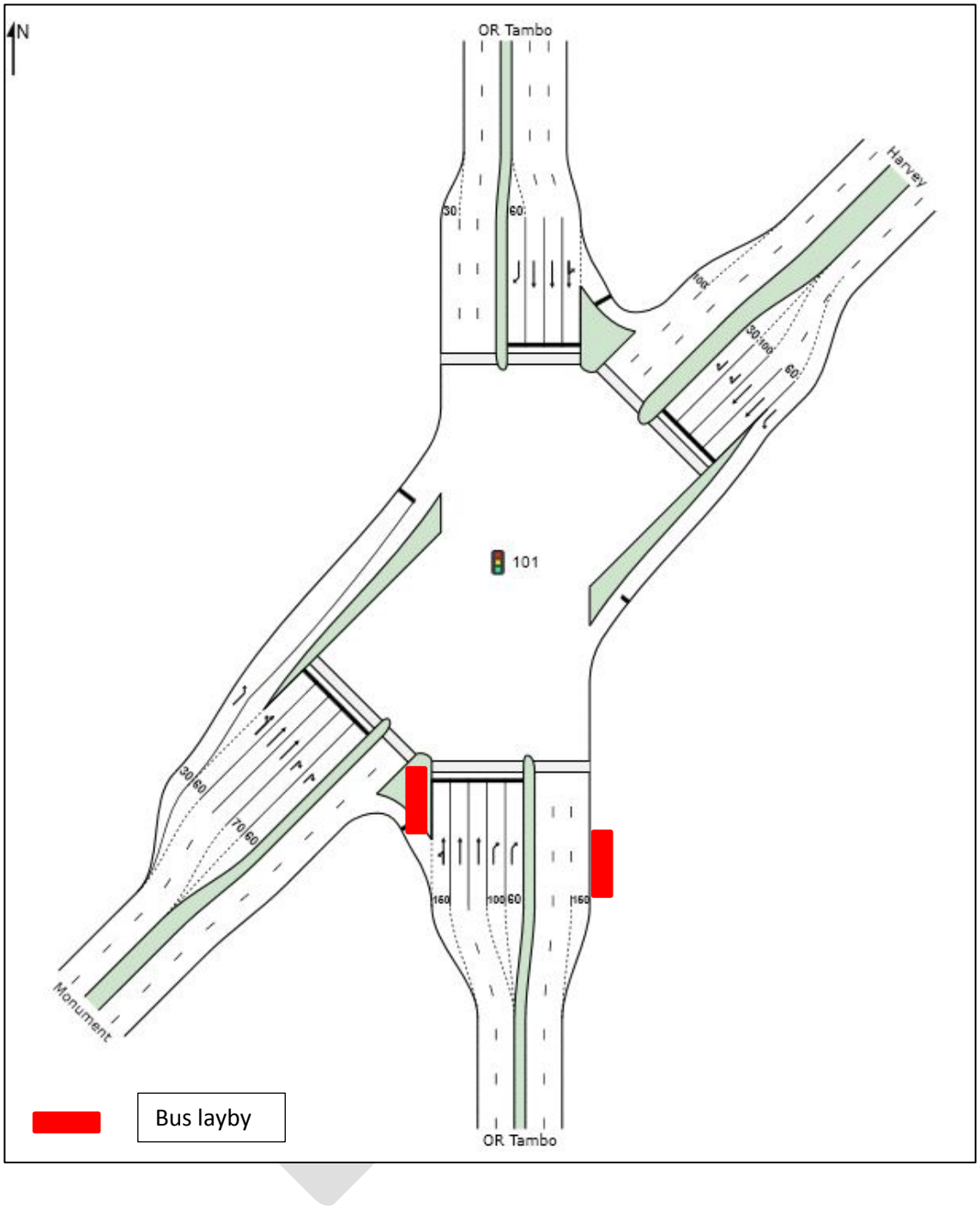


Figure 9: Proposed Layout of the Oliver Tambo and Harvey-Monument signalized Intersection

A significant amount of widening is required, most of which is on the south approach. The busses will have an opportunity to enter the traffic stream when the N-S right turn protected phase has green.

5.1.9 Intersection of Oliver Tambo & Francken

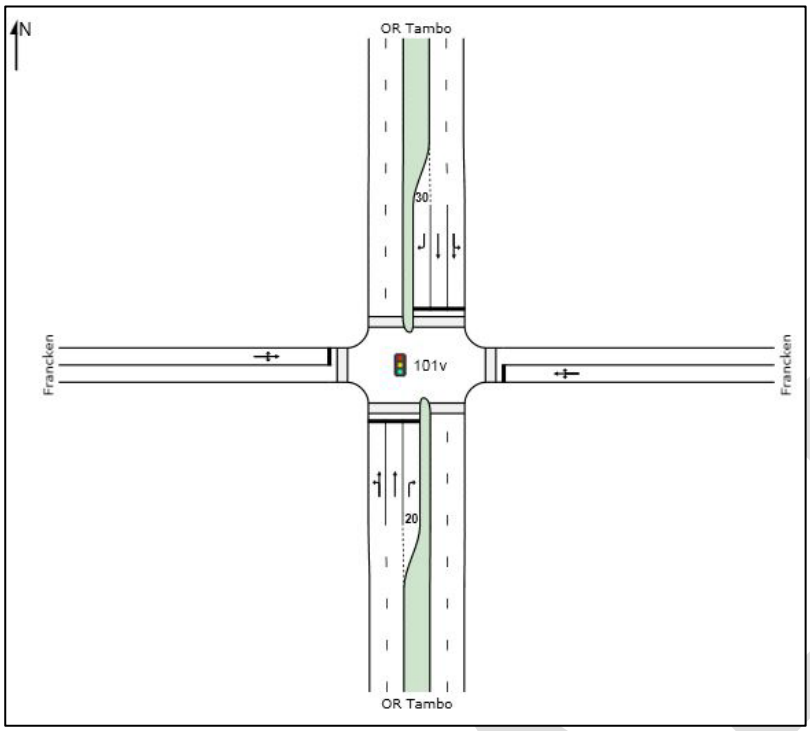


Figure 10: Upgraded concept layout of Oliver Tambo and Francken signalized intersection

5.1.10 Intersection of Oliver Tambo & Cross

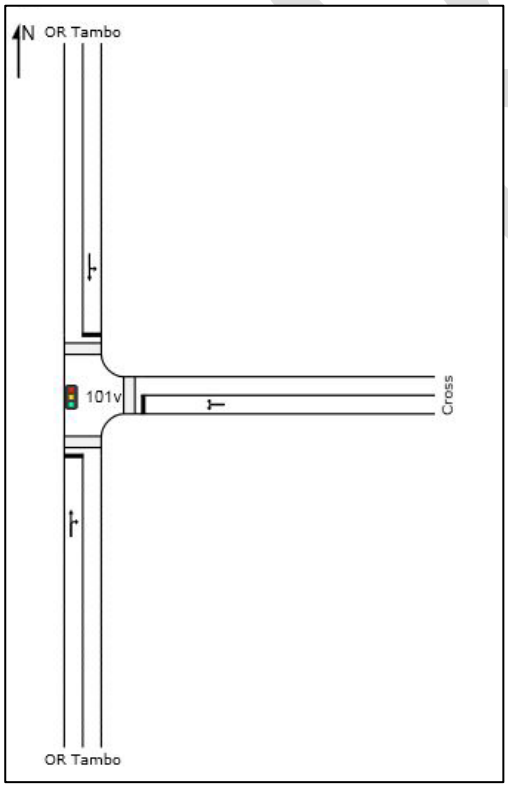


Figure 11: Upgraded concept layout of Oliver Tambo and Cross signalized intersection

6 BUS STOPPING AND REFINEMENT OF STATION POSITIONS

6.1 BUS STOPPING IN TRAFFICKED LANE

The Department of Transport has recommended that the buses stop in the street; this being based on the Cape Town My Citi experience, where the buses have significant difficulty trying to return to the running lane from a layby.

However, the posted speed limit of Oliver Tambo is 80km/h and stopping in lane poses a threat to the safety of the road users of this section of Oliver Tambo Street. Therefore, the buses can stop in the leftmost running lane at all the other stations except those on the 80 km/h Oliver Tambo Street section, where laybys are proposed. Although there are not many stations where laybys are required, we have nevertheless ensured that the traffic signal plan for the intersection straddled by laybys will include a protected right turn signal phase, during which the IPTN bus assuredly will be able to enter the Oliver Tambo traffic stream.

The Taelo Molosioa and Leepile station is a turn-around station, therefore, the provision of an off-street IPTN facility is necessary.

6.2 BUS STATION POSITIONS

The approximate position of the stations has been determined by considering the surrounding land-use (residential Oliver retail) as well as the minibus-taxi stopping activity in the same particular area.

A map of the Phase 1 Oliver Tambo Route with station positions and names is shown in **Figure 4** below. The proposed intersection layouts of the future signalized intersections have been provided in section 5.

6.2.1 Harvey-Monument and Oliver Tambo Station

Monument Oliver Tambo Station- for the northbound and southbound station, the bus can stop in the leftmost lane as proposed by the DOT since the operating speed should be no higher than 60 km/h. The bus stations should be placed on the far-side of the intersection. In the northbound case we have had to modify the proposal to the nearside in the traffic island and for the southbound it is opposite the “Dent Doctor”, where a wide sidewalk has already been provided. All the directional slip lanes will have to be signalized and this configuration tested with a likely additional through lane to compensate for the loss of capacity.

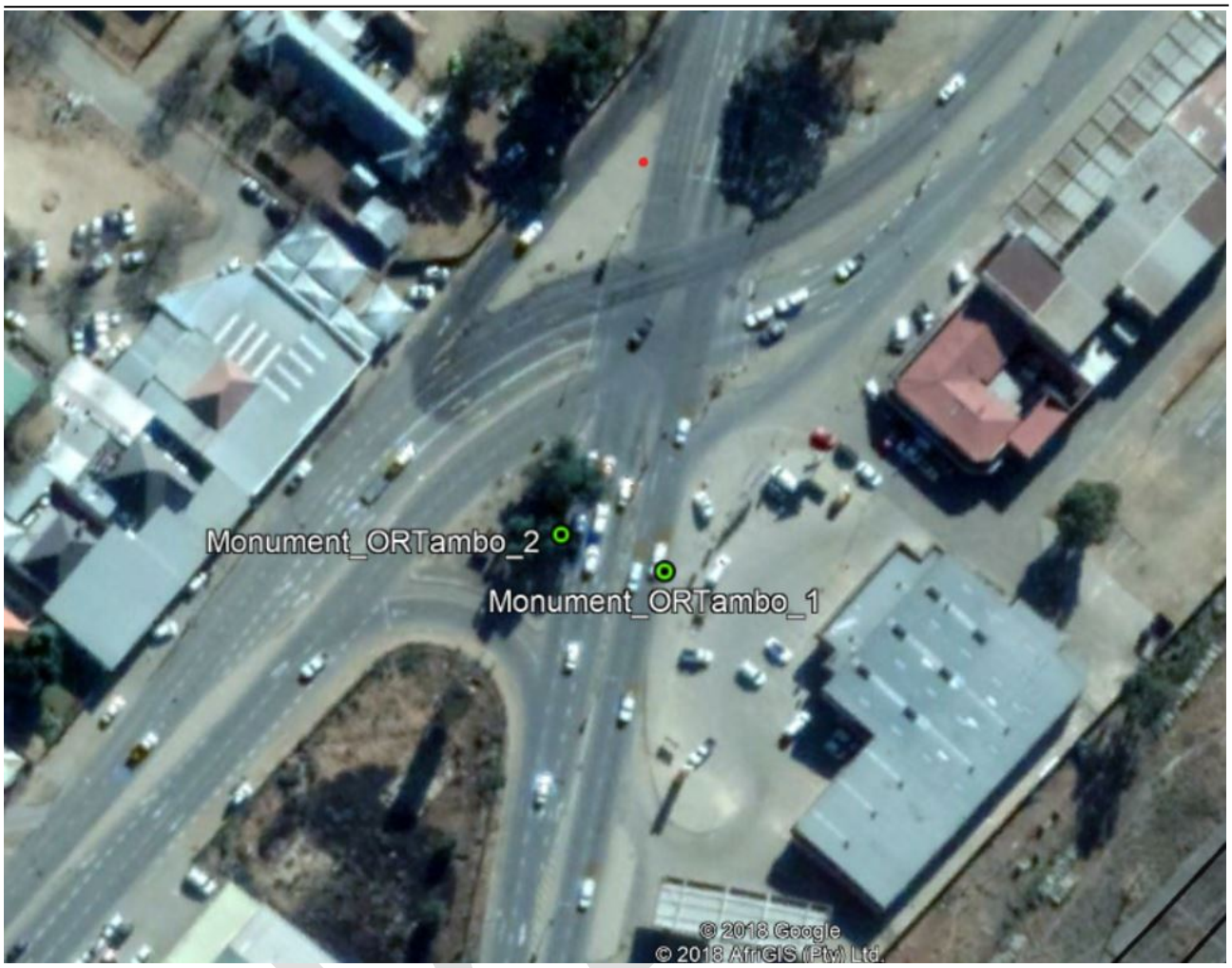


Figure 12: Proposed location of e bus stations at the Oliver Tambo & Harvey-Monument intersection.

6.2.2 Vooruitsig_De Waal Station

Vooruitsig_De waal Station- The posted speed limit of Oliver Tambo Road is 80km/h, therefore, the construction of laybys for both directions is recommended. The signalization of the nearest intersection (OR Tambo and DeWaal) to the station is recommended for the bus to find a gap and join the traffic. The signalization of the intersection is necessary for the safe crossing of pedestrians and it has been tested that signalization is warranted. As per common traffic engineering practice, the laybys will be provided on the far-side of the intersection for the different directions along Oliver Tambo.

6.2.3 Hartley-Gutsche Station

Hartley-Gutsche Station - The posted speed limit of Oliver Tambo Road is 80km/h, therefore, the construction of laybys for both directions is recommended. The signalization of the nearest intersection (OR Tambo and Gutsche-Hartley) to the station is recommended for the bus to find a gap and join the traffic. The signalization of the intersection is necessary for the safe crossing of pedestrians and it has been tested that signalization is warranted. As per common traffic engineering practice, the laybys will be provided on the far-side of the intersection for the different directions along Oliver Tambo.

6.2.4 Hamilton Station

Hamilton Station- The posted speed limit of Oliver Tambo Road is 80km/h, therefore, the construction of laybys for both directions is recommended. The signalization of the nearest intersection (OR Tambo and Tannery) to the station is recommended for the bus to find a gap and join the traffic. The signalization of the intersection is necessary for the safe crossing of pedestrians and it has been tested that signalization is warranted. As per common traffic engineering practice, the laybys will be provided on the far-side of the intersection for the different directions along Oliver Tambo.

6.2.5 University of Free State South Campus Station

University of Free State South Campus Station- the existing laybys can be used by the bus. The creation and utilization of laybys is necessary as the posted speed on Oliver Tambo Road is 80km/h. In previous Station locations we have motivated for the provision of a traffic signal which creates time for the bus to enter the Oliver Tambo traffic stream. However, in this case the location of the bus station is determined by the pedestrian pathways to the main University of the Free State South campus pedestrian access. If laybys are provided, since there is no side road intersection, there will be little opportunity for the bus to enter back into the traffic stream. Therefore, two alternative solutions are proposed:

a) Create a T-junction intersection from the east side service road (industrial area with vacant properties for industrial densification.) The location will be exactly in the middle of the Oliver Tambo section between DM Selemela Street intersection and the vehicular access to the UFS South Campus (total distance of 630 m). Such a T-junction would need to be signalized to create the bus traffic stream entry opportunity, although may not be warranted from a vehicular viewpoint. In terms of Road Hierarchy and Access Requirements, such a T-junction would be allowed for a Class 2U arterial.

b) A drop-off is created at the existing drop-off facility and the IPTN bus must divert to the UFS South campus drop-off/pick-up (which would have to be upgraded for boarding/alighting to UA standards) via the current T-junction off Oliver Tambo Road. This would mean an additional 1.12 km length per direction for the IPTN route, which may not be operationally acceptable.

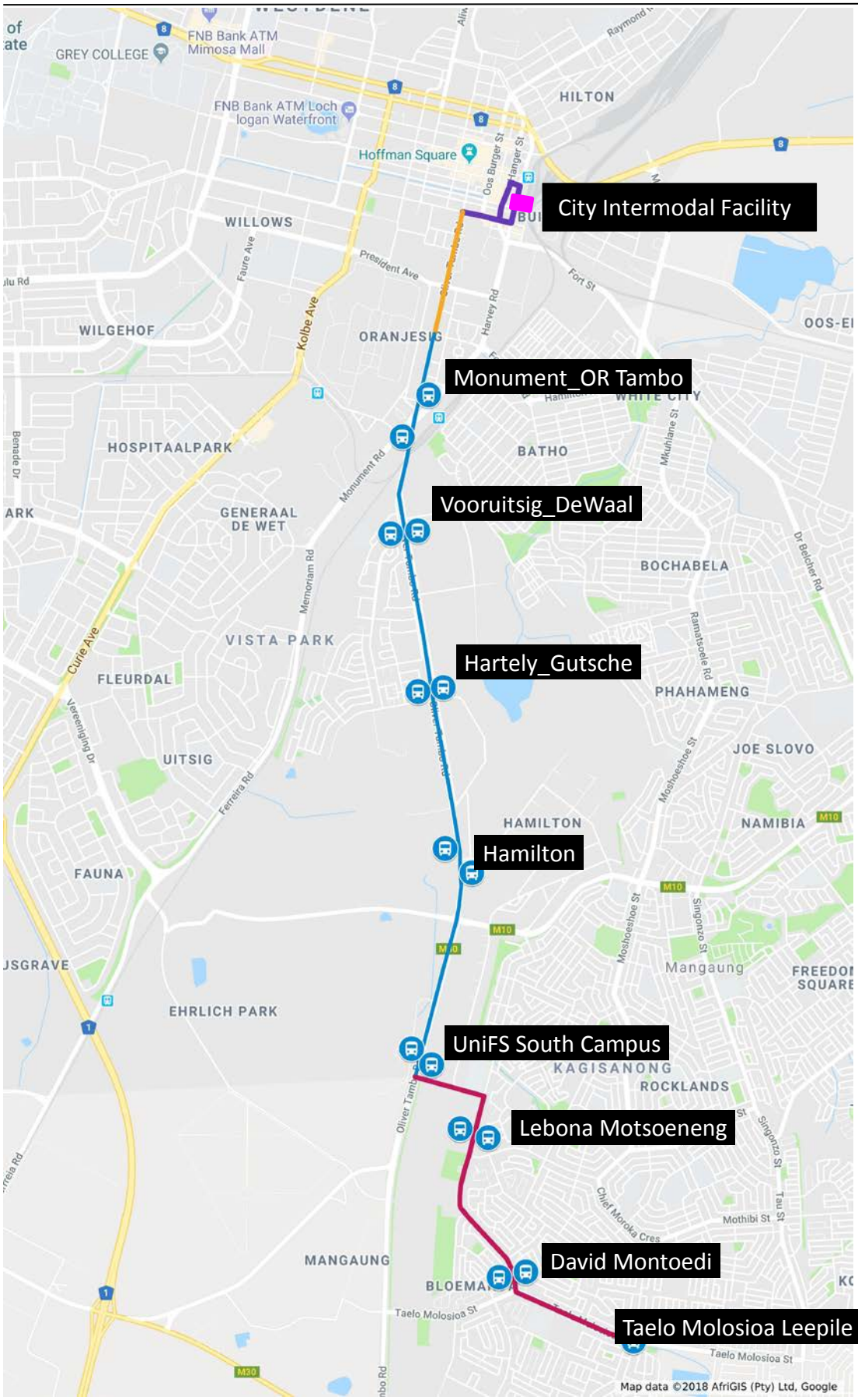


Figure 13:Phase 1 Oliver Tambo Route and Station locations

6.2.6 Lebona Motsoeneng Station

Lebona Motsoeneng- for the northbound and southbound station, the bus can stop in the lane. This station has been placed purposely to serve the Mateo FET College. It is proposed to provide the northbound stop north of the vehicular College access and the southbound station south of the access. A pedestrian crossing (midbolock yield-controlled should be located just south of the southbound station.

6.2.7 David Montoedi Station

David Montoedi Stations- for the northbound and southbound station, the bus can stop in the lane. This north east corner property is currently vacant and may be an ideal land-use opportunity for a community facility with the IPTN station nearby. It would be preferable to place both stations well south of the bend in the road, and closer to the intersection, so that vehicles passing the stationary bus can see the opposing traffic properly before the bend in the road.

6.2.8 Taelo Molosioa Leepile Station

Taelo Molosioa Leepile Station- this is a turn-around station and the in principle this will be a IPTN bus terminal. It is envisaged that the eastbound bus will turn right (south) into the Leepile Street and then right again into a terminal/transfer facility on the vacant corner property. The bus station will be separated by a wide walkway/waiting area at which any potential taxi transfers can take place without bus and taxi mixing.

It is highly unlikely that the traffic from the south along Leepile Street will increase as the residential area is well established. This means that the right turn for the bus will not encounter any higher traffic growth that it should cross. Nevertheless, Leepile Street should have a local widening with an exclusive right turn lane southbound for the bus to wait for a gap.

The IPTN bus will the exit onto Taelo Molosioa Street as a left turn yield control in order to proceed westbound.

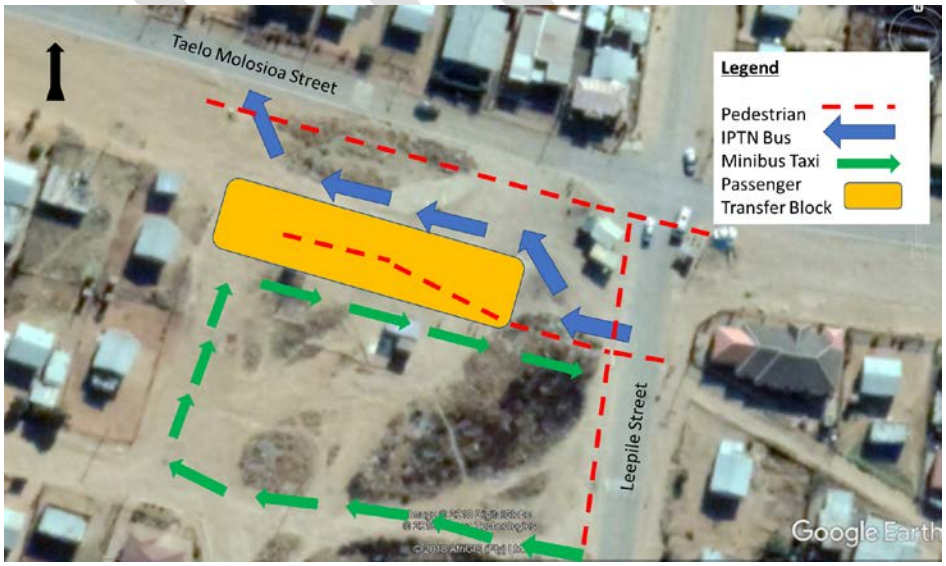


Figure 14: Concept Layout of Oliver Tambo Route Turnaround/Transfer facility

7 RATIONALIZATION OF PEDESTRIAN CROSSINGS

7.1 PEDESTRIAN CROSSING NECESSITY EVALUATION

In general, paved walkways are provided only along the northern part of the route from Monument Road into the CBD. The south part of the road does not have formal pedestrian sidewalk facilities. Pedestrian crossings (6) are provided along Taelo Molosioa Street (1), David Montoedi Street (2), Oliver Tambo Road (2) and St George Street (1).

Many of these have been placed because of a pedestrian desire lines, however, we would have to check the warrants for these crossings in their current positions by undertaking 12-hour pedestrian counts and evaluating the average of the highest 4 hour weekday pedestrian volumes and opposing vehicular traffic volumes warrant as contained in SARB-RR92/126: Pedestrian Facilities Guidelines. Unfortunately, there was not enough time towards the end of the year to undertake these surveys timeously during school terms because of exam writing, so these will be undertaken in 2019 during the new school term.

In general, there will be facilities placed near the Bus Stations, especially to cross Oliver Tambo to access work opportunities on both sides of the corridor. Apart from the first section in the township suburb of JB Mafora and Blomanda, there is generally no need for a sidewalk along the length of Oliver Tambo since pedestrians are walking along the service roads. It may be within the scope of the Oliver Tambo design to provide these service road sidewalks as well. From the intersection of Harvey-Monument Road northwards to the CBD, there is a need to provide paved sidewalks along both sides of Oliver Tambo, St George Street and in all CBD streets where the bus runs, if there are none such sidewalks currently in existence.

Specifically, there is at present a yield-controlled pedestrian crossing on Oliver Tambo Road just south of Nuffield Street. The only significant destination may be the two large industries on the eastern side of Oliver Tambo on Nuffield Street, but the warrant for this pedestrian crossing will need to be confirmed with counts in January 2019.

8 2023 FUTURE TRAFFIC EVALUATION

8.1 MODELLING ASSUMPTIONS

- The future traffic growth on the corridor will be taken up by the increase in Quality Bus (QB) patronage. However, we have modelled the traffic flows including all minibus-taxis. This means that effectively we have modelled a future volume which translates to a 1.8% p.a. growth rate for 10 years.
- The TRANSYT model was broken up into 2 separate sections. Model T1 covers the southern Township section and models Oliver Tambo up to Gutsche-Harvey intersection. Model T2 starts at Oliver Tambo/ Goede Hoop proceeding north to St George Street and Hanger Street/Harvey Street. The route via Harvey Road has also been included in this model as the Phase 1 Fort Hare IPTN joins at the Harvey/Fort Hare intersection. The optimized and coordinated signal timings have been assumed as implemented.
- All the intersection upgrades and signalization as proposed Oliver deemed warranted were modelled to be in place.
- The long-term bus frequency of a bus every 2 minutes Oliver 30 buses per hour was used in the TRANSYT future modelling. The service will start with a bus every 3 minutes Oliver 20 buses per hour.
- Future maximum peak station passenger demand is 300 passengers per hour which translates to 15 passengers per bus. The operations plan forecast corridor peak passenger demand is 1250 passengers per hour.
- The total bus dwell time was calculated using 1,4 seconds per passenger (two loading doors with on board tagging) plus 5 second deceleration and acceleration. This resulted in a dwell time of 25 seconds in the peak direction and 15 seconds in the off-peak direction.

8.2 RESULTS OF 2028 FUTURE TRAFFIC EVALUATION WITH QB

The detailed section, intersection by intersection evaluation results are shown in **Annexure C**. Any intersections with signal control were optimized and co-ordinated with a cycle of 90 seconds for the AM peak and PM peak. The off-peak is anticipated to run at a 60 second cycle for the section near the CBD as with the rest of Bloemfontein CBD, however, because of the 4 phase signal plans, a cycle time of 90seconds is also deemed to be appropriate.

8.2.1 Model T1A: South Section- Taelo Molosioa, David Montoedi, DM Selemela, Oliver Tambo up to the intersection of Gutsche-Hartley (distance 6,47 km with a 3km length of Oliver Tambo posted with a 80km/h speed limit.

8.2.2 Model T2(1B): Oliver Tambo Section- from Goede Hoop to St George, Hanger to Douglas Street and back along Harvey Road and St George to Oliver Tambo Street back southwards.

The results of the 2028 TRANSYT intersection evaluations are shown in **Annexure D**.

8.3 TRAVEL SPEEDS MODELLED AND ACHIEVED

The TRANSYT models allow one to determine the average speed achieved per direction per vehicle class along a defined route. This has been reported for the two separate models for different directions, but no significant difference can be observed between the two directions of travel.

8.3.1 2018 Mixed traffic operating speeds

Table 4: 2018 Results of average speeds along IPTN Phase 1 Oliver Tambo Route

EXISTING TRAFFIC EVALUATION 2018

PHASE 1 Oliver Tambo Road- Average per direction

MIXED TRAFFIC SPEED OUTPUT ACHIEVED

			AM Peak			PM Peak		
TRANSYT SECTION	**Description**	**Direction**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**
1A	Taelo Molosioa	NB	6,47	60,5	0,107	6,47	62,0	0,104
1B	Oliver Tambo	NB	4,83	45,7	0,106	4,83	49,1	0,098
1A	Taelo Molosioa	SB	6,47	63,0	0,103	6,47	61,1	0,106
1B	Oliver Tambo	SB	4,63	45,3	0,102	4,63	45,4	0,102
TOTAL	**1A +1B**	**NB**	***11,30***	***53,2***	***0,21***	***11,30***	***55,7***	***0,20***
TOTAL	**1A +1B**	**SB**	***11,10***	***54,2***	***0,20***	***11,10***	***53,4***	***0,21***

8.3.2 2028 Mixed traffic operating speeds

Table 5: 2028 Results of average speeds along IPTN Phase 1 Oliver Tambo Route

FORECAST TRAFFIC EVALUATION 2028 **(growth factor 120%)**

PHASE 1 Oliver Tambo Road - Average per direction

MIXED TRAFFIC SPEED OUTPUT ACHIEVED

			AM Peak			PM Peak		
TRANSYT SECTION	**Description**		**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**
1A	Taelo Molosioa	NB	6,47	59,4	0,109	6,47	62,0	0,104
1B	Oliver Tambo	NB	4,83	43,6	0,111	4,83	44,6	0,108
1A	Taelo Molosioa	SB	6,47	62,8	0,103	6,47	60,4	0,107
1B	Oliver Tambo	SB	4,63	41,9	0,111	4,63	42,2	0,110
TOTAL	**1A +1B**	**NB**	***11,30***	***51,4***	***0,22***	***11,30***	***53,1***	***0,21***
TOTAL	**1A +1B**	**SB**	***11,10***	***52,0***	***0,21***	***11,10***	***51,2***	***0,22***

It should be noted that it is understandable that the 2028 speeds are lower than those of 2018 because the traffic is 120% higher along the Oliver Tambo Route.

8.3.3 Achieved IPTN Quality Bus speeds including stops.

TRANSYT software is able to model the buses in a shared lane with the mixed traffic and is able to assume a stop dwell time for each station, wherever this occurs on the link.

Table 6: 2028 Results of the average IPTN bus travel speeds

FORECAST TRAFFIC EVALUATION 2028 **(growth factor 120%)**

PHASE 1 Oliver Tambo Road - Average per direction

BUS TRAFFIC SPEED OUTPUT ACHIEVED

			AM Peak			PM Peak		
TRANSYT SECTION	**Description**		**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**	**Distance/ (km)**	**Mixed (km/h)**	**Time (hrs)**
1A	Taelo Molosioa	NB	6,47	27,7	0,234	6,47	28,2	0,230
1B	Oliver Tambo	NB	4,83	27,2	0,178	4,83	29,1	0,166
1A	Taelo Molosioa	SB	6,47	31,8	0,203	6,47	23,3	0,277
1B	Oliver Tambo	SB	4,63	23,9	0,193	4,63	21,7	0,214
TOTAL 1A +1B		**NB**	***11,30***	***27,4***	***0,41***	***11,30***	***28,5***	***0,40***
TOTAL 1A +1B		**SB**	***11,10***	***28,0***	***0,40***	***11,10***	***22,6***	***0,49***
AVERAGE ROUND TRIP			both directions			***22,40***	***26,43***	***0,848***

The 2028 IPTN bus round trip speed along the Phase 1 Oliver averages 26km/h or takes 51 minutes, which is a little quicker than that estimated in the Phase 1 Operational Plan.

9 CONCLUSIONS

1) The existing 2018 traffic evaluation show overall levels of service no worse than LoS C (mostly LoS A and B) with certain turning movements operating at LoS D.

2) The upgrading of some of the Oliver Tambo intersections to accommodate the 2028 traffic and Universal Access requirements is significant from DM Selemela Road to Cross Street. The proposed concept layouts with signalized slip lanes and protected right turn phases are depicted in Chapter 5.1.

3) For the most part the IPTN bus will be stopping in the trafficked leftmost lane with no layby required for the bus stations.

4) For the posted 80km/h section of Oliver Tambo, the bus stations require the provision of a bus layby and these are placed at the far-side of the signalized intersections per direction. The signal plans will then be specifically designed to allow a period of about 10 seconds for the bus to enter the traffic stream during every 90 second cycle.

5) The warrants for the existing pedestrian crossings need to be re-evaluated with new traffic counts to be executed in 2019. This will determine the type of control justified for each pedestrian crossing.

6) The section of the route from Taelo Molosia/Leepile Street intersection, via David Montoedi Street and DM Selemela Street needs to be provided with barrier curbs and a paved sidewalk between 2to 3m wide on both sides of the road. The current traffic calming should remain in position, however, these may need to be re-constructed to be bus friendly.

7) The misbehaviour of the minibus-taxis which causes severe unnecessary congestion needs to be addressed with law enforcement and the physical removal of some of the operating licenses, which will be replaced by the Quality Bus route and services.

8) The achieved bus operating speed along the Oliver Tambo corridor is commendable considering the 10 year traffic growth of 1,8% p.a. which results in a flow scaling of 120%. The average round trip bus speed achieved is 26 km/h or 51 minutes excluding the dwell time in the Intermodal facility in the CBD. This is higher than that assumed in the IPTN Phase 1 operations plan, which provides a little leeway for fleet size reduction.

10 RECOMMENDATIONS

It is recommended that the road and intersection upgrade proposals plus those for the intersection upgrades be accepted as basis for the Oliver Tambo Road design.

ANNEXURE A –

2018 Phase 1 Corridor Traffic volumes

ANNEXURE B –

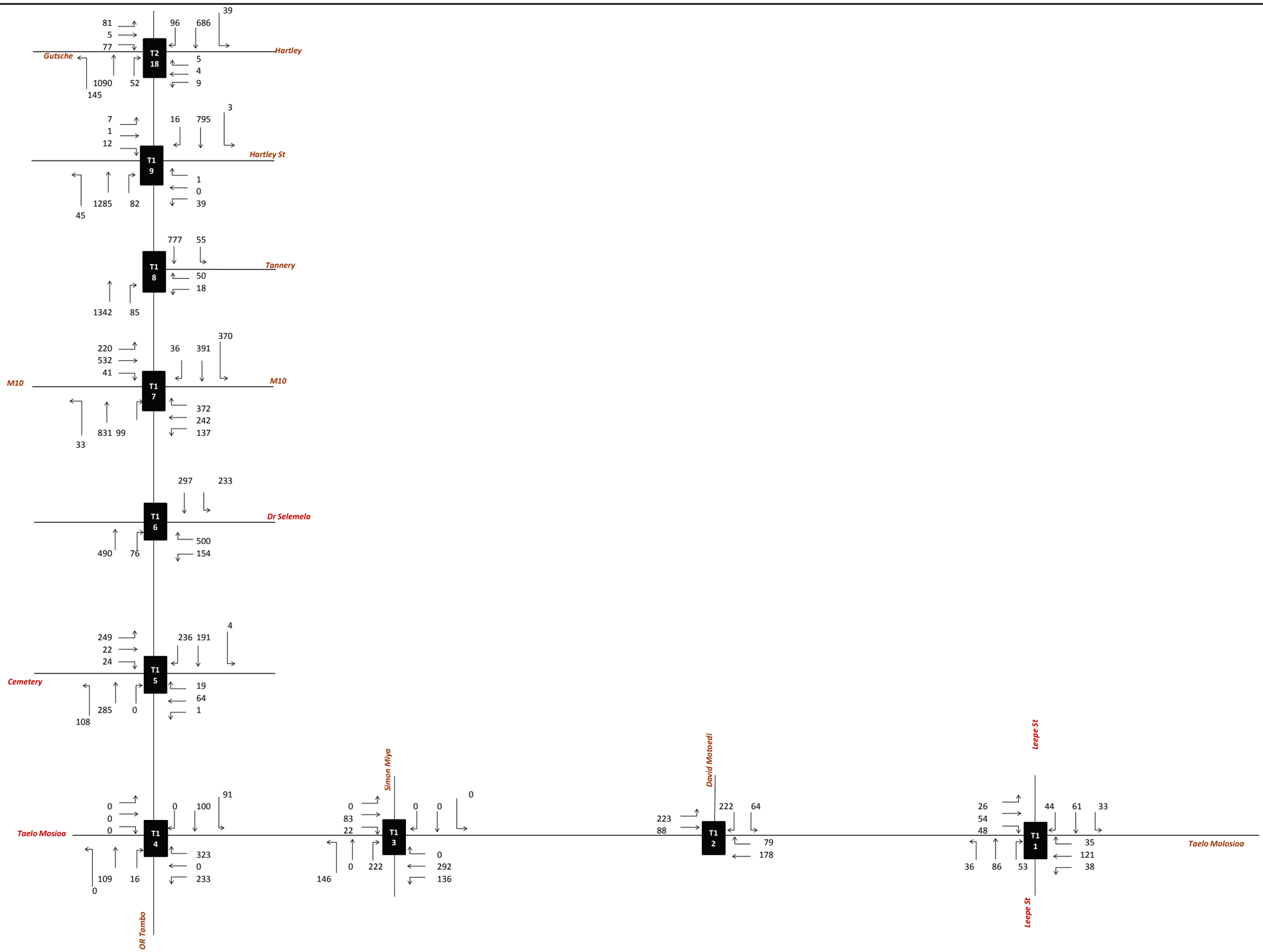
Results of 2018 Existing TRANSYT Traffic Evaluation

ANNEXURE C –
Detailed Results of 2028 Future Traffic Evaluation for key intersection upgrades

ANNEXURE D –
Results of 2028 Future TRANSYT Traffic Evaluation

ANNEXURE A –

2018 Phase 1 Corridor Traffic volumes



	2018 TRAFFIC VOLUMES	**Proj. Nber**
	AM PEAK	**Fig 1AM**

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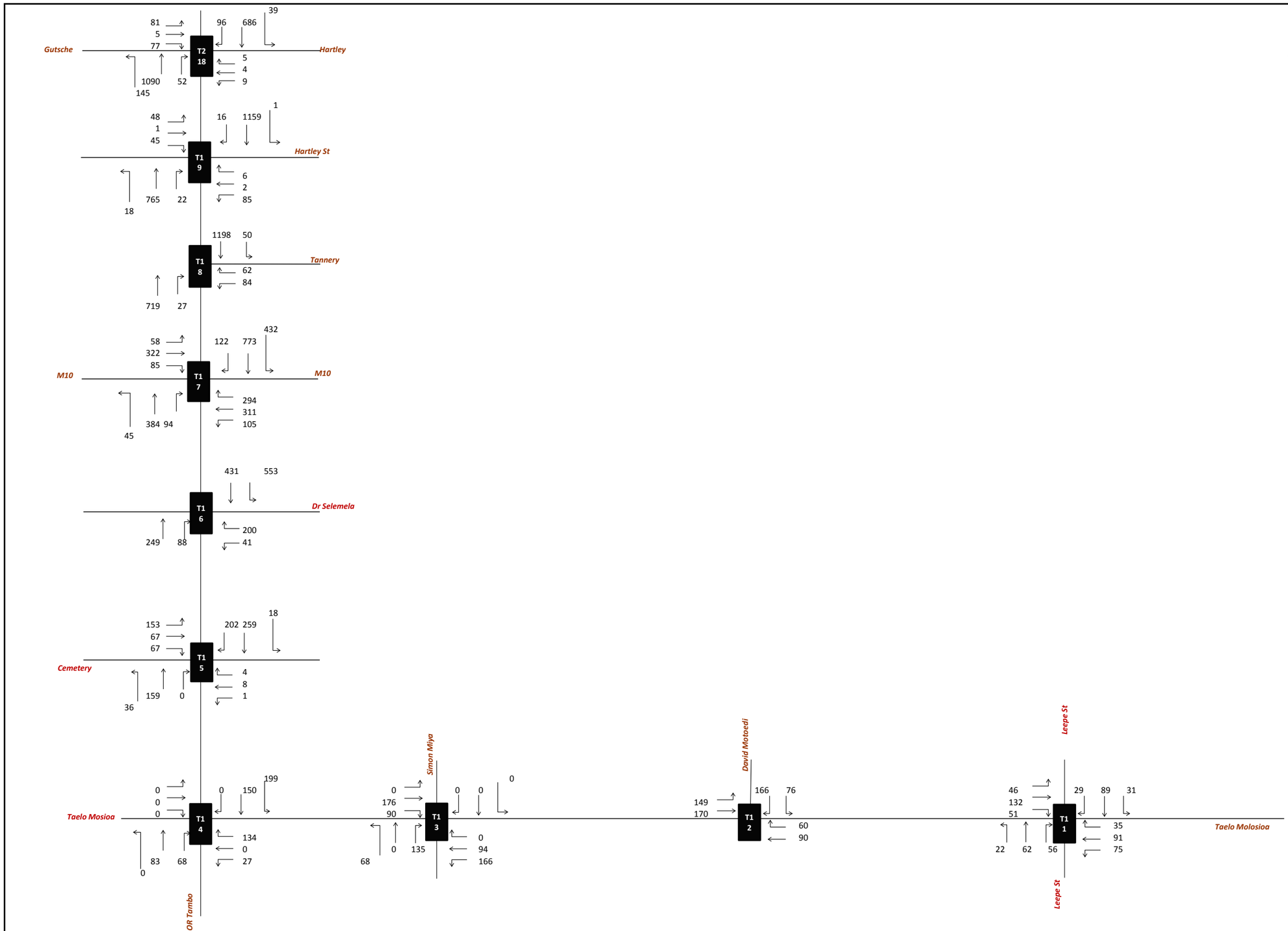

	2018 TRAFFIC VOLUMES	**Proj. Nber**
	PM PEAK	**Fig 1PM**

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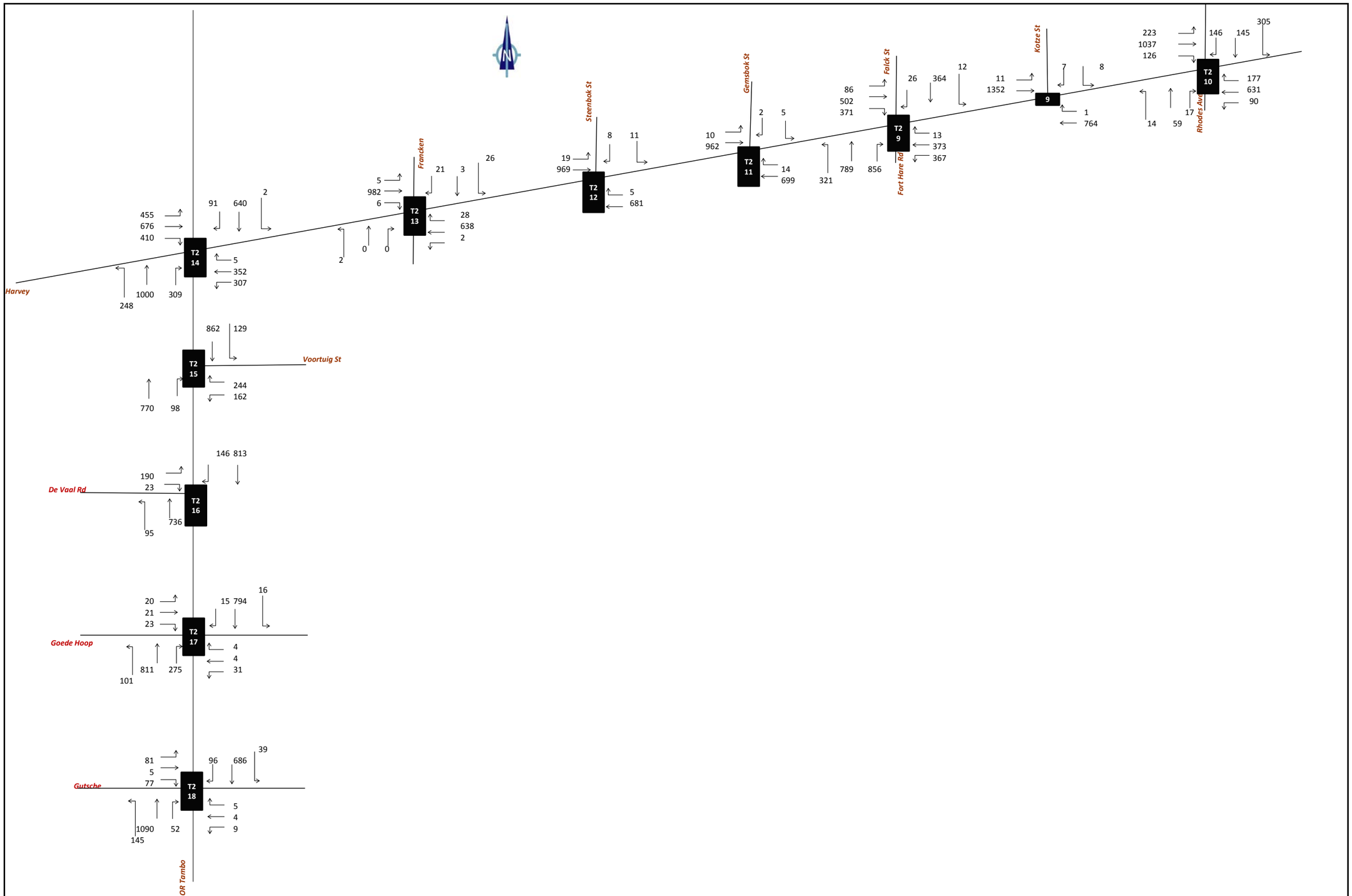

	2018 TRAFFIC VOLUMES	**Proj. Nber**
	AM PEAK	**Fig 1AM**

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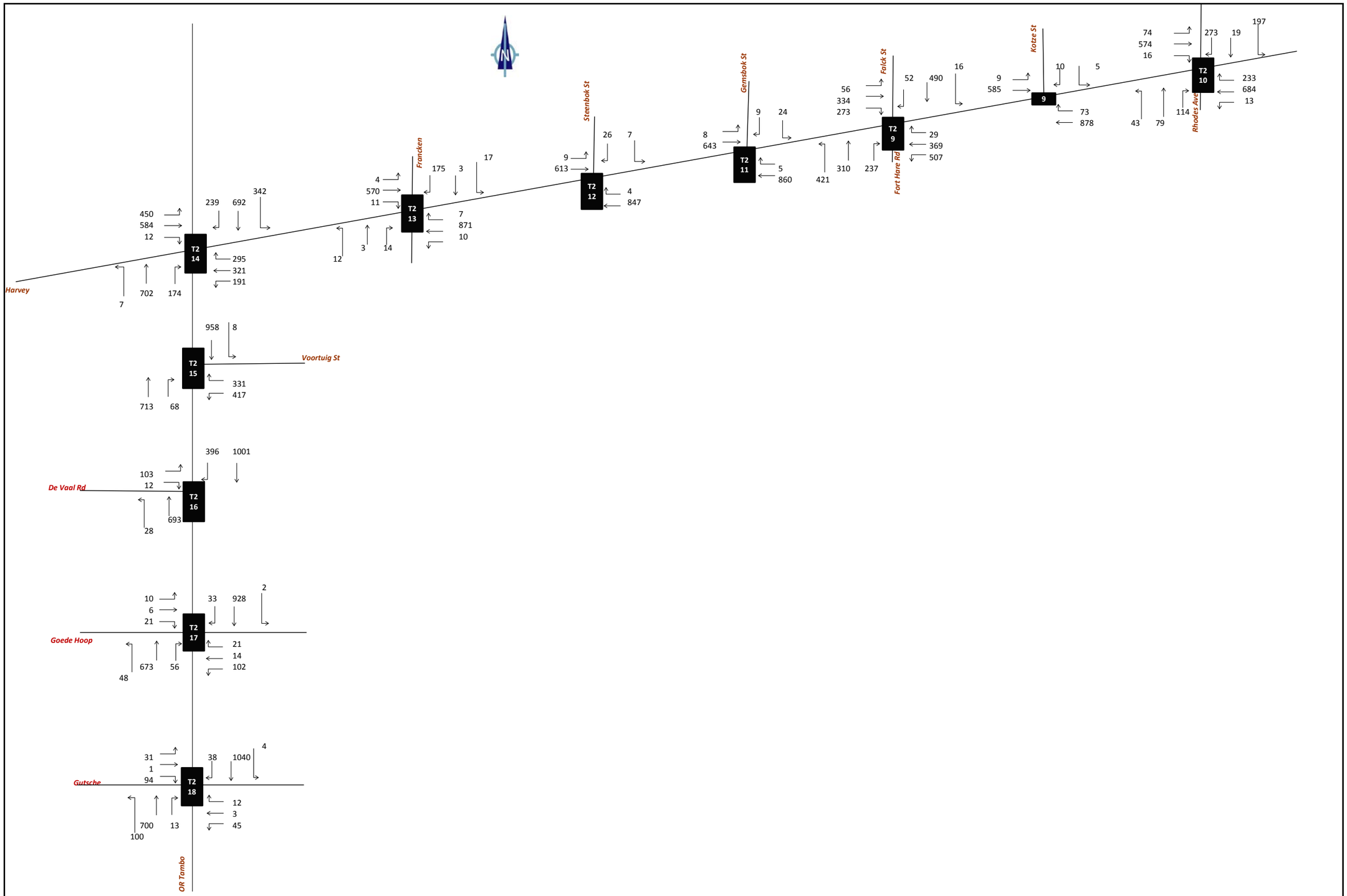

	2018 TRAFFIC VOLUMES	**Proj. Nber**
	PM PEAK	**Fig 1AM**

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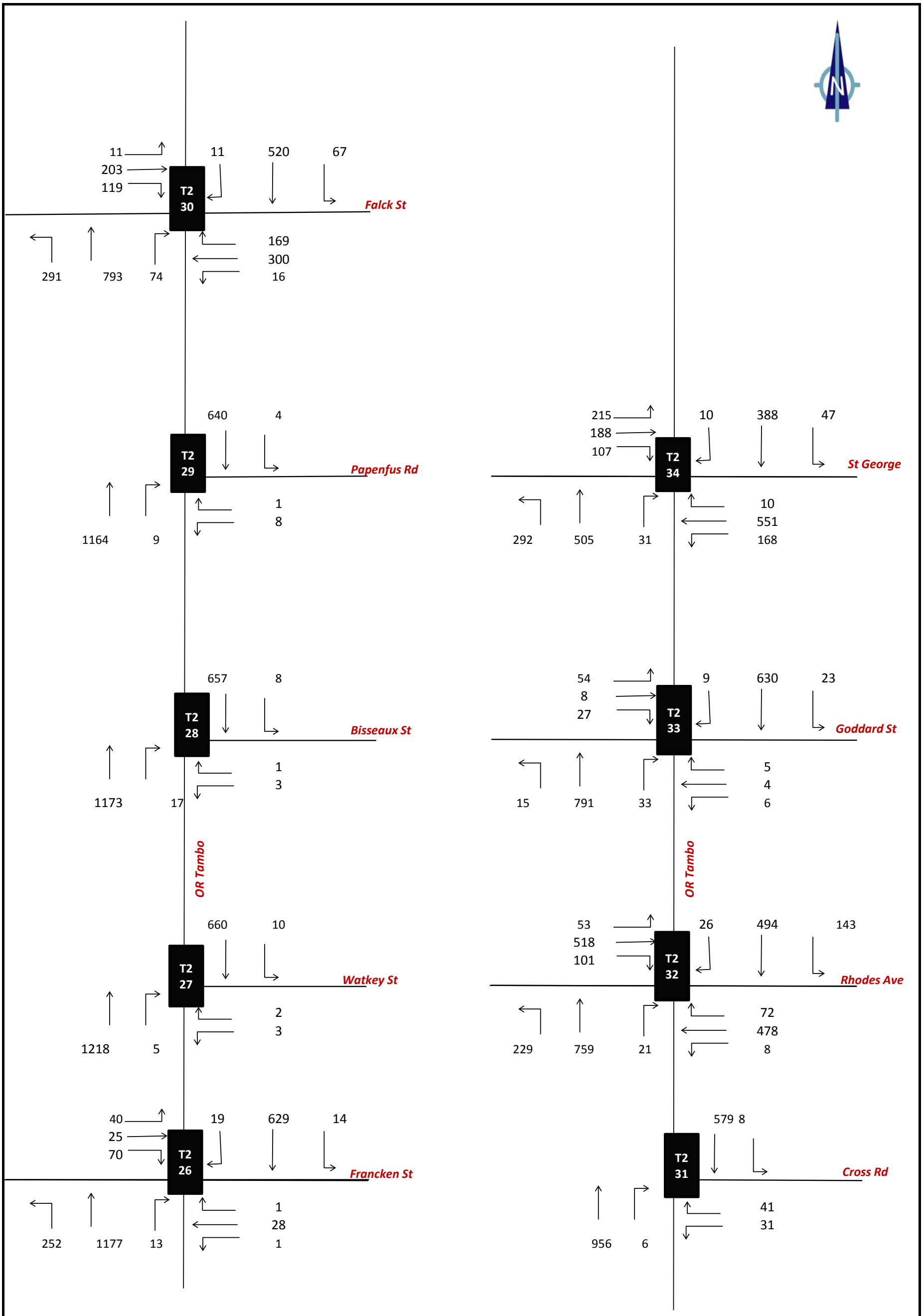

2018 TRAFFIC VOLUMES

AM PEAK

Proj. Nber

Fig .1AM

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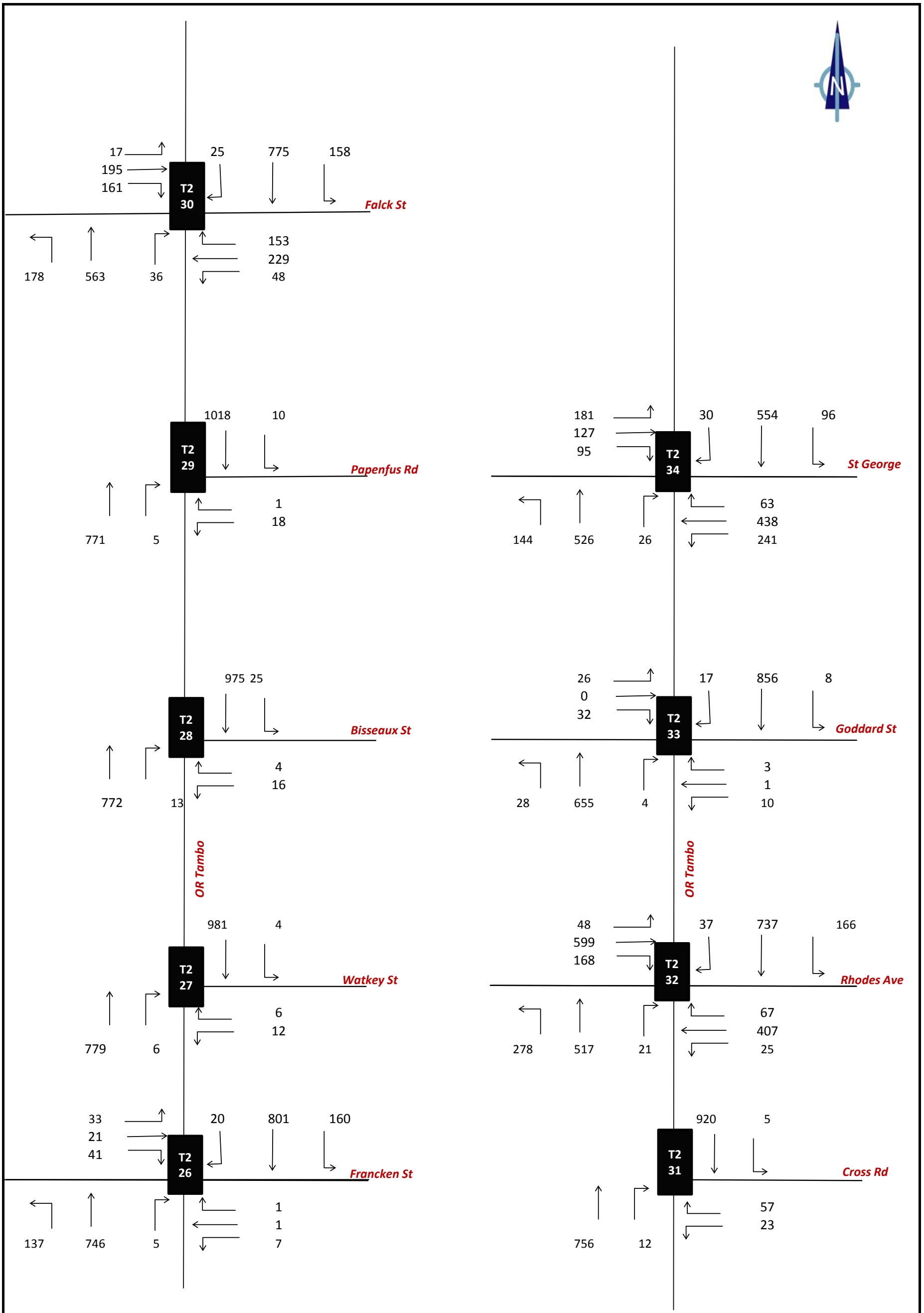

	2018 TRAFFIC VOLUMES **PM PEAK**	**Proj. Nber** **Fig .1AM**

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ANNEXURE B –

Results of 2018 Existing Traffic Evaluation

Table 1.AM: OR TAMBO/ TAELO MOLOSIOA EXISTING AM PEAK TRANSYT EVALUATION

Cycle **90**

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
102	NLTR	138	712	19	1	A	0,02	2,33			
205	ET	178	1950	9	0	A	0	0,46			
108	SLTR	175	962	18	0	A	0,02	2,02			
111	WLTR	128	1950	7	0	A	0	0,23			
T1 1	**Taelo Molosioa & Leepile St**			**13**	**0**	**A**	**0,3%**	**5,04**	**Taelo Molosioa & Leepile St**		
202	NLR	286	701	41	2	A	0,14	14,01			
204	ER	79	932	8	0	A	0	0,39			
205	ET	178	1950	9	0	A	0	0,46			
211	WLT	311	1950	16	0	A	0,02	1,51			
T1 2	**Taelo Molosioa & David Montoedi**			**22**	**1**	**A**	**1,1%**	**16,37**	**Taelo Molosioa & David Montoedi**		
302	NLTR	10	633	2	0	A	0	0,01			
305	ELTR	428	1950	22	0	A	0,03	3,09			
308	SLTR	368	671	55	3	A	0,33	33,04			
311	WLTR	105	1950	5	0	A	0	0,15			
T1 3	**Taelo Molosioa & Simon Miya St**			**33**	**1**	**A**	**2,4%**	**36,29**	**Taelo Molosioa & Simon Miya St**		
402	NTR	100	1950	5	0	A	0	0,14			
403	NL	91	1750	5	0	A	0	0,14			
405	ETR	323	976	57	2	A	0,38	21,81			
406	EL	233	0	0	2	A	0	15,73			
408	SLTR	125	3900	3	0	A	0	0,05			
411	WLTR	10	951	1	0	A	0	0,01			
T1 4	**Taelo Molosioa & OR Tambo**			**22**	**2**	**A**	**2,5%**	**37,88**	**Taelo Molosioa & OR Tambo**		
501	NR	236	937	25	2	A	3,44	41,13			
502	NT	191	3900	5	0	A	0	0,13			
503	NL	4	937	0	0	A	0	0			
504	ER	19	995	2	0	A	0	0,02			
505	ET	64	895	7	0	A	0	0,28			
506	EL	1	958	0	0	A	0	0			
507	SR	1	958	0	0	A	0	0			
508	ST	285	3900	7	0	A	0	0,29			
509	SL	108	1750	6	0	A	0	0,2			
510	WR	24	895	3	0	A	0	0,04			
511	WT	22	895	2	0	A	0	0,03			
512	WL	249	937	27	1	A	0,05	4,8			
T1 5	**Or Tambo & Access to Cemetery**			**14**	**1**	**A**	**3,1%**	**46,92**	**Or Tambo & Access to Cemetery**		
602	NT	292	3900	15	17	B	5,18	240,25	6	37	31
603	NL	233	1317	18	2	A	2,27	27,66			
604	ER	500	1800	55	10	A	8,86	219,96	43	0	47
606	EL	154	0	0	10	A	0	62,92			
607	SR	76	1286	12	16	B	1,15	48,41	6	37	31
608	ST	490	3900	26	14	B	7,12	315,35	6	37	31
T1 6	**Or Tambo & DM Selemela**			**28**	**11**	**B**	**61,1%**	**914,55**	**Or Tambo & DM Selemela**		
701	NR	36	656	10	18	B	0,57	25,58	6	37	31
702	NT	391	3900	19	11	B	5,02	233,97	6	37	31
703	NL	370	906	41	3	A	3,84	60,42			
704	ER	372	974	61	18	B	6,68	275,72	43	0	47
705	ET	242	1950	20	8	A	2,58	85,44	43	0	47
706	EL	137	1098	12	0	A	0,24	3,67			
707	SR	99	1110	17	6	A	1,46	27,99	6	37	31
708	ST	831	3900	40	18	B	13,82	655,89	6	37	31
709	SL	33	1084	3	0	A	0,07	0,88			
710	WR	41	679	10	9	A	0,47	16,91	43	0	47
711	WT	532	3900	22	8	A	5,79	188,15	43	0	47
712	WL	220	914	24	6	A	3,03	74,19			
T1 7	**Or Tambo & M10**			**32**	**11**	**B**	**110,1%**	**1648,81**	**Or Tambo & M10**		
802	NT	777	3900	20	0	A	0,02	2,48			
803	NL	55	1750	3	0	A	0	0,05			
804	ER	50	534	13	1	A	0,07	0,88			
806	ER	18	0	0	1	A	0	0,31			
807	SR	85	829	10	0	A	0,01	0,59			
808	ST	1342	3900	34	0	A	0,09	9,02			
T1 8	**Or Tambo & Tannery St**			**27**	**0**	**A**	**0,9%**	**13,33**	**Or Tambo & Tannery St**		
901	NR	16	689	2	0	A	0	0,03			
902	NT	795	3900	20	0	A	0,03	2,61			
903	NL	3	996	0	0	A	0	0			
905	ERT	1	514	0	0	A	0	0			
906	EL	39	825	5	0	A	0	0,12			
907	SR	82	0	0	0	A	0	0,6			
908	ST	1285	3900	36	0	A	0,1	9,35			
909	SL	45	0	0	0	A	0	0,33			
910	WR	12	0	0	0	A	0	0,05			
911	WT	1	514	4	0	A	0	0			
912	WL	7	0	0	0	A	0	0,03			
T1 9	**Or Tambo & Hartley St**			**27**	**0**	**A**	**0,9%**	**13,12**	**Or Tambo & Hartley St**		

Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**5141,07**	**84,02**	**61,19**	**1694,43**	0	0		**1497,28**	433,35
NB		3719,34	61,45	60,52	6,43	0	0		1015,8	
SB		1421,73	22,57	63	2,66				481,48	

Note: - L = Left, T = Through, R = Righturn

Table 1.PM: OR TAMBO/ TAELO MOLOSIOA EXISTING AM PEAK TRANSYT EVALUATION

Cycle **90**

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
102	NLTR	149	702	21	1	A	0,03	2,86			
205	ET	90	1950	8	0	A	0	0,19			
108	SLTR	140	702	20	1	A	0,02	2,48			
111	WLTR	229	1950	12	0	A	0,01	0,78			
T1 1	**Taelo Molosioa & Leepile St**			**15**	**0**	**A**	**0,4%**	**6,31**	**Taelo Molosioa & Leepile St**		
202	NLR	242	693	35	1	A	0,09	9,36			
204	ER	60	0	0	0	A	0	0,13			
205	ET	90	1950	8	0	A	0	0,19			
211	WLT	319	1950	16	0	A	0,02	1,6			
T1 2	**Taelo Molosioa & David Montoedi**			**20**	**1**	**A**	**0,7%**	**11,28**	**Taelo Molosioa & David Montoedi**		
302	NLTR	10	884	1	0	A	0	0,01			
305	ELTR	260	1950	13	0	A	0,01	1,03			
308	SLTR	204	692	29	1	A	0,06	6,15			
311	WLTR	266	1950	14	0	A	0,01	1,08			
T1 3	**Taelo Molosioa & Simon Miya St**			**18**	**0**	**A**	**0,5%**	**8,27**	**Taelo Molosioa & Simon Miya St**		
402	NTR	150	1950	8	0	A	0	0,32			
403	NL	199	1750	11	0	A	0,01	0,73			
405	ETR	134	934	17	0	A	0,02	1,49			
406	EL	27	0	0	0	A	0	0,3			
408	SLTR	151	3900	4	0	A	0	0,08			
411	WLTR	10	934	1	0	A	0	0,01			
T1 4	**Taelo Molosioa & OR Tambo**			**9**	**0**	**A**	**0,2%**	**2,93**	**Taelo Molosioa & OR Tambo**		
501	NR	202	965	21	2	A	3,64	39,12			
502	NT	259	3900	7	0	A	0	0,24			
503	NL	18	965	2	0	A	0	0,02			
504	ER	4	985	0	0	A	0	0			
505	ET	8	908	1	0	A	0	0			
506	EL	1	943	0	0	A	0	0			
507	SR	1	943	0	0	A	0	0			
508	ST	159	3900	4	0	A	0	0,09			
509	SL	36	1750	2	0	A	0	0,02			
510	WR	67	998	7	0	A	0	0,24			
511	WT	67	908	7	0	A	0	0,29			
512	WL	153	965	16	0	A	0,01	1,49			
T1 5	**Or Tambo & Access to Cemetery**			**10**	**1**	**A**	**2,7%**	**41,51**	**Or Tambo & Access to Cemetery**		
602	NT	431	3900	23	19	B	8,56	410,47	6	37	31
603	NL	553	1291	43	12	B	12,7	336,58			
604	ER	200	1800	21	6	A	2,38	59,1	43	0	47
606	EL	49	0	0	6	A	0	13,38			
607	SR	88	634	28	21	C	1,55	71,95	6	37	31
608	ST	249	3900	13	13	B	3,4	147,37	6	37	31
T1 6	**Or Tambo & DM Selemela**			**28**	**14**	**B**	**68,4%**	**1038,85**	**Or Tambo & DM Selemela**		
701	NR	122	611	41	23	C	2,31	108,64	6	37	31
702	NT	773	3900	41	15	B	12,38	604,53	6	37	31
703	NL	432	1414	31	1	A	0,55	12,02			
704	ER	294	1246	35	9	A	3,53	119,1	43	0	47
705	ET	311	1950	24	6	A	3,06	94,63	43	0	47
706	EL	105	1193	9	1	A	0,38	7,39			
707	SR	94	610	32	17	B	1,72	67,8	6	37	31
708	ST	384	3900	20	18	B	6,87	331,59	6	37	31
709	SL	45	1379	3	1	A	0,2	2,39			
710	WR	85	1193	11	8	A	0,9	30,51	43	0	47
711	WT	322	3900	12	6	A	2,87	86,72	43	0	47
712	WL	58	1461	4	0	A	0,11	1,66			
T1 7	**Or Tambo & M10**			**28**	**10**	**B**	**96,5%**	**1466,98**	**Or Tambo & M10**		
802	NT	1198	3900	31	0	A	0,07	6,81			
803	NL	50	1750	3	0	A	0	0,04			
804	ER	62	578	34	2	A	0,19	3,13			
806	ER	84	0	0	2	A	0	4,13			
807	SR	27	736	4	0	A	0	0,07			
808	ST	719	3900	18	0	A	0,02	2,08			
T1 8	**Or Tambo & Tannery St**			**25**	**0**	**A**	**1,1%**	**16,26**	**Or Tambo & Tannery St**		
901	NR	16	823	2	0	A	0	0,02			
902	NT	1159	3900	30	0	A	0,06	6,28			
903	NL	1	990	0	0	A	0	0			
905	ERT	8	568	1	0	A	0	0,01			
906	EL	85	745	11	0	A	0,01	0,73			
907	SR	22	0	0	0	A	0	0,07			
908	ST	765	3900	21	0	A	0,03	2,55			
909	SL	18	0	0	0	A	0	0,06			
910	WR	45	0	0	0	A	0	0,35			
911	WT	1	568	8	0	A	0	0,01			
912	WL	48	0	0	2	A	0	2,22			
T1 9	**Or Tambo & Hartley St**			**24**	**0**	**A**	**0,8%**	**12,3**	**Or Tambo & Hartley St**		

Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**4278,17**	**69,56**	**61,50**	**1533,02**	0	0		**1519,49**	374,28
NB		1966,65	31,72	62,01	2,93	0	0		486,98	
SB		2311,52	37,84	61,09	5,72				1032,51	

Note: - L = Left, T = Through, R = Righturn

Table 2.AM: Or Tambo/ Harvey & Hanger EXISTING AM PEAK TRANSYT EVALUATION

	90
Cycle	90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
202	NT	363	3900	12	0	A	0,01	0,61			
203	NL	2	728	0	0	A	0	0			
204	ER	79	259	31	3	A	0,07	6,69			
206	EL	50	650	8	0	A	0	0,32			
207	SR	100	500	20	1	A	0,02	2,49			
208	ST	1009	3900	28	0	A	0,06	5,07			
T2 2	**Fort Hare & Mkuhlane**			**23**	**0**	A	**0,1%**	**15,18**	**Fort Hare & Mkuhlane**		
501	NR	68	867	13	5	A	0,42	14,07	80	10	20
502	NTL	465	3900	36	19	B	7,86	278,39	10	40	30
505	ELTR	160	1950	18	15	B	2,38	80,95	45	75	30
507	SR	8	1159	1	7	A	0,08	2,07	80	10	20
508	ST	1059	3900	74	26	C	25,28	910,72	10	40	30
510	WR	35	1320	6	16	B	0,53	19,17	45	75	30
511	WLT	107	1950	12	14	B	1,52	52,02	45	75	30
T2 5	**Fort Hare & Gonyane**			**53**	**22**	C	**8,7%**	**1357,39**	**Fort Hare & Gonyane**		
801	NR	45	516	18	37	D	0,94	51,99	79	32	43
802	NT	340	3900	23	10	A	5,5	115,78	79	32	43
803	NL	495	930	53	9	A	6,22	157,23			
804	ER	500 <	1008	93	54	D	13,89 +	855,42	32	53	21
805	ET	200	1950	34	26	C	3,98	169,52	53	79	26
806	EL	100	1750	19	24	C	1,86	78,54	53	79	26
807	SR	55	1004	11	14	B	0,47	24,25	79	32	43
808	ST	1100	3900	62	22	C	28,27	846,76	79	32	43
809	SL	20	1750	2	12	B	0,17	7,68	79	32	43
810	WR	95	1380	13	11	B	1,17	37,06	32	53	21
811	WT	600	2925	68	32	C	13,9	619,88	53	79	26
812	WL	40	1017	4	4	A	0,31	6,49			
T2 8	**Fort Hare & Hamilton Rd**			**50**	**20**	C	**19,1%**	**2970,6**	**Fort Hare & Hamilton Rd**		
901	NR	26	1135	3	14	B	0,33	14,57	71	16	35
902	NT	364	3900	28	21	C	5,55	267,68	16	39	23
903	NL	12	1750	2	10	B	0,17	4,24	16	39	23
904	ER	13	942	5	47	D	0,31	21,49	45	50	5
905	ET	373	3900	39	32	C	8,68	451,03	50	65	15
906	EL	367	1290	35	1	A	1,08	22,45			
907	SR	856	2394	55	13	B	15,27	543,23	71	16	35
908	ST	789	2400	99	74	E	30,48	1995,02	16	39	23
909	SL	321	1448	22	1	A	0,81	18,09			
910	WR	371	1888	66	20	C	7,45	327,8	45	50	5
911	WT	502	3900	53	22	C	11,46	456,39	50	65	15
912	WL	86	1167	7	12	B	1,5	48,72			
T2 9	**Fort Hare & Harvey**			**54**	**27**	C	**26,8%**	**4170,71**	**Fort Hare & Harvey**		

Table 2.AM: Or Tambo/ Harvey & Hanger EXISTING AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
1001	NR	146	1170	25	15	B	1,84	78,64	6	15	9
1002	NT	145	1950	19	23	C	2,42	117,51	15	44	29
1003	NL	305	1069	29	6	A	2,07	77,47			
1004	ER	177	1800	25	16	B	2,68	111,95	50	62	12
1005	ET	631	3900	48	28	C	15,86	677,75	62	0	28
1006	EL	90	1344	7	0	A	0,11	1,42			
1007	SR	17	1451	2	12	B	0,21	8,49	6	15	9
1008	STL	73	1950	9	17	B	1,14	49,82	15	44	29
1010	WR	126	1053	23	9	A	1,78	59,83	50	62	12
1011	WT	1037	3900	74	13	B	10,87	497,5	62	0	28
1012	WL	223	1642	14	0	A	0,03	1,36			
T2 10	**Harvey & Rhodes**			**45**	**15**	B	**10,8%**	**1681,74**	**Harvey & Rhodes**		
1102	NLR	7	386	2	0	A	0,01	0,21			
1104	ER	14	536	3	0	A	0	0,04			
1105	ET	699	3900	18	0	A	0,02	1,96			
1111	WLT	972	3900	25	0	A	0,04	4,14			
T2 11	**Harvey & Gemsbok St**			**22**	**0**	A	**0,0%**	**6,35**	**Harvey & Gemsbok St**		
1202	NLR	20	384	5	0	A	0,04	0,6			
1204	ER	5	389	1	0	A	0,01	0,11			
1205	ET	681	3900	17	0	A	0,02	1,85			
1211	WLT	988	3900	25	0	A	0,04	4,3			
T2 12	**Harvey & Steenbok St**			**21**	**0**	A	**0,0%**	**6,86**	**Harvey & Steenbok St**		
1301	NR	21	297	7	2	A	0,09	2,65			
1303	NL	29	535	5	0	A	0,05	0,9			
1304	ER	4	399	1	2	A	0,03	0,58			
1305	ET	640	3900	16	0	A	0,02	1,61			
1311	WLT	993	3900	25	0	A	0,04	4,35			
T2 13	**Harvey & Franken St**			**21**	**0**	A	**0,1%**	**10,09**	**Harvey & Franken St**		
1902	NT	709	3900	35	9	A	6,96	267,04	6	40	34
1903	NL	713	1750	78	18	B	12,09	541,27	6	40	34
1905	ET	432	1800	46	15	B	6,91	273,15	68	0	22
1906	EL	171	908	19	8	A	2,25	65,33			
1907	SR	284	1800	30	6	A	2,09	70,26	46	62	16
1909	SL	1037	1091	95	53	D	31,45	1973,19			
T2 19	**Fort St & Hanger**			**63**	**25**	C	**20,5%**	**3190,24**	**Fort St & Hanger**		
2004	ERT	278	667	49	9	A	4,5	119,84	27	0	63
2008	SLT	1287	5850	71	32	C	30,96	1561,21	6	21	15
2011	WLT	351	3900	11	3	A	2,48	57,59	27	0	63
T2 20	**Hanger & St Georges St**			**57**	**23**	C	**10,4%**	**1618,8**	**Hanger & St Georges St**		
2108	SLTR	1294	5850	22	0	A	0,03	3,14			
2111	WLT	87	731	12	2	A	0,44	10,12			
T2 21	**Hanger & Douglas**			**21**	**0**	A	**0,1%**	**13,26**	**Hanger & Douglas**		
2202	NT	209	908	23	1	A	0,03	3,44			
2206	EL	209	908	23	9	A	2,88	88,45			
2210	WR	209	908	23	1	A	0,03	3,44			
T2 22	**Harvey & Peet Ave**			**23**	**3**	A	**0,6%**	**95,33**	**Harvey & Peet Ave**		
2302	NLT	1108	3900	28	0	A	0,06	5,64			
2306	EL	40	756	5	0	A	0	0,15			
T2 23	**Harvey & Douglas**			**27**	**0**	A	**0,0%**	**5,79**	**Harvey & Douglas**		
2402	NLTR	1395	5850	74	31	C	32,55	1659,79	6	22	16
2405	ELT	236	1950	15	2	A	1,13	23,22	28	0	62
2411	WRT	302	3900	9	1	A	1,09	23,9	28	0	62
T2 24	**Harvey & St Georges St**			**57**	**23**	C	**11,0%**	**1712,7**	**Harvey & St Georges St**		

Table 2.AM: Or Tambo/ Harvey & Hanger EXISTING AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
2502	NRT	1326	5850	23	0	A	0,03	3,32			
2505	ET	10	714	1	1	A	0,04	0,87			
2506	EL	32	714	4	2	A	0,15	3,2			
2510	WR	17	714	2	1	A	0,08	1,58			
T2 25	**Harvey & Bastion**			**22**	**0**	**A**	**0,1%**	**8,97**	**Harvey & Bastion**		
1701	NR	15	799	2	0	A	0	0,02			
1702	NT	794	2687	30	0	A	0,29	10,26			
1703	NL	16	0	0	0	A	0	0,17			
1705	ELTR	39	621	6	0	A	0	0,21			
1707	SR	275	822	33	1	A	0,08	8,4			
1708	ST	811	3900	23	0	A	0,04	3,17			
1709	SL	101	0	0	0	A	0	0,4			
1711	WLTR	64	621	10	0	A	0,01	0,59			
T2 17	**Or Tambo & Goede Hoop**			**25**	**0**	**A**	**0,1%**	**23,22**	**Or Tambo & Goede Hoop**		
1601	NR	146	838	17	0	A	0,02	1,84			
1602	NT	813	3900	21	0	A	0,03	2,74			
1608	ST	736	3900	19	0	A	0,02	2,19			
1609	SL	95	1750	5	0	A	0	0,16			
1610	WR	23	659	3	0	A	0	0,06			
1612	WL	190	838	23	1	A	0,03	3,32			
T2 16	**Or Tambo & De Waal Rd**			**19**	**0**	**A**	**0,1%**	**10,31**	**Or Tambo & De Waal Rd**		
1502	NT	862	3900	66	33	C	20,49	1079,33	15	44	29
1503	NL	129	1750	22	20	B	1,69	92,69	15	44	29
1504	ER	244	1800	26	13	B	3,37	129,73	44	0	46
1506	EL	162	1800	17	12	B	2,13	80,73	44	0	46
1507	SR	98	870	23	15	B	1,31	66,24	0	15	15
1508	ST	770	3900	39	15	B	12,11	471,33	0	15	15
T2 15	**Or Tambo & Voortuitsig**			**45**	**22**	**C**	**12,3%**	**1920,05**	**Or Tambo & Voortuitsig**		
1401	NR	91	615	44	40	D	2,1	129,31	15	44	29
1402	NT	640	3900	49	27	C	13,84	615,36	15	44	29
1403	NL	2	1370	0	1	A	0,01	0,14			
1404	ER	5	1044	1	16	B	0,07	3,36	65	0	25
1405	ET	352	3900	31	37	D	8,21	479,18	65	0	25
1406	EL	307	1382	22	1	A	0,9	21,82			
1407	SR	309	1331	46	10	A	1,64	125,24	0	15	15
1408	ST	1000	2925	68	32	C	23,1	1213,13	0	15	15
1409	SL	248	1549	16	0	A	0,15	3,74			
1410	WR	410	2191	36	13	B	5,57	234,17	65	0	25
1411	WT	676	3900	60	30	C	14,91	762,76	65	0	25
1412	WL	455	1480	31	1	A	0,07	6,82			
T2 14	**Or Tambo & Harvey-Monument**			**46**	**21**	**C**	**23,1%**	**3595,03**	**Or Tambo & Harvey-Monument**		
2601	NR	19	686	3	0	A	0	0,04			
2602	NT	629	3900	16	0	A	0,02	1,59			
2603	NL	14	0	0	0	A	0	0,04			
2605	ERT	27	544	5	0	A	0,02	0,21			
2606	EL	1	0	0	0	A	0	0,01			
2607	SR	13	859	2	0	A	0	0,01			
2608	SLT	1429	3900	37	0	A	0,11	10,59			
2611	WRT	95	544	25	1	A	0,27	4,55			
2612	WL	40	0	0	1	A	0	1,82			
T2 26	**Or Tambo & Francken St**			**29**	**0**	**A**	**0,1%**	**18,86**	**Or Tambo & Francken St**		
2702	NT	660	3900	17	0	A	0,02	1,72			
2703	NL	10	1750	1	0	A	0	0			
2704	ER	2	587	0	0	A	0	0			
2706	EL	3	587	1	0	A	0	0			
2707	SR	5	855	1	0	A	0	0			
2708	ST	1218	3900	31	0	A	0,07	7,09			
T2 27	**Or Tambo & Watkey**			**26**	**0**	**A**	**0,1%**	**8,81**	**Or Tambo & Watkey**		

Table 2.AM: Or Tambo/ Harvey & Hanger EXISTING AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
2802	NTL	648	3900	17	0	A	0,02	1,66			
2806	EL	3	857	0	0	A	0	0			
2808	ST	1173	3900	30	0	A	0,06	6,47			
T2 28	**Or Tambo & Bisseaux**			**25**	**0**	A	**0,1%**	**8,13**	**Or Tambo & Bisseaux**		
2902	NLT	644	3900	17	0	A	0,02	1,63			
2905	ER	9	600	1	0	A	0	0,01			
2908	SRT	1173	3900	30	0	A	0,06	6,47			
T2 29	**Or Tambo & Papenfus St**			**25**	**0**	A	**0,1%**	**8,11**	**Or Tambo & Papenfus St**		
3002	NLTR	598	3900	33	12	B	6,19	279,92	6	35	29
3004	ER	169	1343	18	9	A	3,78	89,43	41	0	49
3006	ELT	316	3900	12	1	A	1,7	25,58	41	0	49
3007	SR	74	646	25	27	C	1,26	75,12	6	35	29
3008	SLT	1084	3900	60	33	C	24,46	1321,23	6	35	29
3010	WR	119	1232	14	6	A	1,17	35,64	41	0	49
3011	WLT	214	1950	16	5	A	1,86	54,35	41	0	49
T2 30	**Or Tambo & Falck St**			**38**	**19**	B	**12,1%**	**1881,27**	**Or Tambo & Falck St**		
3102	NLT	587	1950	30	0	A	0,06	6,48			
3105	ELR	72	659	11	0	A	0,01	0,67			
3108	SRT	964	1950	49	3	A	16,78	228,56			
T2 31	**Or Tambo & Cross Rd**			**40**	**2**	A	**1,5%**	**235,71**	**Or Tambo & Cross Rd**		
3201	NR	26	200	25	21	C	0,38	20,56	6	40	34
3202	NT	494	1950	49	15	B	7,87	303,01	6	40	34
3203	NL	143	1573	9	0	A	0	0,45			
3204	ER	72	873	13	16	B	1,11	46,04	46	0	44
3205	ELT	486	1950	39	12	B	6,97	253,18	46	0	44
3207	SR	21	775	5	14	B	0,19	10,64	6	40	34
3208	ST	759	1950	75	15	B	6,24	396,76	6	40	34
3209	SL	229	1580	14	0	A	0,01	1,23			
3210	WR	101	929	17	15	B	1,62	64,97	46	0	44
3211	WT	518	1950	42	9	A	6,48	218,06	46	0	44
3212	WL	53	941	6	1	A	0,15	2,32			
T2 32	**Or Tambo & Rhodes Ave**			**45**	**11**	B	**8,5%**	**1317,22**	**Or Tambo & Rhodes Ave**		
3302	NLTR	662	3900	17	0	A	0,02	1,73			
3305	ELTR	15	1950	1	0	A	0	0			
3308	SLTR	839	3900	22	0	A	0,03	2,95			
3311	WLTR	89	1950	5	0	A	0	0,11			
T2 33	**Or Tambo & Goddard St**			**19**	**0**	A	**0,0%**	**4,79**	**Or Tambo & Goddard St**		
3401	NR	10	810	2	12	B	0,13	4,88	6	46	40
3402	NLT	435	1950	38	11	B	5,79	205,72	6	46	40
3407	SR	31	949	6	7	A	0,19	8,36	6	46	40
3408	ST	505	1950	44	11	B	4,72	223,88	6	46	40
3409	SL	292	1750	28	5	A	1,28	57,8	6	46	40
3410	WR	107	1800	10	9	A	1,22	43,47	52	0	38
3411	WLT	403	1950	36	12	B	5,59	202,46	52	0	38
T2 34	**Or Tambo & St Georges St**			**35**	**10**	A	**4,8%**	**746,57**	**Or Tambo & St Georges St**		
3502	NLR	350	1950	38	17	B	5,76	240,31	6	35	29
3505	ET	505	1950	38	17	B	10,83	392,67	41	0	49
3511	WT	264	1950	20	6	A	2,33	60,05	41	0	49
T2 34	**Or Tambo & St Georges St**			**34**	**15**	B	**10,5%**	**1642,06**	**Or Tambo & St Georges St**		

Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**11447,48**	**318,79**	**35,91**	**20820,87**	0	0		**15571,78**	1574,85
NBOT		4020,55	88	45,69	26,34				3683,72	326
Phase1 NB		3363,81	118,72	28,34	48,21				6340,83	336
Phase1 SB		1301,59	50,99	25,52	22,35				3034,2	144
SBOT		2761,53	61,08	45,21	18,32				2513,03	222
Other										

Note: - L = Left, T = Through, R = Righturn

Table 4.PM: Or Tambo/ Harvey & Hanger EXISTING PM PEAK TRANSYT EVALUATION

90

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
202	NT	642	3900	19	0	A	0,02	1,9			
203	NL	79	744	11	1	A	0,88	3,26			
204	ER	37	349	11	1	A	0,01	0,63			
206	EL	81	589	14	0	A	0,01	1,1			
207	SR	29	439	7	0	A	0	0,23			
208	ST	319	3900	10	0	A	0,01	0,48			
T2 2	**Fort Hare & Mkuhlane**			**15**	**0**	A	**0,1%**	**7,6**	**Fort Hare & Mkuhlane**		
501	NR	87	1274	11	2	A	0,25	7,89	80	10	20
502	NTL	714	3900	52	19	B	11,53	436,53	10	40	30
505	ELTR	52	1950	6	14	B	0,72	24,42	45	75	30
507	SR	11	956	2	10	A	0,12	3,9	80	10	20
508	ST	391	3900	31	19	B	8,22	246,87	10	40	30
510	WR	33	1540	5	15	B	0,47	16,17	45	75	30
511	WLT	76	1950	9	14	B	1,06	36,1	45	75	30
T2 5	**Fort Hare & Gonyane**			**38**	**17**	B	**7,4%**	**771,88**	**Fort Hare & Gonyane**		
801	NR	60	1131	11	21	C	1,05	41,9	79	32	43
802	NT	705	3900	42	14	B	13,69	338,78	79	32	43
803	NL	325	1649	20	0	A	0,02	2,42			
804	ER	440	1480	56	16	B	7,07 +	242,53	32	53	21
805	ET	150	1950	26	25	C	2,88	121,47	53	79	26
806	EL	100	1750	19	24	C	1,86	78,54	53	79	26
807	SR	50	642	16	20	B	0,54	30,83	79	32	43
808	ST	360	3900	24	19	B	9,05	239,69	79	32	43
809	SL	10	1750	1	13	B	0,1	4,2	79	32	43
810	WR	50	1462	6	10	B	0,6	18,4	32	53	21
811	WT	180	2925	21	24	C	3,38	140,63	53	79	26
812	WL	40	1447	3	1	A	0,1	1,11			
T2 8	**Fort Hare & Hamilton Rd**			**33**	**15**	B	**12,1%**	**1260,5**	**Fort Hare & Hamilton Rd**		
901	NR	52	1398	5	4	A	0,24	10,2	71	16	35
902	NT	490	3900	38	17	B	6,89	299,85	16	39	23
903	NL	16	1750	3	9	A	0,25	5,12	16	39	23
904	ER	29	1173	8	43	D	0,69	44,44	45	50	5
905	ET	369	3900	39	39	D	8,96	519,43	50	65	15
906	EL	507	1366	44	2	A	9,94 +	86,78			
907	SR	237	2283	20	4	A	2,63	60,86	71	16	35
908	ST	310	2400	39	15	B	4,15	180,82	16	39	23
909	SL	421	1555	27	1	A	5,04	48,4			
910	WR	275	1892	48	19	B	5,35	223,34	45	50	5
911	WT	334	3900	35	21	C	7,21	295,22	50	65	15
912	WL	56	1449	4	1	A	0,22	2,74			
T2 9	**Fort Hare & Harvey**			**35**	**14**	B	**17,0%**	**1777,2**	**Fort Hare & Harvey**		

Table 4.PM: Or Tambo/ Harvey & Hanger EXISTING PM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
1001	NR	273	1487	37	16	B	3,94	161,79	6	15	9
1002	NT	19	1950	2	21	C	0,32	13,87	15	44	29
1003	NL	197	1241	16	1	A	0,64	15,21			
1004	ER	233	1800	32	9	A	2,81	95,01	50	62	12
1005	ET	684	3900	51	33	C	17,91	857,38	62	0	28
1006	EL	13	1690	1	0	A	0	0			
1007	SR	114	1663	14	12	B	1,53	59,17	6	15	9
1008	STL	122	1950	16	18	B	1,95	86,16	15	44	29
1010	WR	16	1027	3	8	A	0,14	6,46	50	62	12
1011	WT	574	3900	44	6	A	4,57	124,76	62	0	28
1012	WL	74	1595	5	0	A	0,02	0,32			
T2 10	**Harvey & Rhodes**			**37**	**16**	B	**13,6%**	**1420,13**	**Harvey & Rhodes**		
1102	NLR	33	668	5	0	A	0	0,13			
1104	ER	5	457	1	0	A	0	0,01			
1105	ET	860	3900	22	0	A	0,03	3,12			
1111	WLT	651	3900	17	0	A	0,02	1,67			
T2 11	**Harvey & Gemsbok St**			**19**	**0**	A	**0,0%**	**4,93**	**Harvey & Gemsbok St**		
1202	NLR	33	427	8	0	A	0	0,32			
1204	ER	4	463	1	0	A	0	0			
1205	ET	847	3900	22	0	A	0,03	3,01			
1211	WLT	622	3900	16	0	A	0,02	1,51			
T2 12	**Harvey & Steenbok St**			**19**	**0**	A	**0,0%**	**4,84**	**Harvey & Steenbok St**		
1301	NR	175	296	59	12	B	2,21	84,64			
1303	NL	20	871	2	0	A	0	0,03			
1304	ER	7	471	1	0	A	0	0,01			
1305	ET	881	3900	23	0	A	0,03	3,3			
1311	WLT	585	3900	15	0	A	0,01	1,32			
T2 13	**Harvey & Franken St**			**24**	**1**	A	**0,9%**	**89,3**	**Harvey & Franken St**		
1902	NT	621	3900	30	5	A	3,13	125,23	6	40	34
1903	NL	800	1750	88	20	B	19,93 +	639,88	6	40	34
1905	ET	489	1950	48	15	B	7,96	313,41	68	0	22
1906	EL	312	1173	27	2	A	1,61	35,42			
1907	SR	272	1488	57	36	D	6,87	364,46	46	62	16
1909	SL	651	1009	65	26	C	15,06	680,21			
T2 19	**Fort St & Hanger**			**57**	**17**	B	**20,7%**	**2158,61**	**Fort St & Hanger**		
2004	ERT	152	1147	16	14	B	2,64	94,91	27	0	63
2008	SLT	1052	5850	58	26	C	20,53	1044,15	6	21	15
2011	WLT	499	3900	15	2	A	3,48	68,18	27	0	63
T2 20	**Hanger & St Georges St**			**42**	**18**	B	**10,7%**	**1112,33**	**Hanger & St Georges St**		
2108	SLTR	1075	5850	18	0	A	0,02	2,07			
2111	WLT	83	775	11	1	A	0,28	5,4			
T2 21	**Hanger & Douglas**			**17**	**0**	A	**0,1%**	**7,47**	**Hanger & Douglas**		
2202	NT	209	954	22	1	A	0,03	3,07			
2206	EL	209	954	22	1	A	0,03	3,07			
2210	WR	209	781	27	1	A	0,05	4,89			
T2 22	**Harvey & Peet Ave**			**24**	**1**	A	**0,1%**	**11,03**	**Harvey & Peet Ave**		
2302	NLT	522	3900	13	0	A	0,01	1,03			
2306	EL	51	885	6	0	A	0	0,18			
T2 23	**Harvey & Douglas**			**12**	**0**	A	**0,0%**	**1,21**	**Harvey & Douglas**		
2402	NLTR	1003	5850	53	26	C	19,5	985,29	6	22	16
2405	ELT	106	1950	7	1	A	0,44	9,34	28	0	62
2411	WRT	501	3900	15	1	A	1,58	37,04	28	0	62
T2 24	**Harvey & St Georges St**			**38**	**17**	B	**9,9%**	**1032,88**	**Harvey & St Georges St**		

Table 4.PM: Or Tambo/ Harvey & Hanger EXISTING PM PEAK TRANSYT EVALUATION

90

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
2502	NRT	1325	5850	23	0	A	0,03	3,32			
2505	ET	10	719	1	1	A	0,03	0,41			
2506	EL	74	719	10	1	A	0,23	4,18			
2510	WR	51	719	7	1	A	0,16	2,57			
T2 25	**Harvey & Bastion**			**22**	**0**	**A**	**0,1%**	**10,48**	**Harvey & Bastion**		
1701	NR	33	852	4	0	A	0	0,08			
1702	NT	928	2650	35	0	A	0,64	20,38			
1703	NL	2	0	0	0	A	0	0,05			
1705	ELTR	137	647	21	1	A	0,03	2,84			
1707	SR	56	795	7	0	A	0	0,27			
1708	ST	673	3900	17	0	A	0,02	1,8			
1709	SL	48	1750	3	0	A	0	0,04			
1711	WLTR	37	647	6	0	A	0	0,17			
T2 17	**Or Tambo & Goede Hoop**			**25**	**0**	**A**	**0,2%**	**25,63**	**Or Tambo & Goede Hoop**		
1601	NR	396	848	47	8	A	9,54 +	194,69			
1602	NT	1001	3900	26	0	A	0,04	4,43			
1608	ST	693	3900	18	0	A	0,02	1,92			
1609	SL	28	1750	2	0	A	0	0,01			
1610	WR	12	627	2	0	A	0	0,02			
1612	WL	103	848	12	0	A	0,01	0,84			
T2 16	**Or Tambo & De Waal Rd**			**26**	**2**	**A**	**1,9%**	**201,91**	**Or Tambo & De Waal Rd**		
1502	NT	958	3900	74	42	D	24,25	1454,91	15	44	29
1503	NL	8	1750	1	9	A	0,05	2,62	15	44	29
1504	ER	331	1800	35	14	B	4,88	189,89	44	0	46
1506	EL	417	1800	44	15	B	6,55	259,39	44	0	46
1507	SR	68	1487	9	12	B	0,87	34,74	0	15	15
1508	ST	713	3900	37	14	B	11	427,28	0	15	15
T2 15	**Or Tambo & Vooruitsig**			**51**	**25**	**C**	**22,7%**	**2368,83**	**Or Tambo & Vooruitsig**		
1401	NR	239	1117	64	37	D	5,5	319,97	15	44	29
1402	NT	692	3900	53	28	C	14,97	684,29	15	44	29
1403	NL	342	1407	24	2	A	1,9	29,28			
1404	ER	295	1115	51	20	C	5,38 +	248,13	65	0	25
1405	ET	321	3900	28	36	D	7,44	421,52	65	0	25
1406	EL	191	1564	12	0	A	0,01	0,85			
1407	SR	174	1276	27	8	A	0,86	60,57	0	15	15
1408	ST	702	2925	48	27	C	15,21	733,72	0	15	15
1409	SL	7	1567	0	0	A	0	0,05			
1410	WR	12	2226	1	11	B	0,14	5,73	65	0	25
1411	WT	584	3900	52	28	C	12,44	629,54	65	0	25
1412	WL	450	1247	36	4	A	3,48	91,44			
T2 14	**Or Tambo & Harvey-Monument**			**43**	**21**	**C**	**30,9%**	**3225,09**	**Or Tambo & Harvey-Monument**		
2601	NR	20	806	2	0	A	0	0,03			
2602	NT	801	3900	25	0	A	0,04	3,36			
2603	NL	160	0	0	0	A	0	0,67			
2605	ERT	1	594	1	0	A	0	0			
2606	EL	7	0	0	0	A	0	0,01			
2607	SR	5	789	1	0	A	0	0			
2608	SLT	883	3900	23	0	A	0,03	3,31			
2611	WRT	62	594	16	1	A	0,02	0,99			
2612	WL	33	0	0	1	A	0	0,53			
T2 26	**Or Tambo & Francken St**			**21**	**0**	**A**	**0,1%**	**8,9**	**Or Tambo & Francken St**		
2702	NT	981	3900	25	0	A	0,04	4,23			
2703	NL	4	1750	0	0	A	0	0			
2704	ER	6	613	1	0	A	0	0			
2706	EL	12	784	2	0	A	0	0,01			
2707	SR	6	784	1	0	A	0	0			
2708	ST	779	3900	20	0	A	0,02	2,49			
T2 27	**Or Tambo & Watkey**			**22**	**0**	**A**	**0,1%**	**6,73**	**Or Tambo & Watkey**		

Table 4.PM: Or Tambo/ Harvey & Hanger EXISTING PM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
2802	NTL	1028	3900	26	0	A	0,05	4,72			
2806	EL	16	774	2	0	A	0	0,02			
2808	ST	772	3900	20	0	A	0,02	2,44			
T2 28	**Or Tambo & Bisseaux**			**23**	**0**	A	**0,1%**	**7,18**	**Or Tambo & Bisseaux**		
2902	NLT	1028	3900	26	0	A	0,05	4,72			
2905	ER	19	603	3	0	A	0	0,05			
2908	SRT	776	3900	20	0	A	0,02	2,47			
T2 29	**Or Tambo & Papenfus St**			**23**	**0**	A	**0,1%**	**7,24**	**Or Tambo & Papenfus St**		
3002	NLTR	958	3900	53	14	B	12,79	535,86	6	35	29
3004	ER	153	1391	16	7	A	2,4	60,16	41	0	49
3006	ELT	277	3900	10	2	A	3,51	54,47	41	0	49
3007	SR	36	258	30	31	C	0,67	43,47	6	35	29
3008	SLT	741	3900	41	23	C	15,04	686,36	6	35	29
3010	WR	161	1349	17	7	A	1,72	54,82	41	0	49
3011	WLT	212	1950	11	0	A	0,01	0,66	41	0	49
T2 30	**Or Tambo & Falck St**			**36**	**14**	B	**13,8%**	**1435,8**	**Or Tambo & Falck St**		
3102	NLT	925	1950	47	1	A	0,21	21,38			
3105	ELR	80	628	13	0	A	0,01	0,93			
3108	SRT	768	1950	39	2	A	11,66	131,2			
T2 31	**Or Tambo & Cross Rd**			**42**	**1**	A	**1,5%**	**153,51**	**Or Tambo & Cross Rd**		
3201	NR	37	807	7	9	A	0,37	13,98	6	40	34
3202	NT	737	1950	60	11	B	10,47	363,53	6	40	34
3203	NL	166	1236	13	2	A	0,89	17,13			
3204	ER	67	767	17	36	D	1,64	90,16	46	0	44
3205	ELT	432	1950	42	28	C	10,57 +	488,06	46	0	44
3207	SR	21	554	6	8	A	0,18	6,75	6	40	34
3208	ST	517	1950	42	4	A	1,64	75,74	6	40	34
3209	SL	278	1328	21	3	A	1,52	46,76			
3210	WR	168	942	34	26	C	3,31	166,84	46	0	44
3211	WT	499	1950	49	16	B	8,14	322,63	46	0	44
3212	WL	48	1153	4	0	A	0,04	0,48			
T2 32	**Or Tambo & Rhodes Ave**			**42**	**13**	B	**15,3%**	**1592,06**	**Or Tambo & Rhodes Ave**		
3302	NLTR	881	3900	23	0	A	0,03	3,3			
3305	ELTR	14	655	2	0	A	0	0,02			
3308	SLTR	687	3900	18	0	A	0,02	1,88			
3311	WLTR	58	655	9	0	A	0	0,43			
T2 33	**Or Tambo & Goddard St**			**20**	**0**	A	**0,1%**	**5,63**	**Or Tambo & Goddard St**		
3401	NR	30	780	7	13	B	0,39	15,82	6	46	40
3402	NLT	650	1950	57	13	B	10,3	377,33	6	46	40
3407	SR	26	626	7	14	B	0,28	13,6	6	46	40
3408	ST	526	1950	46	10	B	5,41	225,91	6	46	40
3409	SL	144	1750	14	7	A	1,09	43,82	6	46	40
3410	WR	95	1800	9	9	A	1,09	38,25	52	0	38
3411	WLT	308	1950	28	11	B	3,99	143,48	52	0	38
T2 34	**Or Tambo & St Georges St**			**41**	**11**	B	**8,2%**	**858,21**	**Or Tambo & St Georges St**		
3502	NLR	838	1950	73	18	B	15,87	616,11	6	35	29
3505	ET	374	1950	34	19	B	7,77	298,46	41	0	49
3511	WT	263	1950	24	12	B	3,18	127,63	41	0	49
T2 34	**Or Tambo & St Georges St**			**54**	**17**	B	**19,6%**	**2043,89**	**Or Tambo & St Georges St**		

Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**9789,65**	**248,05**	**39,47**	**15302,19**	0	0		**10434,52**	1324,77
NBOT		2982,92	60,17	49,57	14,15				2086,19	231
Phase1 NB		1469,02	47,16	31,15	17,62				2399,09	141
Phase1 SB		1814,01	63,06	28,77	21,24				2839,31	174
SBOT		3523,7	77,66	45,37	23,11				3109,93	280
Other										

Note: - L = Left, T = Through, R = Righturn

ANNEXURE C –

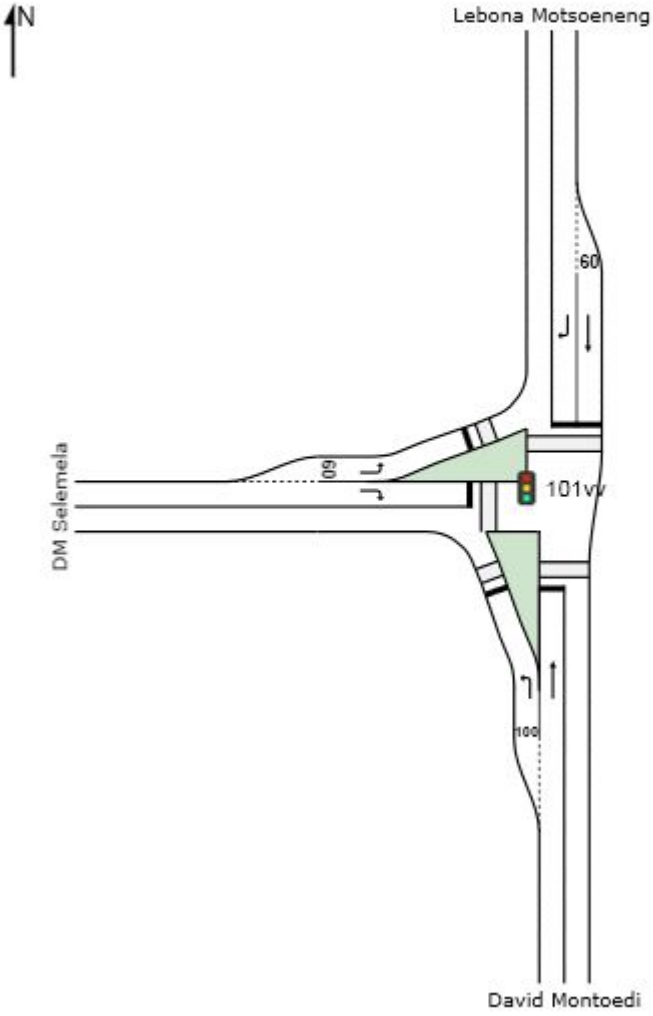
SIDRA Detailed Results of 2028 Key Intersection Evaluations

David Montoedi & DM Selemela

SITE LAYOUT

Site: 101vv [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101vv [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: David Montoedi											
1	L2	347	9.1	0.689	37.3	LOS D	13.9	105.2	0.95	0.85	36.9
2	T1	126	0.0	0.224	26.3	LOS C	4.2	29.7	0.80	0.64	41.9
Approach		474	6.7	0.689	34.3	LOS C	13.9	105.2	0.91	0.80	38.1
North: Lebona Motsoeneng											
8	T1	253	0.0	0.448	28.4	LOS C	9.2	64.1	0.87	0.73	40.9
9	R2	505	0.0	0.674	26.1	LOS C	16.9	118.6	0.82	0.83	41.1
Approach		758	0.0	0.674	26.8	LOS C	16.9	118.6	0.83	0.80	41.0
West: DM Selemela											
10	L2	253	0.0	0.219	13.5	LOS B	4.8	33.5	0.47	0.69	48.6
12	R2	140	22.5	0.657	48.7	LOS D	6.3	52.4	1.00	0.83	32.4
Approach		393	8.0	0.657	26.0	LOS C	6.3	52.4	0.66	0.74	41.3
All Vehicles		1624	3.9	0.689	28.8	LOS C	16.9	118.6	0.81	0.78	40.2

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	8.9	LOS A	0.1	0.1	0.45	0.45
P1S	South Slip/Bypass Lane Crossing	53	7.6	LOS A	0.1	0.1	0.41	0.41
P3	North Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	27.3	LOS C	0.1	0.1	0.78	0.78
P4S	West Slip/Bypass Lane Crossing	53	25.0	LOS C	0.1	0.1	0.75	0.75
All Pedestrians		263	21.6	LOS C			0.66	0.66

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

PHASING SUMMARY

Site: 101vv [AM Peak - Conversion]

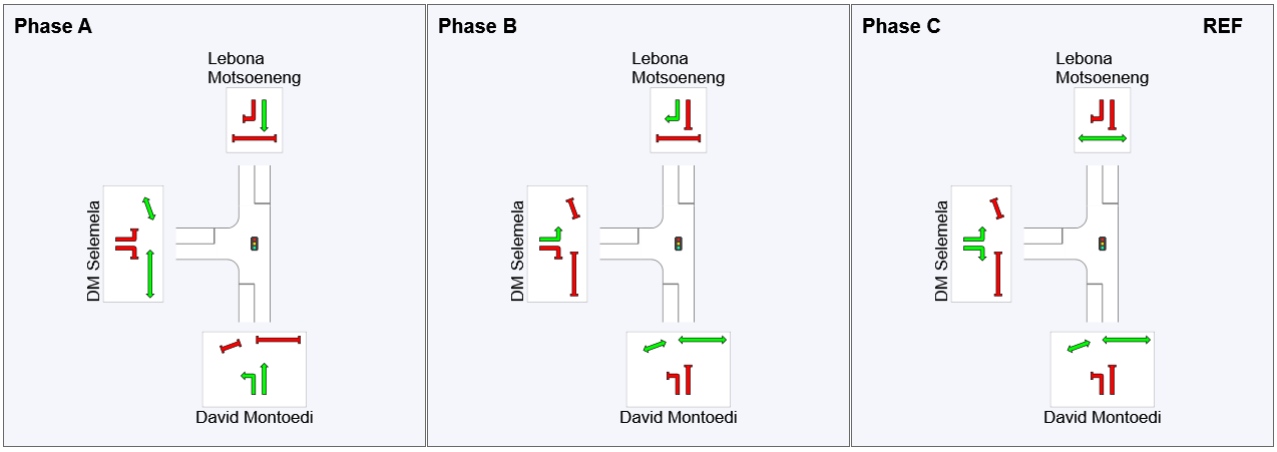
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase C
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

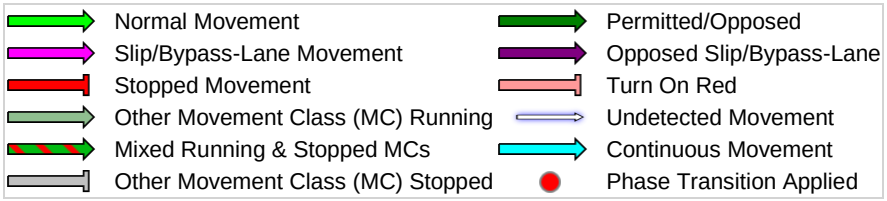
Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	16	46	0
Green Time (sec)	25	39	11
Phase Time (sec)	30	44	16
Phase Split	33%	49%	18%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase



MOVEMENT SUMMARY

Site: 101vv [PM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: David Montoedi											
1	L2	208	15.2	0.431	34.2	LOS C	7.6	59.7	0.86	0.79	38.0
2	T1	63	0.0	0.112	25.3	LOS C	2.0	14.3	0.77	0.59	42.4
Approach		272	11.7	0.431	32.1	LOS C	7.6	59.7	0.84	0.75	38.9
North: Lebona Motsoeneng											
8	T1	51	0.0	0.090	25.1	LOS C	1.6	11.3	0.76	0.58	42.5
9	R2	126	0.0	0.383	41.6	LOS D	5.0	35.2	0.93	0.78	34.9
Approach		177	0.0	0.383	36.9	LOS D	5.0	35.2	0.88	0.73	36.8
West: DM Selemela											
10	L2	505	0.0	0.437	15.0	LOS B	11.4	79.8	0.56	0.74	47.7
12	R2	284	11.1	0.413	26.6	LOS C	9.0	69.0	0.77	0.79	40.6
Approach		789	4.0	0.437	19.2	LOS B	11.4	79.8	0.63	0.76	44.9
All Vehicles		1238	5.1	0.437	24.5	LOS C	11.4	79.8	0.71	0.75	42.1

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	8.9	LOS A	0.1	0.1	0.45	0.45
P1S	South Slip/Bypass Lane Crossing	53	7.6	LOS A	0.1	0.1	0.41	0.41
P3	North Full Crossing	53	21.4	LOS C	0.1	0.1	0.69	0.69
P4	West Full Crossing	53	27.3	LOS C	0.1	0.1	0.78	0.78
P4S	West Slip/Bypass Lane Crossing	53	25.0	LOS C	0.1	0.1	0.75	0.75
All Pedestrians		263	18.0	LOS B			0.61	0.61

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

PHASING SUMMARY

Site: 101vv [PM Peak - Conversion]

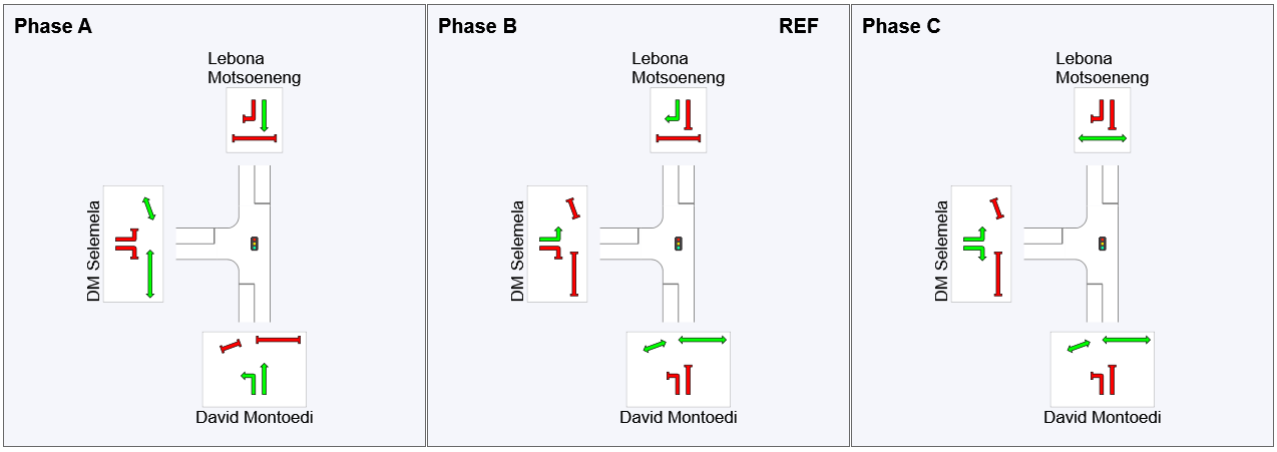
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

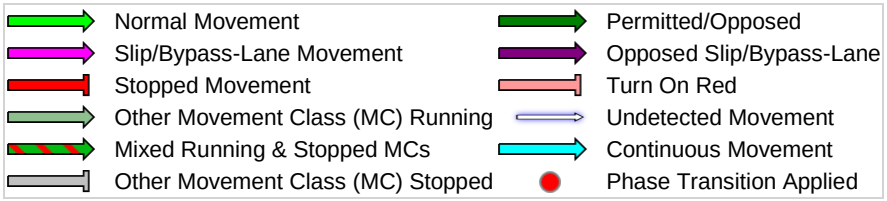
Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	60	0	20
Green Time (sec)	25	15	35
Phase Time (sec)	30	20	40
Phase Split	33%	22%	44%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

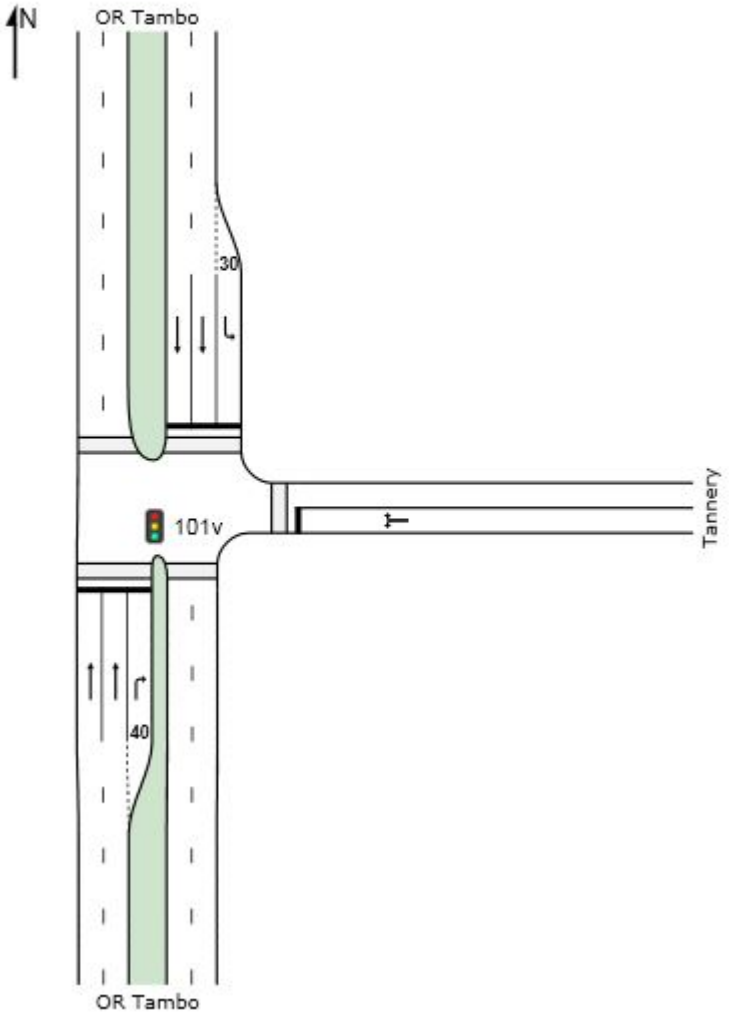


OR Tambo & Tannery

SITE LAYOUT

Site: 101v [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
2	T1	1727	1.8	0.764	12.0	LOS B	28.2	200.5	0.74	0.68	50.1
3	R2	107	5.0	0.639	50.9	LOS D	4.9	35.8	1.00	0.82	32.0
Approach		1834	2.0	0.764	14.3	LOS B	28.2	200.5	0.75	0.69	48.5
East: Tannery											
4	L2	23	0.0	0.378	46.4	LOS D	3.6	25.4	0.96	0.77	33.5
6	R2	63	0.0	0.378	46.4	LOS D	3.6	25.4	0.96	0.77	33.6
Approach		86	0.0	0.378	46.4	LOS D	3.6	25.4	0.96	0.77	33.6
North: OR Tambo											
7	L2	69	5.0	0.065	12.3	LOS B	1.1	8.4	0.40	0.66	48.7
8	T1	1013	3.1	0.447	8.9	LOS A	11.5	82.9	0.54	0.49	52.3
Approach		1083	3.2	0.447	9.1	LOS A	11.5	82.9	0.54	0.50	52.1
All Vehicles		3003	2.4	0.764	13.3	LOS B	28.2	200.5	0.68	0.62	49.1

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	39.3	LOS D	0.1	0.1	0.94	0.94
P2	East Full Crossing	53	8.5	LOS A	0.1	0.1	0.43	0.43
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		263	33.1	LOS D			0.84	0.84

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

PHASING SUMMARY

Site: 101v [AM Peak - Conversion]

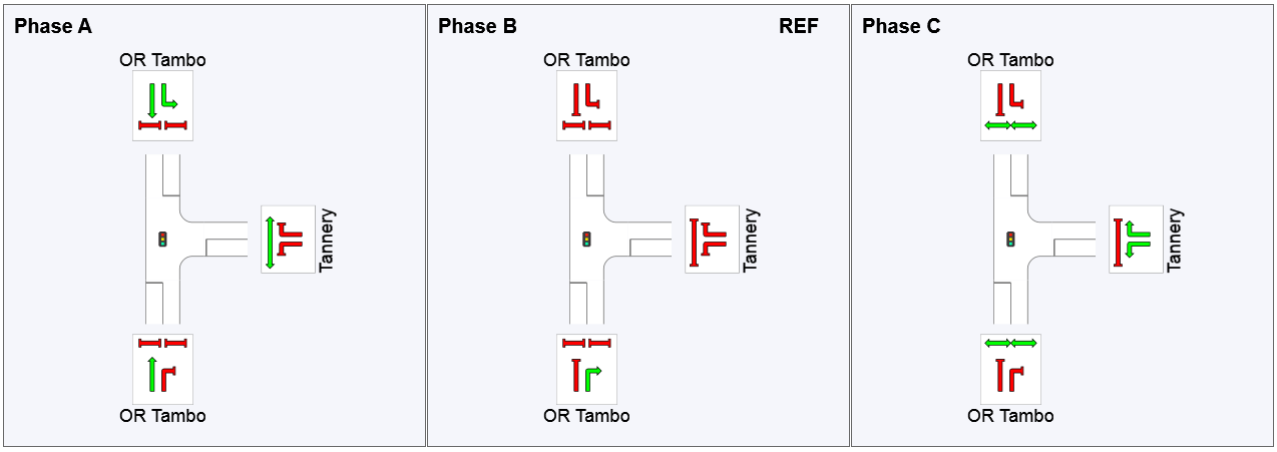
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Phase Times)

Phase Times specified by the user
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	30	0	14
Green Time (sec)	56	8	10
Phase Time (sec)	62	14	14
Phase Split	69%	16%	16%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

MOVEMENT SUMMARY

Site: 101v [PM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
2	T1	940	3.4	0.427	9.2	LOS A	10.8	78.1	0.55	0.48	52.1
3	R2	34	5.0	0.261	50.5	LOS D	1.5	11.0	0.98	0.73	32.1
Approach		974	3.5	0.427	10.7	LOS B	10.8	78.1	0.56	0.49	51.0
East: Tannery											
4	L2	106	0.0	0.687	47.6	LOS D	8.2	57.3	1.00	0.85	33.2
6	R2	78	0.0	0.687	47.6	LOS D	8.2	57.3	1.00	0.85	33.2
Approach		184	0.0	0.687	47.6	LOS D	8.2	57.3	1.00	0.85	33.2
North: OR Tambo											
7	L2	63	5.0	0.060	12.6	LOS B	1.1	7.8	0.41	0.66	48.4
8	T1	1545	2.0	0.682	11.7	LOS B	22.7	162.0	0.70	0.64	50.3
Approach		1608	2.1	0.682	11.7	LOS B	22.7	162.0	0.68	0.64	50.2
All Vehicles		2766	2.4	0.687	13.7	LOS B	22.7	162.0	0.66	0.60	48.8

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	35.6	LOS D	0.1	0.1	0.89	0.89
P2	East Full Crossing	53	8.9	LOS A	0.1	0.1	0.45	0.45
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
All Pedestrians		263	32.1	LOS D			0.82	0.82

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

PHASING SUMMARY

Site: 101v [PM Peak - Conversion]

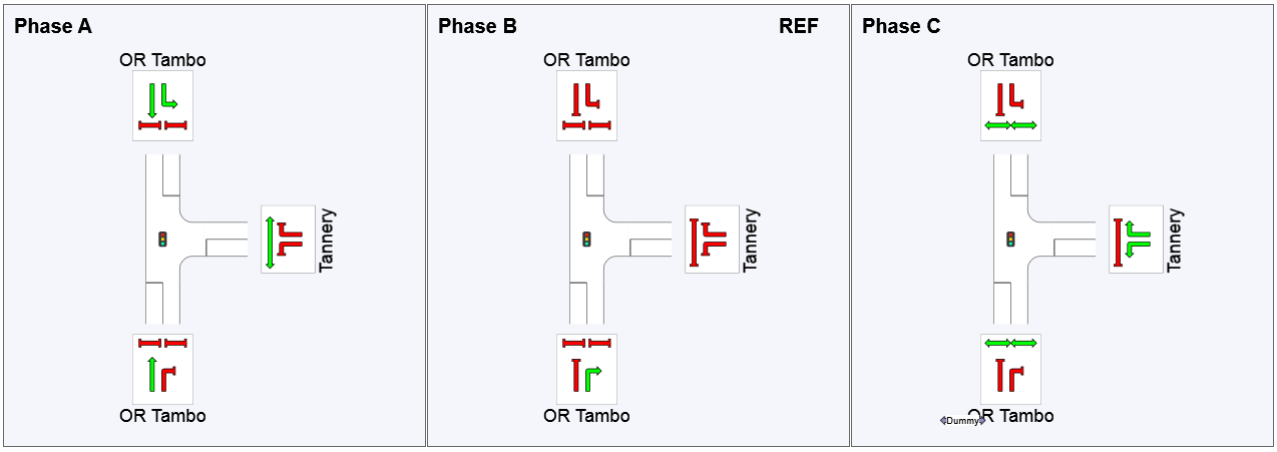
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	30	0	12
Green Time (sec)	55	6	12
Phase Time (sec)	61	12	17
Phase Split	68%	13%	19%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



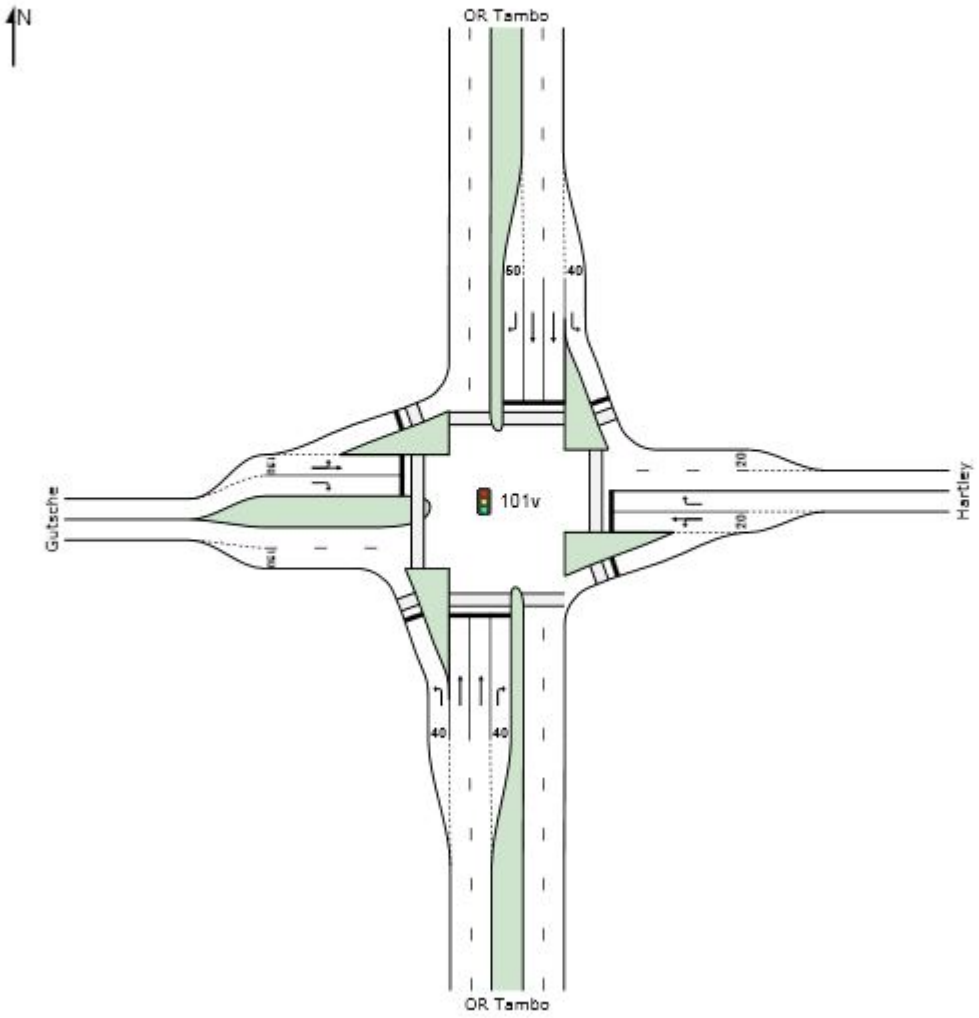
REF: Reference Phase
VAR: Variable Phase

OR Tambo & Gutsche

SITE LAYOUT

Site: 101v [AM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [AM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	183	0.0	0.156	14.4	LOS B	3.2	22.5	0.43	0.71	53.5
2	T1	1408	2.2	0.826	25.5	LOS C	28.7	204.5	0.85	0.87	46.5
3	R2	66	5.0	0.440	51.7	LOS D	2.9	21.3	0.99	0.76	34.2
Approach		1657	2.1	0.826	25.3	LOS C	28.7	204.5	0.81	0.85	46.5
East: Hartley											
4	L2	11	0.0	0.071	44.2	LOS D	0.7	4.6	0.91	0.67	35.2
5	T1	5	0.0	0.071	38.6	LOS D	0.7	4.6	0.91	0.67	35.5
6	R2	6	0.0	0.044	48.6	LOS D	0.3	1.9	0.95	0.65	33.1
Approach		23	0.0	0.071	44.2	LOS D	0.7	4.6	0.92	0.67	34.7
North: OR Tambo											
7	L2	49	5.0	0.046	14.0	LOS B	0.8	5.8	0.40	0.68	53.8
8	T1	898	3.5	0.528	17.5	LOS B	13.9	99.9	0.70	0.71	51.8
9	R2	121	0.0	0.735	54.6	LOS D	5.7	39.9	1.00	0.85	33.4
Approach		1069	3.2	0.735	21.5	LOS C	13.9	99.9	0.72	0.72	48.8
West: Gutsche											
10	L2	102	0.0	0.477	47.1	LOS D	4.7	32.6	0.98	0.78	33.8
11	T1	6	0.0	0.477	41.5	LOS D	4.7	32.6	0.98	0.78	34.1
12	R2	97	0.0	0.673	53.2	LOS D	4.5	31.8	1.00	0.83	31.8
Approach		206	0.0	0.673	49.8	LOS D	4.7	32.6	0.99	0.80	32.8
All Vehicles		2955	2.3	0.826	25.8	LOS C	28.7	204.5	0.79	0.80	45.8

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	39.3	LOS D	0.1	0.1	0.94	0.94
P1S	South Slip/Bypass Lane Crossing	53	37.4	LOS D	0.1	0.1	0.91	0.91
P2	East Full Crossing	53	16.8	LOS B	0.1	0.1	0.61	0.61
P2S	East Slip/Bypass Lane Crossing	53	12.3	LOS B	0.1	0.1	0.52	0.52
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	39.3	LOS D	0.1	0.1	0.94	0.94
P3S	North Slip/Bypass Lane Crossing	53	37.4	LOS D	0.1	0.1	0.91	0.91
P4	West Full Crossing	53	19.4	LOS B	0.1	0.1	0.66	0.66
P4S	West Slip/Bypass Lane Crossing	53	12.3	LOS B	0.1	0.1	0.52	0.52
All Pedestrians		526	29.3	LOS C			0.79	0.79

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

PHASING SUMMARY

Site: 101v [AM Peak - Conversion V2]

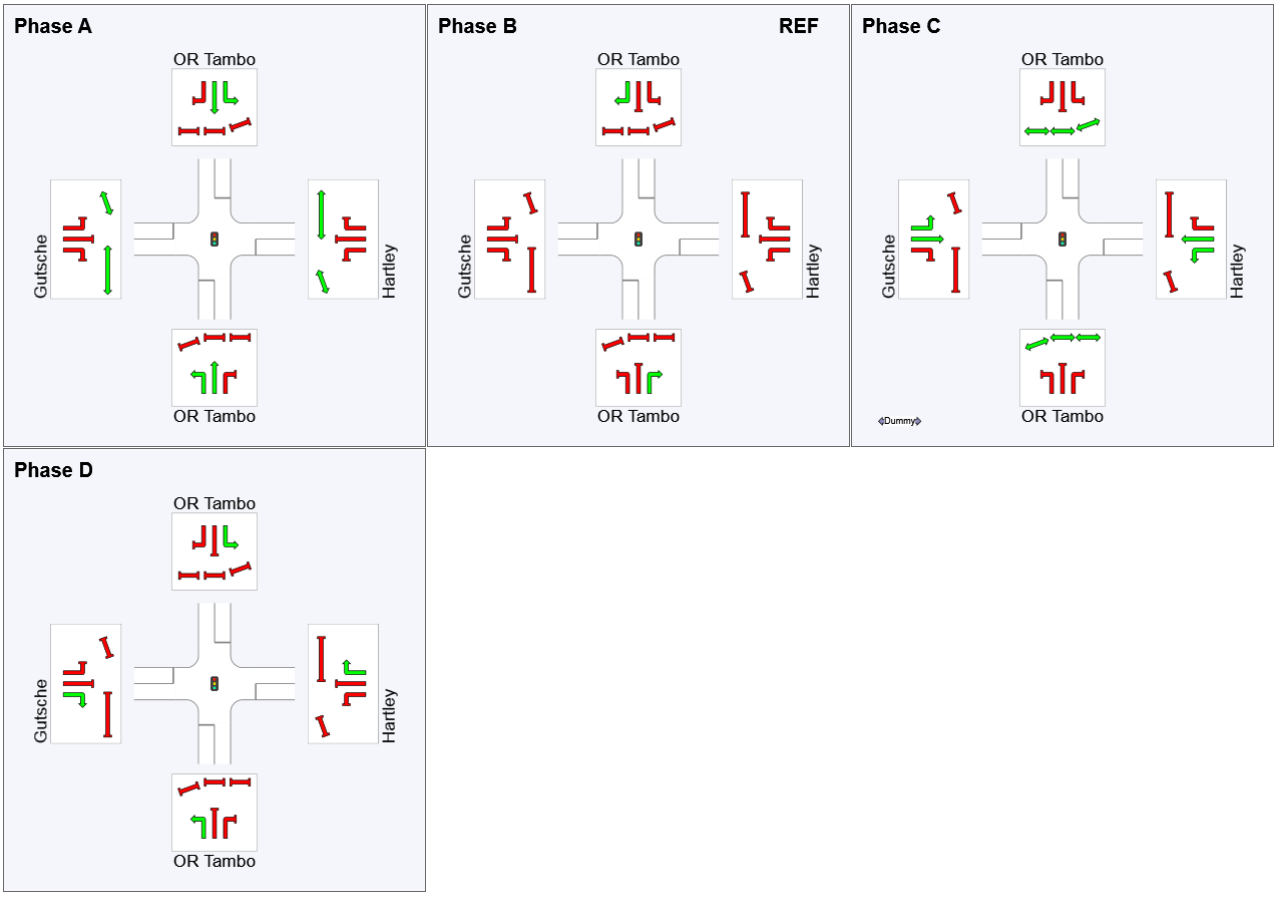
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Phase Change Time (sec)	40	0	13	29
Green Time (sec)	45	7	10	6
Phase Time (sec)	51	13	15	11
Phase Split	57%	14%	17%	12%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

MOVEMENT SUMMARY

Site: 101v [PM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	126	0.0	0.139	19.0	LOS B	3.0	21.1	0.58	0.70	45.3
2	T1	916	3.4	0.540	16.9	LOS B	14.1	101.8	0.73	0.64	47.0
3	R2	16	5.0	0.126	49.6	LOS D	0.7	5.2	0.96	0.69	32.5
Approach		1059	3.0	0.540	17.6	LOS B	14.1	101.8	0.72	0.65	46.5
East: Hartley											
4	L2	57	0.0	0.225	43.4	LOS D	2.4	17.0	0.92	0.74	35.0
5	T1	4	0.0	0.225	37.8	LOS D	2.4	17.0	0.92	0.74	35.3
6	R2	15	0.0	0.092	47.8	LOS D	0.6	4.5	0.95	0.69	33.4
Approach		76	0.0	0.225	44.0	LOS D	2.4	17.0	0.93	0.73	34.7
North: OR Tambo											
7	L2	5	5.0	0.006	18.0	LOS B	0.1	0.8	0.53	0.61	45.8
8	T1	1345	2.3	0.758	20.3	LOS C	24.7	176.1	0.86	0.79	45.0
9	R2	48	0.0	0.332	50.6	LOS D	2.1	14.9	0.98	0.74	32.3
Approach		1398	2.2	0.758	21.3	LOS C	24.7	176.1	0.87	0.78	44.4
West: Gutsche											
10	L2	39	0.0	0.150	42.8	LOS D	1.6	11.2	0.91	0.72	35.1
11	T1	1	0.0	0.150	37.2	LOS D	1.6	11.2	0.91	0.72	35.4
12	R2	119	0.0	0.719	53.0	LOS D	5.6	38.9	1.00	0.86	31.9
Approach		159	0.0	0.719	50.3	LOS D	5.6	38.9	0.98	0.82	32.7
All Vehicles		2692	2.3	0.758	22.2	LOS C	24.7	176.1	0.82	0.73	43.9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P1S	South Slip/Bypass Lane Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P2	East Full Crossing	53	18.1	LOS B	0.1	0.1	0.63	0.63
P2S	East Slip/Bypass Lane Crossing	53	13.4	LOS B	0.1	0.1	0.55	0.55
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P3S	North Slip/Bypass Lane Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P4	West Full Crossing	53	20.7	LOS C	0.1	0.1	0.68	0.68
P4S	West Slip/Bypass Lane Crossing	53	13.4	LOS B	0.1	0.1	0.55	0.55
All Pedestrians		526	29.0	LOS C			0.79	0.79

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

PHASING SUMMARY

Site: 101v [PM Peak - Conversion V2]

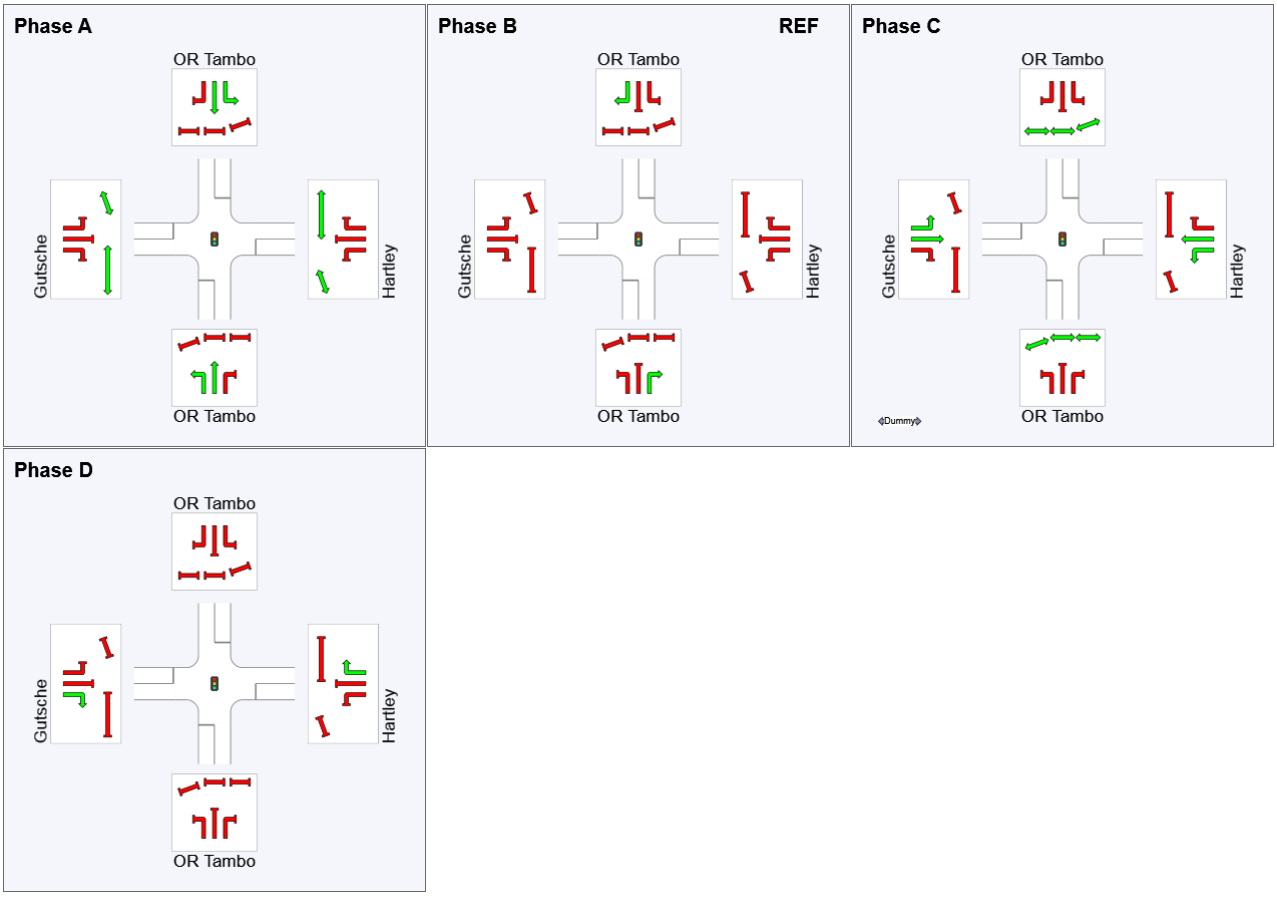
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Phase Change Time (sec)	42	0	12	30
Green Time (sec)	43	6	12	7
Phase Time (sec)	49	12	17	12
Phase Split	54%	13%	19%	13%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



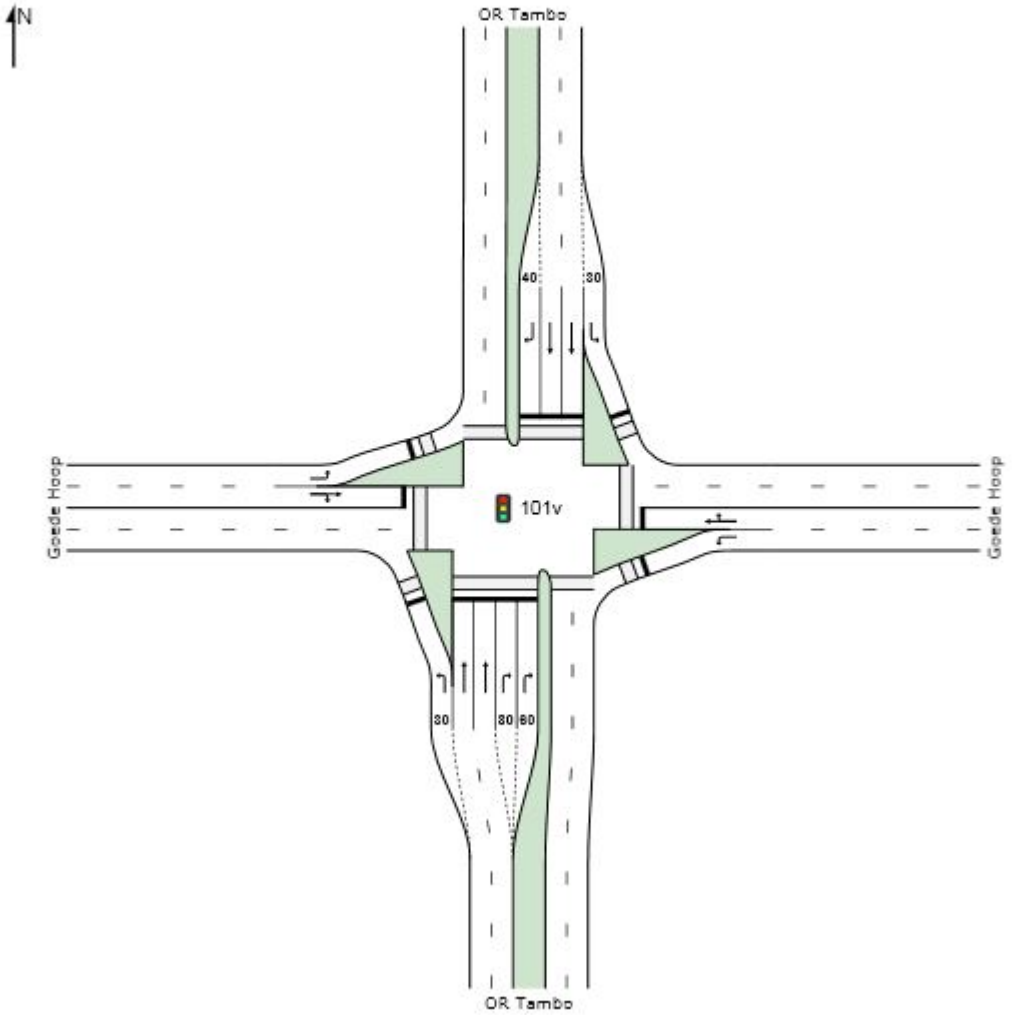
REF: Reference Phase
VAR: Variable Phase

OR Tambo & Goede Hoop

SITE LAYOUT

Site: 101v [AM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [AM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	128	0.0	0.132	19.0	LOS B	2.8	19.9	0.54	0.72	43.5
2	T1	1056	3.0	0.583	17.6	LOS B	16.8	120.9	0.72	0.73	51.7
3	R2	347	5.0	0.582	44.9	LOS D	7.3	53.0	0.97	0.81	27.3
Approach		1531	3.2	0.583	23.9	LOS C	16.8	120.9	0.76	0.75	45.5
East: Goede Hoop											
4	L2	39	0.0	0.163	41.3	LOS D	1.6	11.0	0.92	0.72	26.2
5	T1	5	0.0	0.043	36.4	LOS D	0.4	2.7	0.89	0.64	5.5
6	R2	5	0.0	0.043	39.3	LOS D	0.4	2.7	0.89	0.64	27.4
Approach		49	0.0	0.163	40.6	LOS D	1.6	11.0	0.91	0.71	25.0
North: OR Tambo											
7	L2	20	5.0	0.023	18.4	LOS B	0.4	3.1	0.50	0.67	44.2
8	T1	1035	3.1	0.553	17.5	LOS B	15.1	108.5	0.71	0.72	51.8
9	R2	19	0.0	0.057	40.4	LOS D	0.7	4.9	0.86	0.70	29.1
Approach		1074	3.1	0.553	17.9	LOS B	15.1	108.5	0.71	0.72	51.3
West: Goede Hoop											
10	L2	25	0.0	0.095	39.7	LOS D	1.0	6.9	0.90	0.70	26.7
11	T1	27	0.0	0.229	38.0	LOS D	2.2	15.7	0.92	0.72	5.4
12	R2	29	0.0	0.229	41.0	LOS D	2.2	15.7	0.92	0.72	26.9
Approach		81	0.0	0.229	39.6	LOS D	2.2	15.7	0.91	0.72	22.0
All Vehicles		2735	3.0	0.583	22.3	LOS C	16.8	120.9	0.75	0.73	46.8

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P1S	South Slip/Bypass Lane Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P2	East Full Crossing	53	14.5	LOS B	0.1	0.1	0.57	0.57
P2S	East Slip/Bypass Lane Crossing	53	11.8	LOS B	0.1	0.1	0.51	0.51
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P3S	North Slip/Bypass Lane Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P4	West Full Crossing	53	14.5	LOS B	0.1	0.1	0.57	0.57
P4S	West Slip/Bypass Lane Crossing	53	11.8	LOS B	0.1	0.1	0.51	0.51
All Pedestrians		526	27.7	LOS C			0.76	0.76

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

PHASING SUMMARY

Site: 101v [AM Peak - Conversion V2]

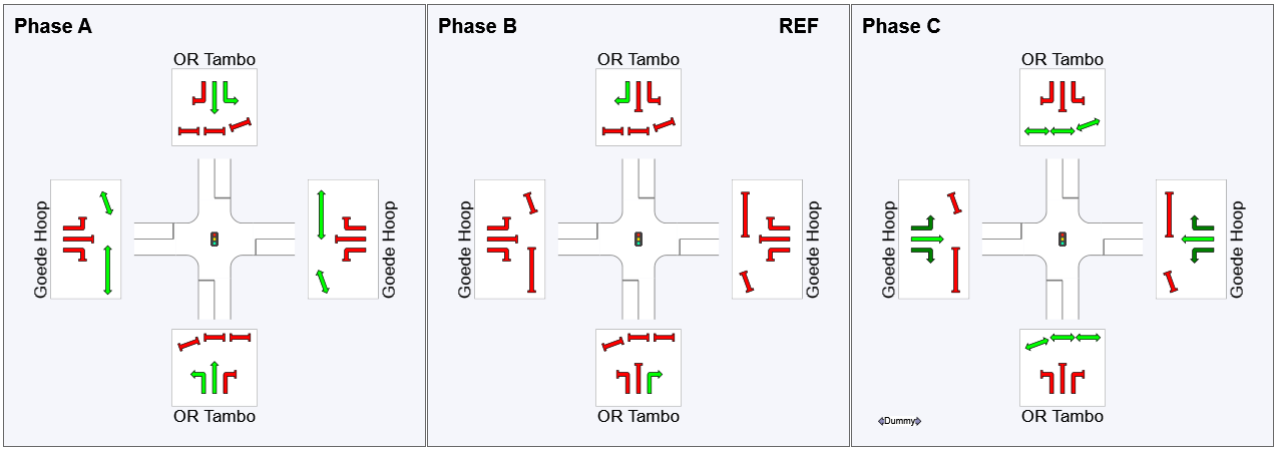
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	39	0	21
Green Time (sec)	46	15	12
Phase Time (sec)	52	21	17
Phase Split	58%	23%	19%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

MOVEMENT SUMMARY

Site: 101v [PM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	61	0.0	0.052	14.3	LOS B	1.0	7.1	0.41	0.68	48.6
2	T1	882	3.6	0.396	11.2	LOS B	9.8	70.4	0.54	0.61	56.8
3	R2	71	5.0	0.271	52.0	LOS D	1.6	11.4	0.98	0.73	24.8
Approach		1013	3.5	0.396	14.2	LOS B	9.8	70.4	0.56	0.63	53.8
East: Goede Hoop											
4	L2	129	0.0	0.533	43.9	LOS D	5.5	38.6	0.98	0.79	25.3
5	T1	18	0.0	0.185	37.7	LOS D	1.8	12.4	0.91	0.71	5.3
6	R2	27	0.0	0.185	40.6	LOS D	1.8	12.4	0.91	0.71	26.8
Approach		173	0.0	0.533	42.7	LOS D	5.5	38.6	0.96	0.77	24.3
North: OR Tambo											
7	L2	3	5.0	0.002	14.1	LOS B	0.0	0.3	0.39	0.63	48.9
8	T1	1204	2.6	0.537	12.3	LOS B	15.2	109.0	0.60	0.66	55.9
9	R2	42	0.0	0.289	51.7	LOS D	1.8	12.8	0.98	0.73	24.8
Approach		1248	2.5	0.537	13.6	LOS B	15.2	109.0	0.62	0.67	54.6
West: Goede Hoop											
10	L2	13	0.0	0.052	40.3	LOS D	0.5	3.5	0.90	0.67	26.5
11	T1	8	0.0	0.149	37.5	LOS D	1.4	9.5	0.91	0.71	5.4
12	R2	27	0.0	0.149	40.5	LOS D	1.4	9.5	0.91	0.71	26.8
Approach		47	0.0	0.149	39.9	LOS D	1.4	9.5	0.91	0.70	24.5
All Vehicles		2481	2.7	0.537	16.4	LOS B	15.2	109.0	0.62	0.66	51.4

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P1S	South Slip/Bypass Lane Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P2	East Full Crossing	53	9.8	LOS A	0.1	0.1	0.47	0.47
P2S	East Slip/Bypass Lane Crossing	53	7.6	LOS A	0.1	0.1	0.41	0.41
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P3S	North Slip/Bypass Lane Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P4	West Full Crossing	53	9.8	LOS A	0.1	0.1	0.47	0.47
P4S	West Slip/Bypass Lane Crossing	53	7.6	LOS A	0.1	0.1	0.41	0.41
All Pedestrians		526	26.0	LOS C			0.72	0.72

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

PHASING SUMMARY

Site: 101v [PM Peak - Conversion V2]

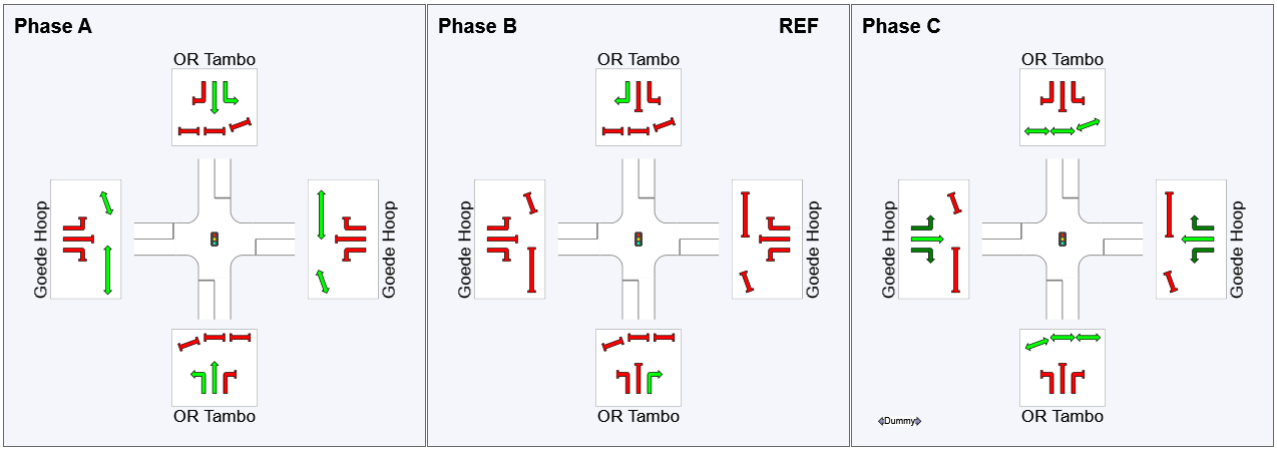
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	30	0	12
Green Time (sec)	55	6	12
Phase Time (sec)	61	12	17
Phase Split	68%	13%	19%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

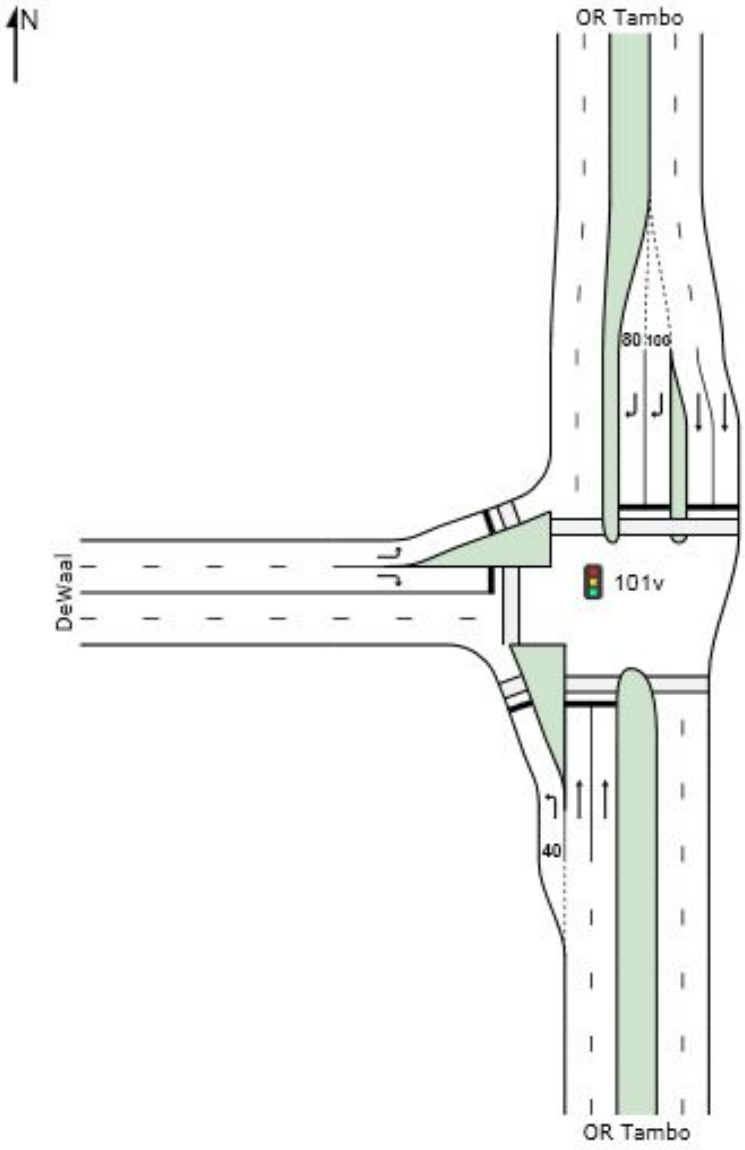
Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

OR Tambo & DeWaal

SITE LAYOUT

Site: 101v [AM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [AM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	120	0.0	0.124	17.3	LOS B	2.7	18.6	0.54	0.69	46.3
2	T1	961	3.4	0.521	15.0	LOS B	14.3	102.7	0.70	0.62	48.2
Approach		1081	3.0	0.521	15.2	LOS B	14.3	102.7	0.68	0.62	48.0
North: OR Tambo											
8	T1	1059	3.0	0.551	15.5	LOS B	15.5	111.5	0.72	0.64	47.9
9	R2	184	0.0	0.559	50.7	LOS D	4.1	29.0	1.00	0.78	32.3
Approach		1243	2.6	0.559	20.7	LOS C	15.5	111.5	0.76	0.66	44.7
West: DeWaal											
10	L2	240	0.0	0.554	39.0	LOS D	9.5	66.3	0.93	0.82	36.4
12	R2	29	0.0	0.067	34.6	LOS C	1.0	7.0	0.81	0.70	37.8
Approach		269	0.0	0.554	38.5	LOS D	9.5	66.3	0.92	0.80	36.5
All Vehicles		2593	2.5	0.559	20.3	LOS C	15.5	111.5	0.74	0.66	44.9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	30.5	LOS D	0.1	0.1	0.82	0.82
P12	South Stage 2	53	30.5	LOS D	0.1	0.1	0.82	0.82
P1S	South Slip/Bypass Lane Crossing	53	28.9	LOS C	0.1	0.1	0.80	0.80
P31	North Stage 1	53	36.5	LOS D	0.1	0.1	0.90	0.90
P32	North Stage 2	53	30.5	LOS D	0.1	0.1	0.82	0.82
P4	West Full Crossing	53	14.5	LOS B	0.1	0.1	0.57	0.57
P4S	West Slip/Bypass Lane Crossing	53	11.8	LOS B	0.1	0.1	0.51	0.51
All Pedestrians		368	26.2	LOS C			0.75	0.75

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

PHASING SUMMARY

Site: 101v [AM Peak - Conversion V2]

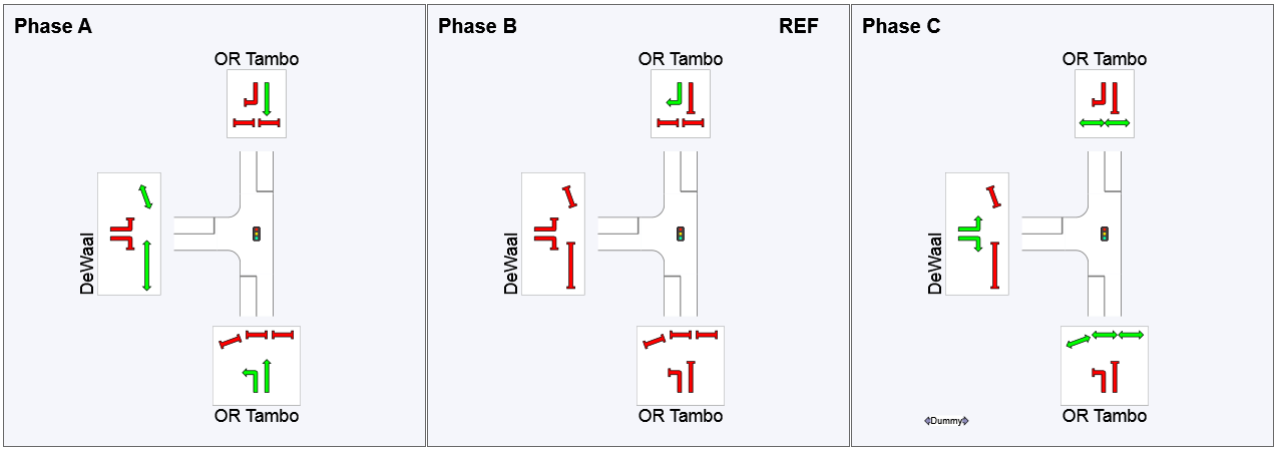
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	39	0	13
Green Time (sec)	46	7	20
Phase Time (sec)	52	13	25
Phase Split	58%	14%	28%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

MOVEMENT SUMMARY

Site: 101v [PM Peak - Conversion V2]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	35	0.0	0.038	17.7	LOS B	0.8	5.4	0.53	0.66	46.1
2	T1	907	3.5	0.503	16.1	LOS B	13.4	96.5	0.71	0.63	47.5
Approach		942	3.4	0.503	16.1	LOS B	13.4	96.5	0.71	0.63	47.4
North: OR Tambo											
8	T1	1296	2.4	0.697	18.5	LOS B	21.8	155.7	0.83	0.74	46.0
9	R2	500	0.0	0.673	43.0	LOS D	10.6	74.1	0.98	0.84	34.6
Approach		1796	1.7	0.697	25.3	LOS C	21.8	155.7	0.87	0.77	42.1
West: DeWaal											
10	L2	130	0.0	0.485	45.2	LOS D	5.5	38.2	0.97	0.79	34.3
12	R2	15	0.0	0.057	42.0	LOS D	0.6	4.1	0.89	0.69	35.1
Approach		145	0.0	0.485	44.9	LOS D	5.5	38.2	0.96	0.78	34.4
All Vehicles		2884	2.2	0.697	23.3	LOS C	21.8	155.7	0.82	0.73	43.2

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	37.4	LOS D	0.1	0.1	0.91	0.91
P12	South Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P1S	South Slip/Bypass Lane Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P4	West Full Crossing	53	15.6	LOS B	0.1	0.1	0.59	0.59
P4S	West Slip/Bypass Lane Crossing	53	12.8	LOS B	0.1	0.1	0.53	0.53
All Pedestrians		368	30.8	LOS D			0.81	0.81

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

PHASING SUMMARY

Site: 101v [PM Peak - Conversion V2]

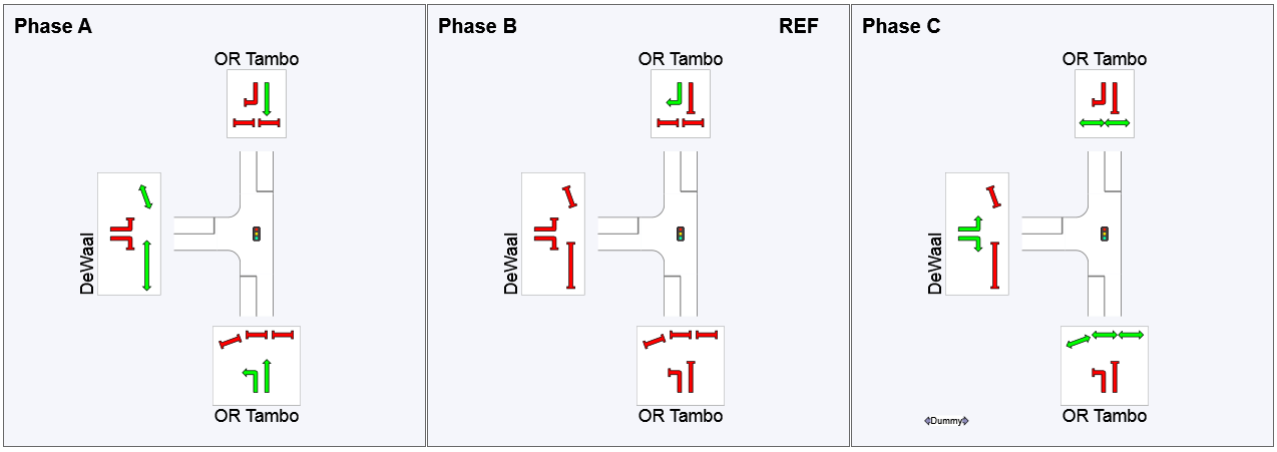
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	41	0	23
Green Time (sec)	44	17	12
Phase Time (sec)	50	23	17
Phase Split	56%	26%	19%

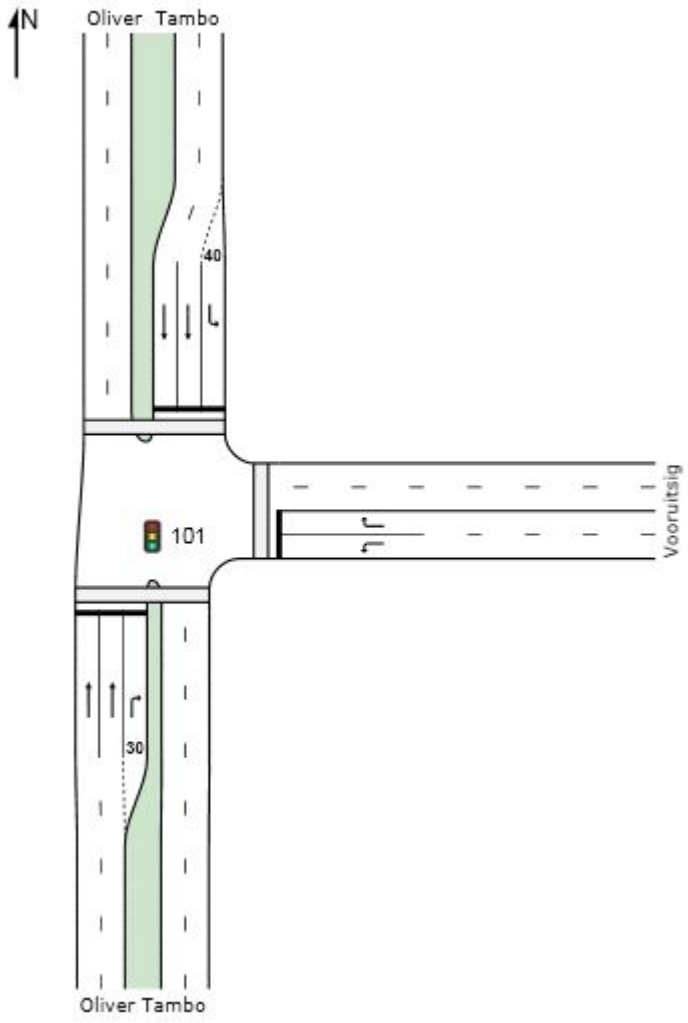
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Oliver Tambo & Vooruitsig



MOVEMENT SUMMARY

Site: 101 [AM Peak]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Oliver Tambo											
2	T1	1004	3.1	0.667	16.4	LOS B	20.4	146.3	0.75	0.66	47.3
3	R2	124	5.0	0.825	54.5	LOS D	6.6	48.5	0.99	1.03	31.1
Approach		1128	3.3	0.825	20.6	LOS C	20.4	146.3	0.77	0.70	44.7
East: Vooruitsig											
4	L2	205	5.0	0.457	35.8	LOS D	7.6	55.8	0.88	0.80	37.1
6	R2	308	5.0	0.688	38.9	LOS D	12.6	92.1	0.96	0.85	36.1
Approach		513	5.0	0.688	37.7	LOS D	12.6	92.1	0.93	0.83	36.5
North: Oliver Tambo											
7	L2	163	5.0	0.190	18.3	LOS B	3.8	28.1	0.57	0.72	45.0
8	T1	1120	2.8	0.632	16.6	LOS B	18.9	135.4	0.76	0.67	47.2
Approach		1283	3.1	0.632	16.8	LOS B	18.9	135.4	0.73	0.68	46.9
All Vehicles		2924	3.5	0.825	21.9	LOS C	20.4	146.3	0.78	0.72	43.9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	30.5	LOS D	0.1	0.1	0.82	0.82
P12	South Stage 2	53	28.1	LOS C	0.1	0.1	0.79	0.79
P2	East Full Crossing	53	16.8	LOS B	0.1	0.1	0.61	0.61
P31	North Stage 1	53	30.5	LOS D	0.1	0.1	0.82	0.82
P32	North Stage 2	53	28.1	LOS C	0.1	0.1	0.79	0.79
All Pedestrians		263	26.8	LOS C			0.77	0.77

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

PHASING SUMMARY

Site: 101 [AM Peak]

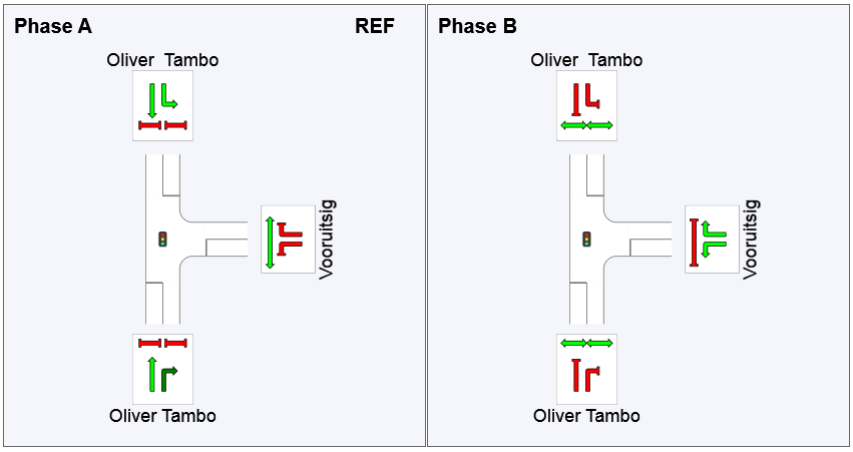
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Phase Times)

Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

Phase	A	B
Phase Change Time (sec)	0	60
Green Time (sec)	45	23
Phase Time (sec)	52	38
Phase Split	58%	42%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

MOVEMENT SUMMARY

Site: 101 [PM Peak]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Oliver Tambo											
2	T1	932	3.4	0.683	21.2	LOS C	19.2	138.1	0.83	0.73	44.5
3	R2	86	5.0	0.739	52.7	LOS D	4.2	30.8	1.00	0.92	31.6
Approach		1018	3.5	0.739	23.9	LOS C	19.2	138.1	0.84	0.74	43.0
East: Vooruitsig											
4	L2	527	5.0	0.910	53.2	LOS D	28.6	208.7	1.00	1.02	31.5
6	R2	418	5.0	0.723	34.6	LOS C	16.6	121.2	0.93	0.87	37.7
Approach		945	5.0	0.910	45.0	LOS D	28.6	208.7	0.97	0.95	34.0
North: Oliver Tambo											
7	L2	10	5.0	0.014	21.0	LOS C	0.2	1.8	0.59	0.65	43.6
8	T1	1242	2.5	0.775	25.1	LOS C	24.4	174.3	0.92	0.85	42.5
Approach		1252	2.5	0.775	25.0	LOS C	24.4	174.3	0.91	0.85	42.5
All Vehicles		3215	3.6	0.910	30.5	LOS C	28.6	208.7	0.91	0.85	39.7

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	25.0	LOS C	0.1	0.1	0.75	0.75
P12	South Stage 2	53	22.8	LOS C	0.1	0.1	0.71	0.71
P2	East Full Crossing	53	21.4	LOS C	0.1	0.1	0.69	0.69
P31	North Stage 1	53	25.0	LOS C	0.1	0.1	0.75	0.75
P32	North Stage 2	53	22.8	LOS C	0.1	0.1	0.71	0.71
All Pedestrians		263	23.4	LOS C			0.72	0.72

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

PHASING SUMMARY

Site: 101 [PM Peak]

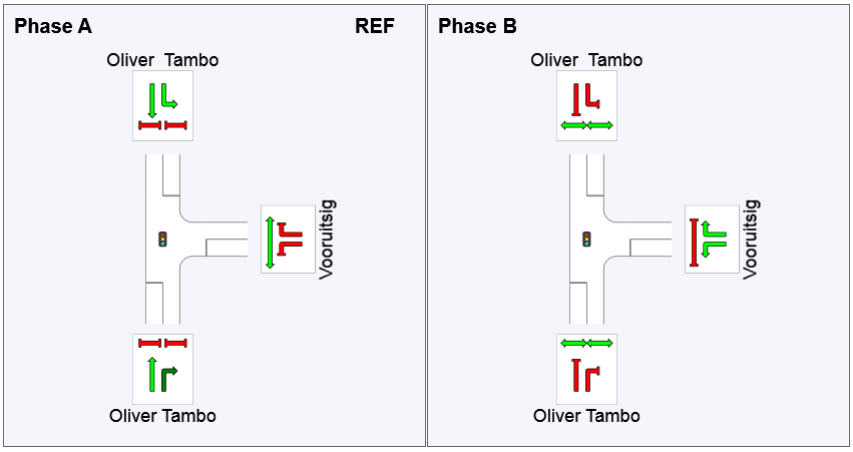
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Phase Times)

Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

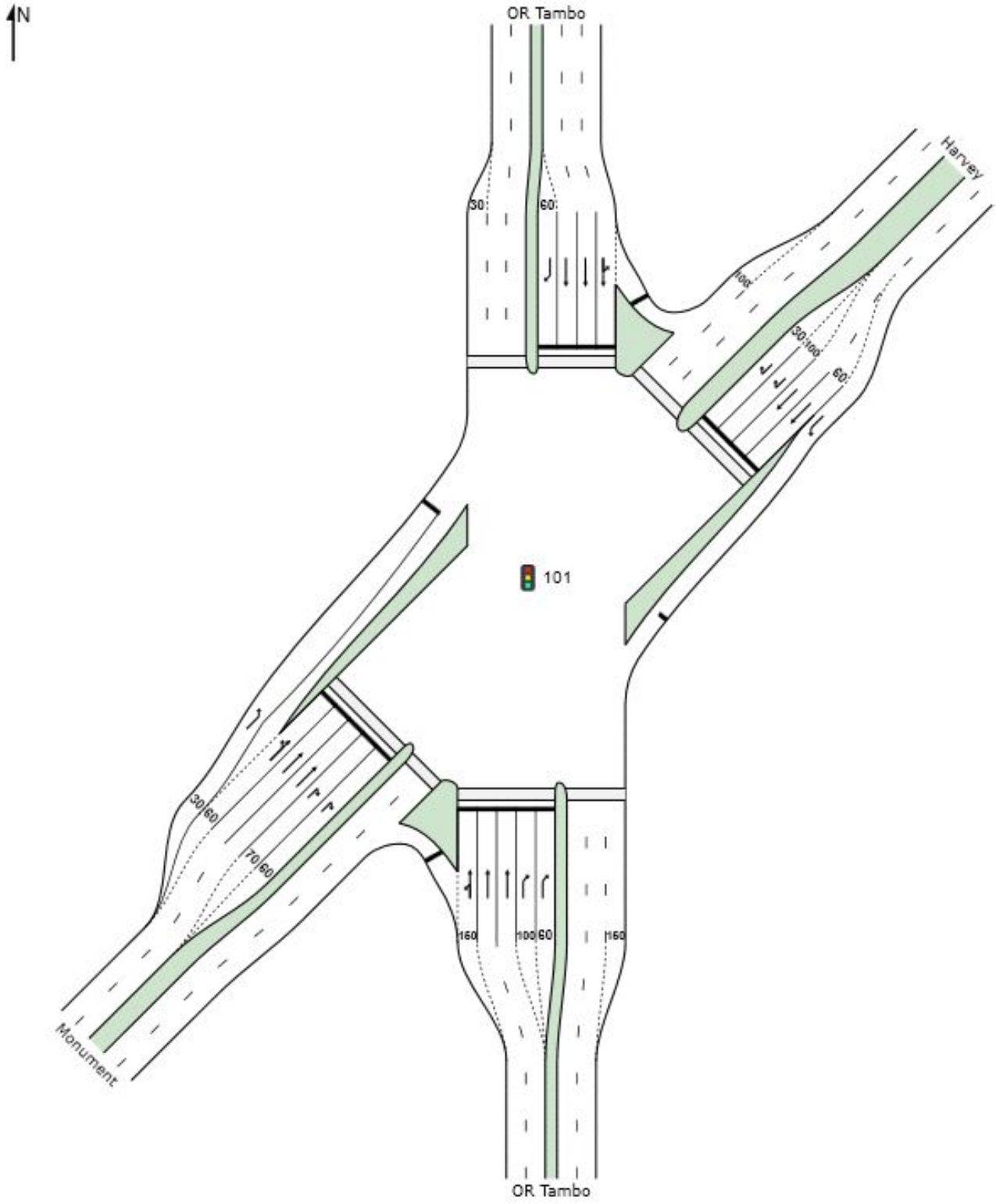
Phase	A	B
Phase Change Time (sec)	0	53
Green Time (sec)	38	30
Phase Time (sec)	45	45
Phase Split	50%	50%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

OR Tambo & Harvey-Monument



MOVEMENT SUMMARY

Site: 101 [AM Peak V3]

New Site
Signals - Fixed Time Coordinated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1b	L3	293	0,0	0,523	16,7	LOS B	7,9	55,4	0,65	0,55	47,4
2	T1	1210	2,4	0,957	37,5	LOS D	32,6	232,5	0,99	1,11	37,6
3a	R1	354	0,0	0,926	49,7	LOS D	8,9	62,4	1,00	0,97	33,5
Approach		1856	1,6	0,957	36,6	LOS D	32,6	232,5	0,94	0,99	38,0
NorthEast: Harvey											
24a	L1	362	0,0	0,898	37,8	LOS D	17,1	119,7	1,00	0,98	37,5
25	T1	415	0,0	0,504	28,3	LOS C	7,3	51,4	0,83	0,69	41,4
26b	R3	6	0,0	0,023	40,5	LOS D	0,1	0,8	0,89	0,56	36,5
Approach		784	0,0	0,898	32,8	LOS C	17,1	119,7	0,91	0,82	39,5
North: OR Tambo											
7b	L3	2	0,0	0,420	15,9	LOS B	6,5	47,0	0,60	0,51	47,9
8	T1	785	3,8	0,420	15,9	LOS B	6,5	47,1	0,60	0,51	47,9
9a	R1	107	0,0	0,562	40,7	LOS D	4,6	32,1	0,96	0,75	36,5
Approach		894	3,3	0,562	18,9	LOS B	6,5	47,1	0,64	0,53	46,2
SouthWest: Monument											
30a	L1	537	0,0	0,472	15,9	LOS B	8,0	56,1	0,60	0,51	47,9
31	T1	798	0,0	0,594	17,1	LOS B	11,4	79,7	0,69	0,60	47,2
32b	R3	484	0,0	0,837	37,6	LOS D	10,9	76,6	0,99	0,91	37,6
Approach		1818	0,0	0,837	22,2	LOS C	11,4	79,7	0,74	0,65	44,4
All Vehicles		5352	1,1	0,957	28,2	LOS C	32,6	232,5	0,82	0,78	41,5

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39,3	LOS D	0,1	0,1	0,94	0,94
P12	South Stage 2	53	34,7	LOS D	0,1	0,1	0,88	0,88
P61	NorthEast Stage 1	53	7,1	LOS A	0,0	0,0	0,56	0,56
P62	NorthEast Stage 2	53	25,0	LOS C	0,1	0,1	0,75	0,75
P31	North Stage 1	53	36,5	LOS D	0,1	0,1	0,90	0,90
P32	North Stage 2	53	34,7	LOS D	0,1	0,1	0,88	0,88
P81	SouthWest Stage 1	53	13,9	LOS B	0,1	0,1	0,56	0,56
P82	SouthWest Stage 2	53	22,8	LOS C	0,1	0,1	0,71	0,71
All Pedestrians		421	26,8	LOS C			0,77	0,77

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

PHASING SUMMARY

Site: 101 [AM Peak V3]

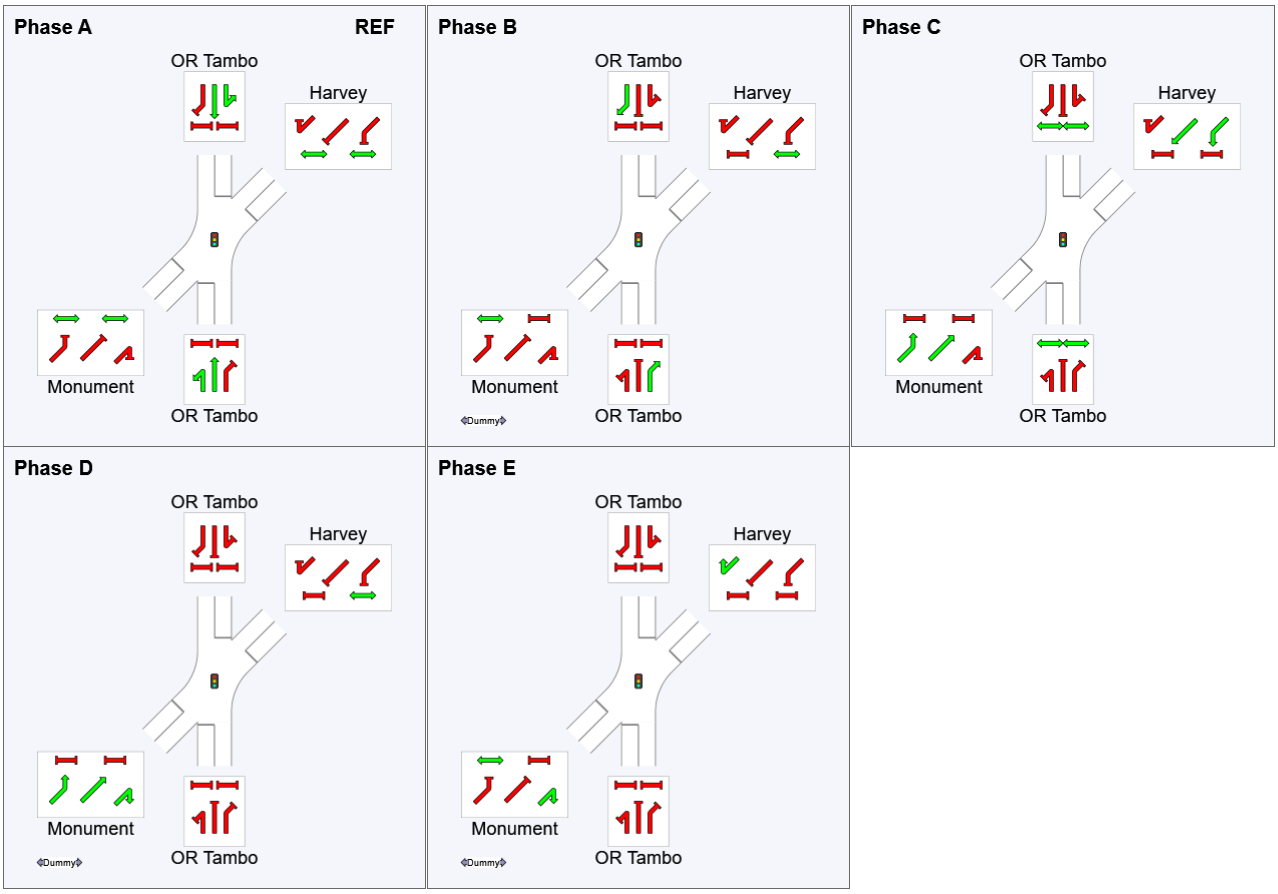
New Site
Signals - Fixed Time Coordinated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Green Split Priority applies
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

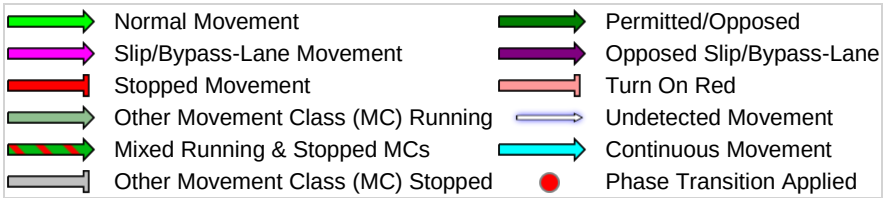
Phase Timing Results

Phase	A	B	C	D	E
Phase Change Time (sec)	0	33	46	69	81
Green Time (sec)	30	8	18	6	6
Phase Time (sec)	35	13	24	9	9
Phase Split	39%	14%	27%	10%	10%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase



MOVEMENT SUMMARY

Site: 101 [PM Peak V3]

New Site
Signals - Fixed Time Coordinated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1b	L3	8	0,0	0,262	20,4	LOS C	3,6	25,9	0,64	0,52	45,3
2	T1	831	2,4	0,682	23,2	LOS C	12,4	88,5	0,81	0,69	43,9
3a	R1	203	0,0	0,341	33,0	LOS C	3,7	26,1	0,85	0,67	39,4
Approach		1042	1,9	0,682	25,1	LOS C	12,4	88,5	0,81	0,68	42,9
NorthEast: Harvey											
24a	L1	225	0,0	0,663	33,0	LOS C	9,0	63,0	0,93	0,77	39,4
25	T1	379	0,0	0,312	17,9	LOS B	4,8	33,6	0,61	0,50	46,7
26b	R3	348	0,0	0,536	29,9	LOS C	6,4	44,9	0,86	0,70	40,7
Approach		952	0,0	0,663	25,9	LOS C	9,0	63,0	0,77	0,64	42,5
North: OR Tambo											
7b	L3	404	0,0	0,894	32,8	LOS C	18,7	131,0	0,98	0,97	39,4
8	T1	817	3,8	0,870	29,9	LOS C	19,2	138,8	0,92	0,89	40,7
9a	R1	282	0,0	0,948	49,0	LOS D	14,7	103,1	1,00	1,04	33,8
Approach		1502	2,1	0,948	34,2	LOS C	19,2	138,8	0,95	0,94	38,9
SouthWest: Monument											
30a	L1	531	0,0	0,642	19,1	LOS B	11,4	79,8	0,68	0,58	46,0
31	T1	689	0,0	0,883	37,9	LOS D	14,3	100,1	0,99	0,93	37,5
32b	R3	14	0,0	0,056	41,0	LOS D	0,3	2,0	0,90	0,60	36,3
Approach		1234	0,0	0,883	29,8	LOS C	14,3	100,1	0,85	0,77	40,7
All Vehicles		4731	1,1	0,948	29,4	LOS C	19,2	138,8	0,86	0,78	40,9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39,3	LOS D	0,1	0,1	0,94	0,94
P12	South Stage 2	53	37,4	LOS D	0,1	0,1	0,91	0,91
P61	NorthEast Stage 1	53	11,8	LOS B	0,1	0,1	0,51	0,51
P62	NorthEast Stage 2	53	29,7	LOS C	0,1	0,1	0,81	0,81
P31	North Stage 1	53	39,3	LOS D	0,1	0,1	0,94	0,94
P32	North Stage 2	53	37,4	LOS D	0,1	0,1	0,91	0,91
P81	SouthWest Stage 1	53	25,0	LOS C	0,1	0,1	0,75	0,75
P82	SouthWest Stage 2	53	27,3	LOS C	0,1	0,1	0,78	0,78
All Pedestrians		421	30,9	LOS D			0,82	0,82

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

PHASING SUMMARY

Site: 101 [PM Peak V3]

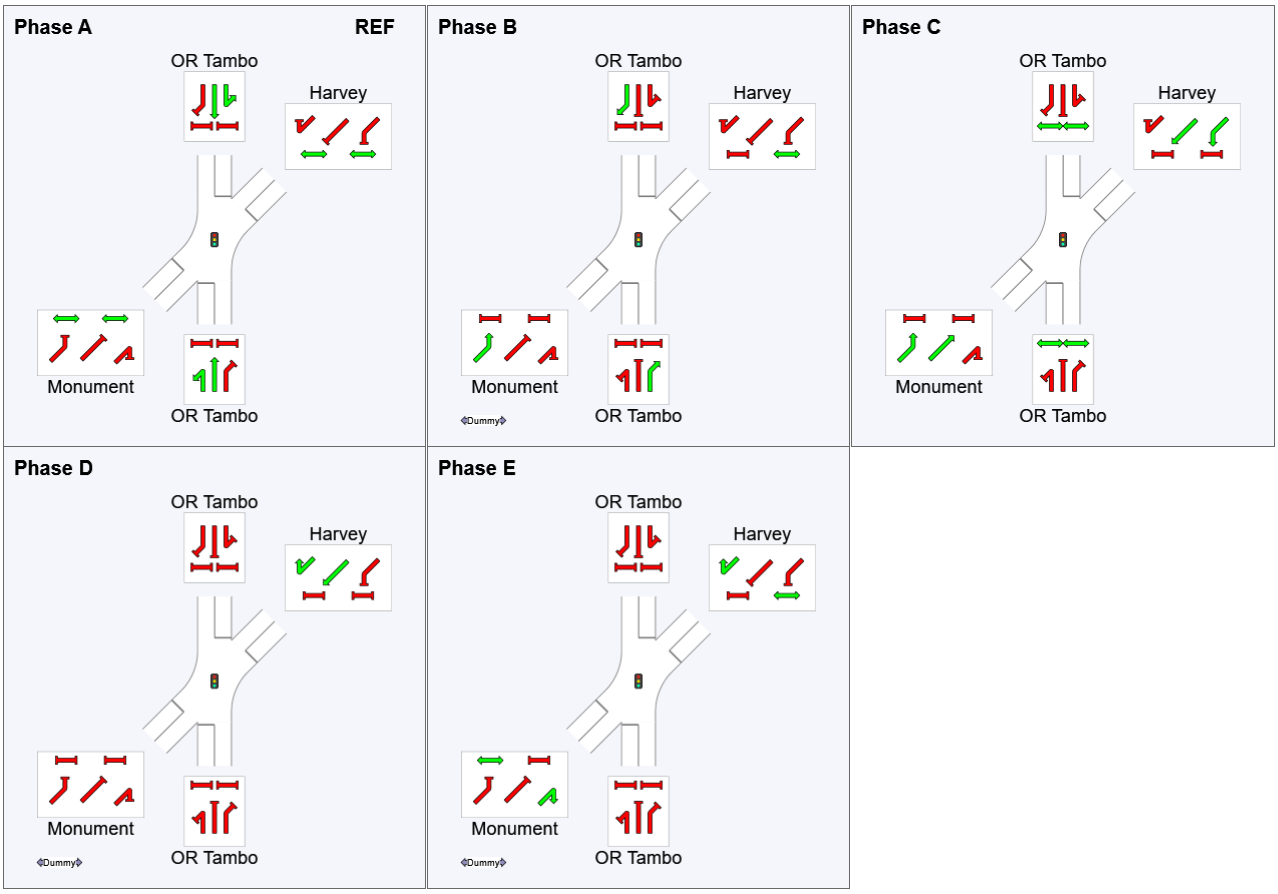
New Site
Signals - Fixed Time Coordinated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Green Split Priority applies
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, E
Output Phase Sequence: A, B, C, D, E

Phase Timing Results

Phase	A	B	C	D	E
Phase Change Time (sec)	0	29	47	67	79
Green Time (sec)	24	13	15	6	6
Phase Time (sec)	29	18	21	11	11
Phase Split	32%	20%	23%	12%	12%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



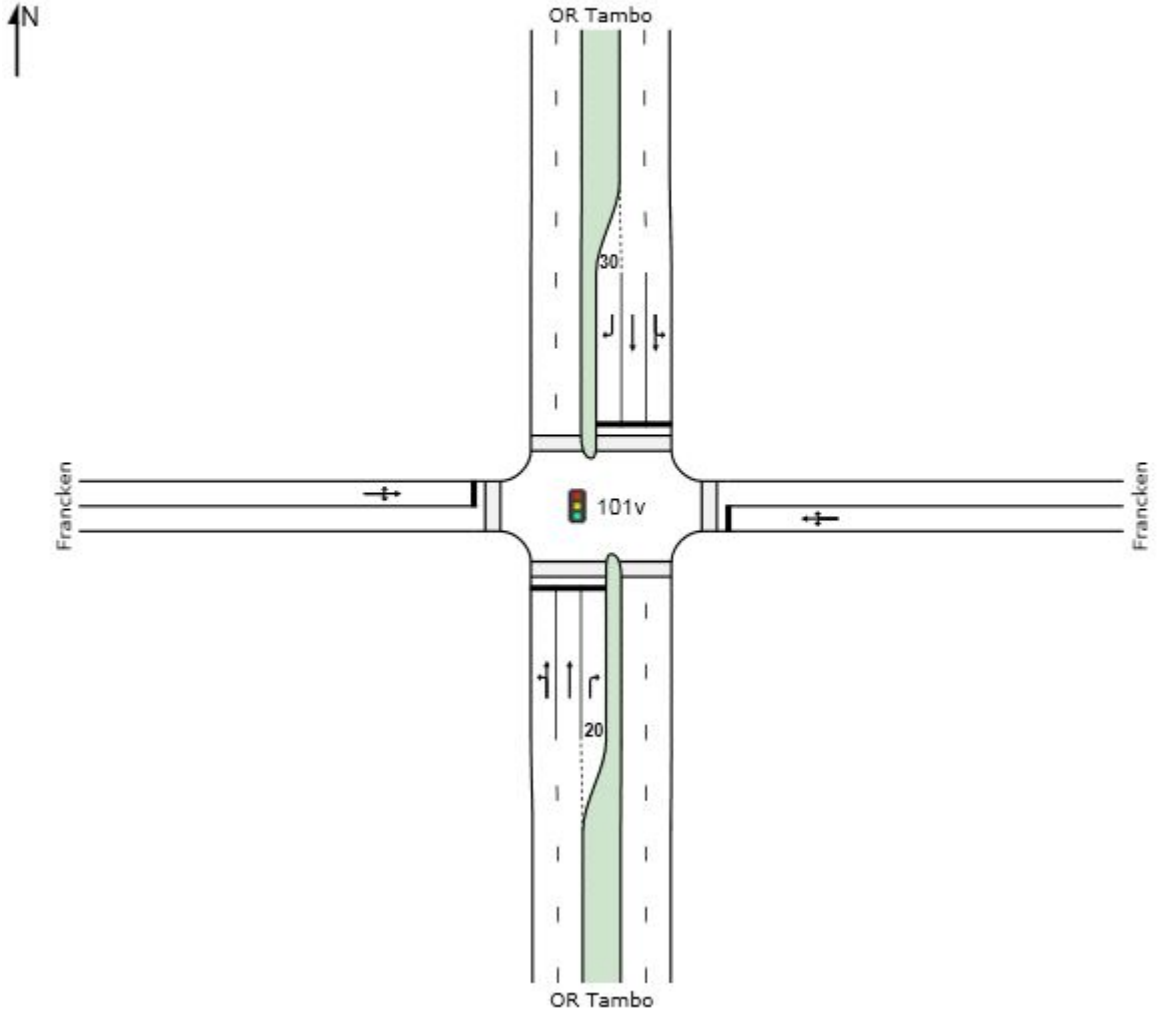
REF: Reference VAR: Variable Phase

OR Tambo & Francken

SITE LAYOUT

Site: 101v [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	318	5.0	0.811	22.8	LOS C	31.8	228.6	0.83	0.86	48.9
2	T1	1518	2.1	0.811	17.5	LOS B	31.8	228.6	0.82	0.84	51.2
3	R2	16	5.0	0.126	50.9	LOS D	0.7	5.2	0.96	0.70	34.3
Approach		1853	2.6	0.811	18.7	LOS B	31.8	228.6	0.82	0.84	50.6
East: Francken											
4	L2	1	0.0	0.150	43.7	LOS D	1.5	10.6	0.92	0.68	36.2
5	T1	35	0.0	0.150	38.2	LOS D	1.5	10.6	0.92	0.68	36.8
6	R2	1	0.0	0.150	43.8	LOS D	1.5	10.6	0.92	0.68	36.2
Approach		38	0.0	0.150	38.6	LOS D	1.5	10.6	0.92	0.68	36.8
North: OR Tambo											
7	L2	18	5.0	0.384	14.6	LOS B	9.3	67.4	0.53	0.48	50.6
8	T1	826	3.8	0.384	8.9	LOS A	9.3	67.4	0.53	0.47	52.2
9	R2	24	5.0	0.184	50.0	LOS D	1.0	7.7	0.97	0.71	32.3
Approach		868	3.9	0.384	10.2	LOS B	9.3	67.4	0.54	0.48	51.3
West: Francken											
10	L2	51	0.0	0.808	53.2	LOS D	8.2	57.7	1.00	0.95	31.9
11	T1	32	0.0	0.808	47.6	LOS D	8.2	57.7	1.00	0.95	32.3
12	R2	88	0.0	0.808	53.2	LOS D	8.2	57.7	1.00	0.95	31.9
Approach		171	0.0	0.808	52.2	LOS D	8.2	57.7	1.00	0.95	32.0
All Vehicles		2929	2.8	0.811	18.4	LOS B	31.8	228.6	0.75	0.74	48.9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	38.4	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	8.9	LOS A	0.1	0.1	0.45	0.45
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	38.4	LOS D	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	8.9	LOS A	0.1	0.1	0.45	0.45
All Pedestrians		316	28.9	LOS C			0.77	0.77

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

PHASING SUMMARY

Site: 101v [AM Peak - Conversion]

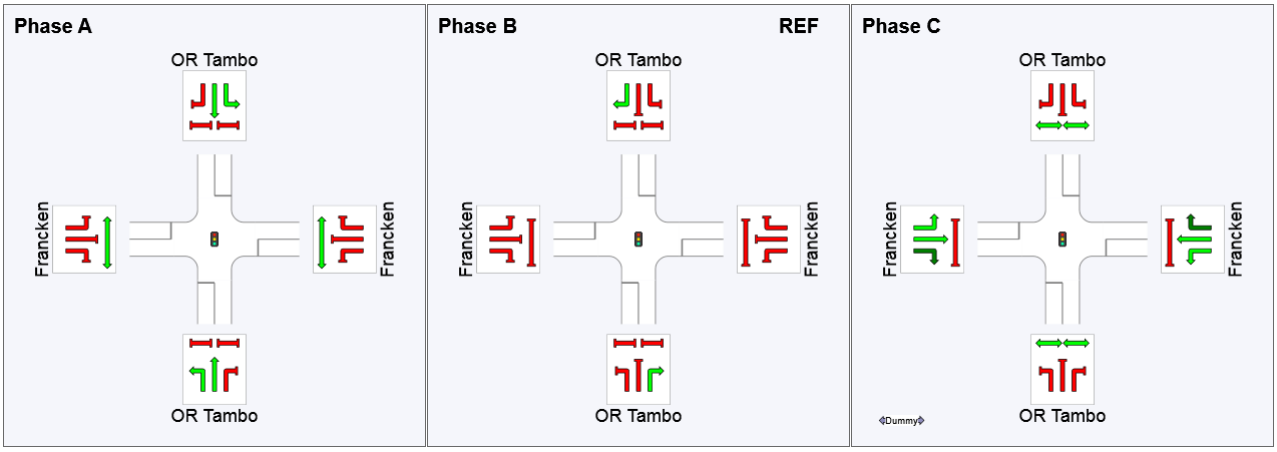
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	29	0	12
Green Time (sec)	55	6	11
Phase Time (sec)	61	12	17
Phase Split	68%	13%	19%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

MOVEMENT SUMMARY

Site: 101v [PM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
1	L2	173	5.0	0.522	17.7	LOS B	14.2	102.3	0.62	0.71	52.7
2	T1	974	3.2	0.522	12.7	LOS B	14.3	102.9	0.61	0.69	54.9
3	R2	6	5.0	0.048	50.2	LOS D	0.3	2.0	0.95	0.66	34.6
Approach		1153	3.5	0.522	13.6	LOS B	14.3	102.9	0.62	0.69	54.4
East: Francken											
4	L2	9	0.0	0.045	41.9	LOS D	0.4	3.1	0.89	0.67	35.2
5	T1	1	0.0	0.045	36.4	LOS D	0.4	3.1	0.89	0.67	35.8
6	R2	1	0.0	0.045	41.9	LOS D	0.4	3.1	0.89	0.67	35.2
Approach		11	0.0	0.045	41.3	LOS D	0.4	3.1	0.89	0.67	35.3
North: OR Tambo											
7	L2	202	5.0	0.573	18.2	LOS B	16.3	117.7	0.65	0.73	52.2
8	T1	1043	3.0	0.573	13.1	LOS B	16.3	117.7	0.64	0.70	54.6
9	R2	25	5.0	0.193	51.4	LOS D	1.1	8.1	0.97	0.71	34.2
Approach		1271	3.4	0.573	14.7	LOS B	16.3	117.7	0.65	0.71	53.5
West: Francken											
10	L2	42	0.0	0.500	45.5	LOS D	5.1	35.6	0.97	0.79	34.2
11	T1	27	0.0	0.500	40.0	LOS D	5.1	35.6	0.97	0.79	34.8
12	R2	52	0.0	0.500	45.5	LOS D	5.1	35.6	0.97	0.79	34.2
Approach		120	0.0	0.500	44.3	LOS D	5.1	35.6	0.97	0.79	34.3
All Vehicles		2555	3.2	0.573	15.7	LOS B	16.3	117.7	0.65	0.70	52.4

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P12	South Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P2	East Full Crossing	53	9.4	LOS A	0.1	0.1	0.46	0.46
P31	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94
P32	North Stage 2	53	37.4	LOS D	0.1	0.1	0.91	0.91
P4	West Full Crossing	53	9.4	LOS A	0.1	0.1	0.46	0.46
All Pedestrians		316	28.7	LOS C			0.77	0.77

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

PHASING SUMMARY

Site: 101v [PM Peak - Conversion]

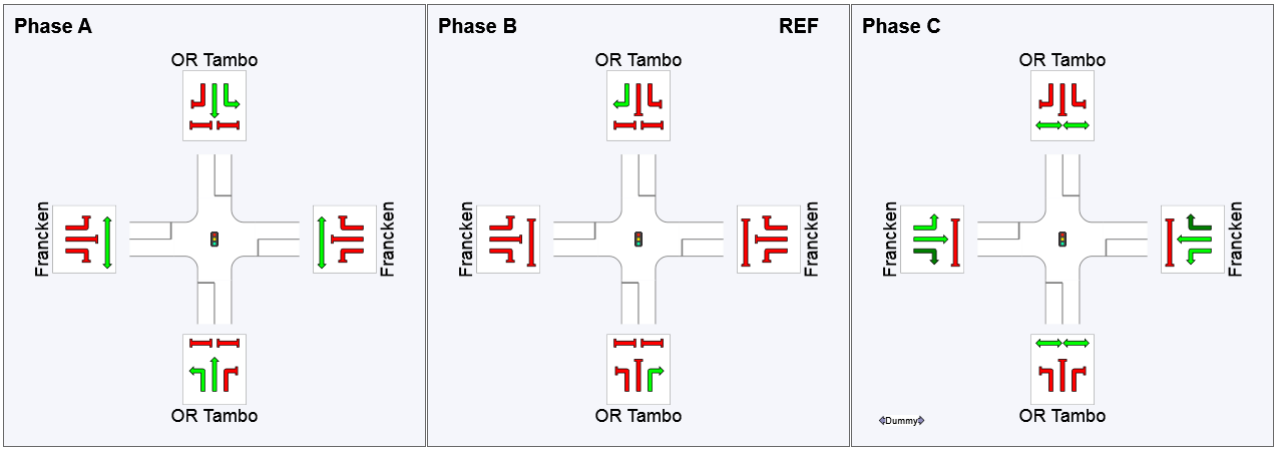
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Phase Change Time (sec)	30	0	12
Green Time (sec)	54	6	12
Phase Time (sec)	60	12	18
Phase Split	67%	13%	20%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

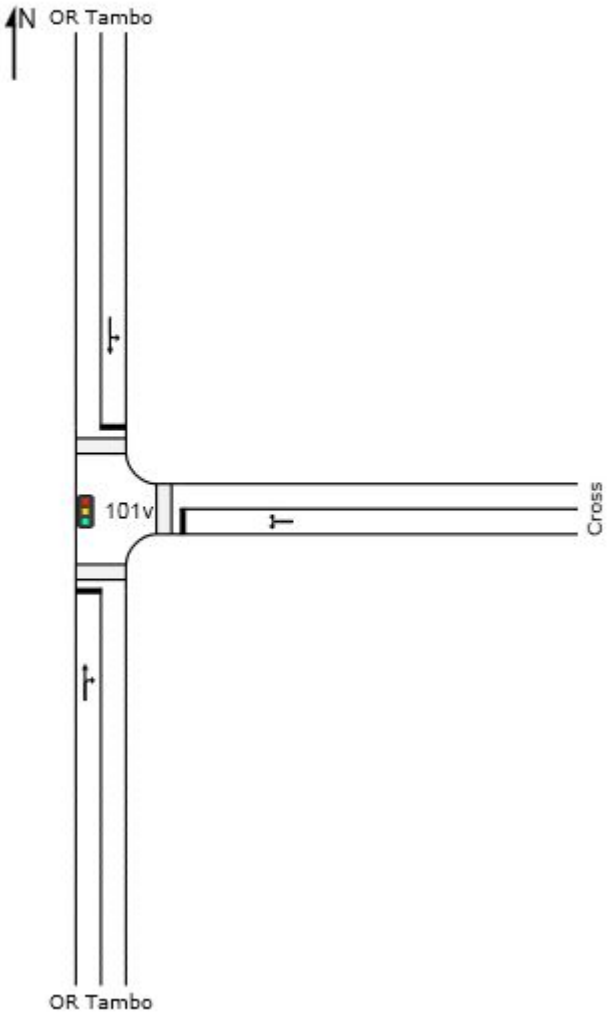
Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

OR Tambo & Cross

SITE LAYOUT

Site: 101v [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101v [AM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
2	T1	1239	2.5	0.905	21.2	LOS C	53.9	385.4	0.85	0.90	44.5
3	R2	8	5.0	0.905	26.7	LOS C	53.9	385.4	0.85	0.90	43.0
Approach		1247	2.5	0.905	21.2	LOS C	53.9	385.4	0.85	0.90	44.4
East: Cross											
4	L2	39	0.0	0.339	44.1	LOS D	3.7	26.0	0.94	0.77	34.2
6	R2	52	0.0	0.339	44.0	LOS D	3.7	26.0	0.94	0.77	34.0
Approach		91	0.0	0.339	44.1	LOS D	3.7	26.0	0.94	0.77	34.1
North: OR Tambo											
7	L2	10	5.0	0.568	10.6	LOS B	14.4	104.1	0.46	0.43	53.7
8	T1	763	4.1	0.568	5.0	LOS A	14.4	104.1	0.46	0.43	55.4
Approach		773	4.1	0.568	5.1	LOS A	14.4	104.1	0.46	0.43	55.3
All Vehicles		2111	3.0	0.905	16.3	LOS B	53.9	385.4	0.71	0.72	47.2

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	38.4	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	4.4	LOS A	0.0	0.0	0.31	0.31
P3	North Full Crossing	53	38.4	LOS D	0.1	0.1	0.92	0.92
All Pedestrians		158	27.0	LOS C			0.72	0.72

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

PHASING SUMMARY

Site: 101v [AM Peak - Conversion]

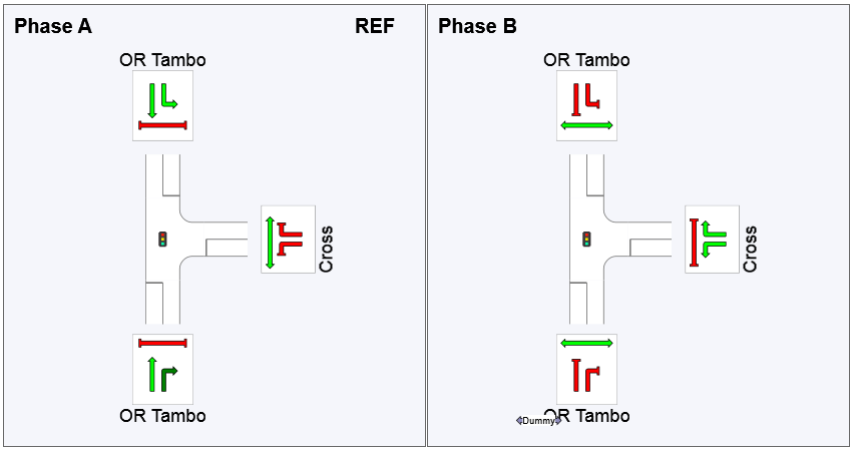
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

Phase	A	B
Phase Change Time (sec)	0	73
Green Time (sec)	67	12
Phase Time (sec)	72	18
Phase Split	80%	20%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

MOVEMENT SUMMARY

Site: 101v [PM Peak - Conversion]

New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: OR Tambo											
2	T1	987	3.2	0.822	12.2	LOS B	32.7	235.1	0.77	0.74	49.9
3	R2	15	5.0	0.822	17.7	LOS B	32.7	235.1	0.77	0.74	48.1
Approach		1002	3.2	0.822	12.3	LOS B	32.7	235.1	0.77	0.74	49.9
East: Cross											
4	L2	29	0.0	0.377	44.4	LOS D	4.2	29.1	0.95	0.78	34.1
6	R2	72	0.0	0.377	44.3	LOS D	4.2	29.1	0.95	0.78	33.9
Approach		101	0.0	0.377	44.3	LOS D	4.2	29.1	0.95	0.78	34.0
North: OR Tambo											
7	L2	6	5.0	0.857	17.6	LOS B	40.3	288.1	0.76	0.75	48.8
8	T1	1194	2.6	0.857	12.0	LOS B	40.3	288.1	0.76	0.75	50.1
Approach		1200	2.6	0.857	12.0	LOS B	40.3	288.1	0.76	0.75	50.1
All Vehicles		2303	2.8	0.857	13.5	LOS B	40.3	288.1	0.77	0.75	49.0

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	38.4	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	4.4	LOS A	0.0	0.0	0.31	0.31
P3	North Full Crossing	53	38.4	LOS D	0.1	0.1	0.92	0.92
All Pedestrians		158	27.0	LOS C			0.72	0.72

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

PHASING SUMMARY

Site: 101v [PM Peak - Conversion]

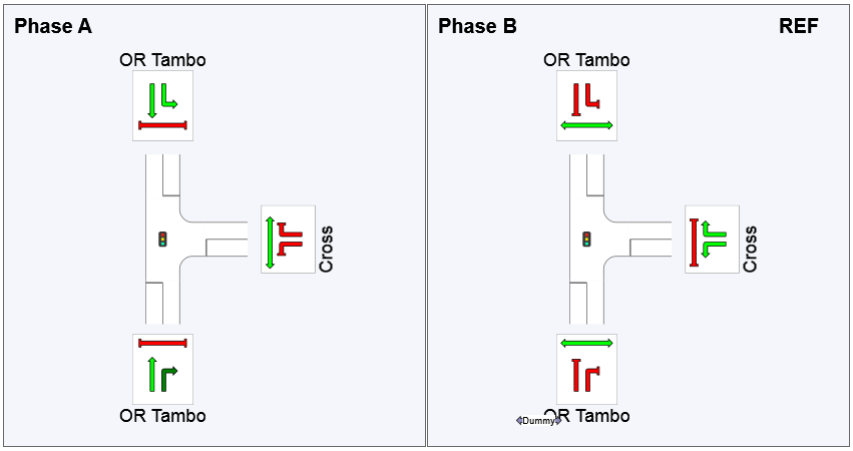
New Site
Signals - Fixed Time Isolated Cycle Time = 90 seconds (User-Given Cycle Time)

Phase Times determined by the program
Phase Sequence: Opposed Turns
Reference Phase: Phase B
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Phase Timing Results

Phase	A	B
Phase Change Time (sec)	17	0
Green Time (sec)	67	12
Phase Time (sec)	72	18
Phase Split	80%	20%

See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.



REF: Reference Phase
VAR: Variable Phase

ANNEXURE D –

Results of 2028 Future Traffic Evaluation

Table 2.AM: OR TAMBO/ TAELO MOLOSIOA FORECAST AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
102	NLTR	166	684	24	1	A	0.04	3.88			
205	ET	214	1950	11	0	A	0.01	0.68			
108	SLTR	210	934	22	1	A	0.03	3.26			
111	WLTR	153	1950	12	0	A	0.01	0.56			
113 B	ET	90	0	0	0	A	0	0.46			
114 B	WT	90	0	0	0	A	0	0.33			
T1 1	**Taelo Molosioa & Leepile St**			**14**	**0**	**A**	**0.4%**	**9.17**	**Taelo Molosioa & Leepile St**		
202	NLR	343	692	63	4	A	0.52	41.14			
204	ER	95	919	20	0	A	0.03	1.3			
205	ET	214	1950	11	0	A	0.01	0.68			
211	WLT	369	1950	19	0	A	0.02	2.21			
213 B	ER	90	0	0	0	A	0	1.23			
214 B	NL	90	0	0	4	A	0	10.8			
T1 2	**Taelo Molosioa & David Montoedi**			**27**	**2**	**A**	**2.7%**	**57.36**	**Taelo Molosioa & David Montoedi**		
302	NLTR	12	610	2	0	A	0	0.02			
305	ELTR	514	1950	26	0	A	0.05	4.71			
308	SLTR	442	656	67	6	A	0.69	68.7			
311	WLTR	121	1950	6	0	A	0	0.2			
T1 3	**Taelo Molosioa & Simon Miya St**			**40**	**2**	**A**	**3.5%**	**73.63**	**Taelo Molosioa & Simon Miya St**		
402	NTR	114	1950	6	0	A	0	0.18			
403	NL	103	1750	6	0	A	0	0.19			
405	ETR	388	972	69	4	A	0.75	43.31			
406	EL	280	0	0	4	A	0	31.24			
408	SLTR	150	3900	4	0	A	0	0.08			
411	WLTR	12	942	1	0	A	0	0.01			
T1 4	**Taelo Molosioa & OR Tambo**			**27**	**3**	**A**	**3.6%**	**75.01**	**Taelo Molosioa & OR Tambo**		
501	NR	283	925	31	3	A	4.27	61.12			
502	NT	229	3900	6	0	A	0	0.18			
503	NL	5	925	1	0	A	0	0			
504	ER	23	994	2	0	A	0	0.03			
505	ET	77	874	9	0	A	0	0.43			
506	EL	1	950	0	0	A	0	0			
507	SR	1	950	0	0	A	0	0			
508	ST	342	3900	9	0	A	0	0.42			
509	SL	130	1750	7	0	A	0	0.3			
510	WR	29	874	3	0	A	0	0.06			
511	WT	26	874	3	0	A	0	0.05			
512	WL	299	925	32	1	A	0.08	7.72			
T1 5	**Or Tambo & Access to Cemetery**			**17**	**1**	**A**	**3.4%**	**70.31**	**Or Tambo & Access to Cemetery**		
602	NT	350	3900	18	17	B	6.3	290.15	6	37	31
603	NL	280	1287	29	3	A	3.66	48.94			
604	ER	600	1800	73	14	B	15.07	360.84	43	0	47
606	EL	185	0	0	14	B	0	103.84			
607	SR	91	660	28	20	B	1.58	70.95	6	37	31
608	ST	588	3900	31	14	B	8.89	391.72	6	37	31
613 B	ST	90	0	0	14	B	0	48.29			
614 B	NT	90	0	0	1	A	0	3.58			
T1 6	**Or Tambo & DM Selemela**			**35**	**13**	**B**	**62.9%**	**1318.31**	**Or Tambo & DM Selemela**		
701	NR	43	411	20	23	C	0.78	38.46	6	41	35
702	NT	470	3900	27	12	B	7.67	295.66	6	41	35
703	NL	445	841	53	11	B	8,24 +	249.15			
704	ER	446	858	84	33	C	11.29	560.18	47	0	43
705	ET	290	1950	24	8	A	3.18	106.03	47	0	43
706	EL	164	1003	16	1	A	0.56	9.01			
707	SR	119	905	25	8	A	2	49.21	6	41	35
708	ST	997	3900	52	20	B	19.38	867.69	6	41	35
709	SL	40	1048	4	0	A	0.08	1.13			
710	WR	49	621	13	10	B	0.59	21.64	47	0	43
711	WT	638	3900	26	8	A	7.14	233.69	47	0	43
712	WL	264	828	32	15	B	4.11	163.44			
713 B	ST	90	0	0	14	B	0	47.56			
714 B	NT	90	0	0	12	B	0	40.65			
T1 7	**Or Tambo & M10**			**40**	**15**	**B**	**128.0%**	**2683.5**	**Or Tambo & M10**		
802	NT	932	3900	26	0	A	0.05	4.24			
803	NL	66	1750	4	0	A	0	0.07			
804	ER	60	403	20	2	A	0.41	6.93			
806	ER	22	0	0	2	A	0	2.34			
807	SR	102	775	13	0	A	0.01	1			
808	ST	1610	3900	44	0	A	0.17	15.95			
813 B	ST	90	0	0	0	A	0	0.89			
814 B	NT	90	0	0	0	A	0	0.41			
T1 8	**Or Tambo & Tannery St**			**33**	**0**	**A**	**1.5%**	**31.83**	**Or Tambo & Tannery St**		
901	NR	19	607	3	0	A	0	0.05			
902	NT	954	3900	27	0	A	0.05	4.47			
903	NL	4	995	0	0	A	0	0			
905	ERT	1	378	0	0	A	0	0			
906	EL	47	770	6	0	A	0	0.2			
907	SR	98	0	0	0	A	0	1.06			
908	ST	1542	3900	46	0	A	0.19	16.66			
909	SL	54	0	0	0	A	0	0.58			
910	WR	14	0	0	0	A	0	0.14			
911	WT	1	378	6	0	A	0	0.01			
912	WL	8	0	0	0	A	0	0.07			
913 B	ST	90	0	0	0	A	0	0.97			
914 B	NT	90	0	0	0	A	0	0.42			
T1 9	**Or Tambo & Hartley St**			**33**	**0**	**A**	**1.2%**	**24.63**	**Or Tambo & Hartley St**		

Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**6756.87**	**121.81**	**55.47**	**2723.78**	0	0		**2095.77**	577.8
NB Mixed		4464.6	74.71	59.76	8.66	0	0		1342.31	308
NB Busses		**280.44**	**9.56**	**29.35**	**0.72**				**99.41**	**20**
SB Mixed		1699.26	27.08	62.75	3.3				597.87	122
SB Busses		**312.57**	**10.46**	**29.88**	**0.44**				**56.18**	**21**

Note: - L = Left, T = Through, R = Righturn

Table 2.PM: OR TAMBO/ TAELO MOLOSIOA FORECAST PM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
102	NLTR	179	673	27	1	A	0.05	4.82			
205	ET	108	1950	14	0	A	0.01	0.45			
108	SLTR	168	673	25	1	A	0.04	4.15			
111	WLTR	275	1950	19	0	A	0.02	1.62			
113 B	ET	90	0	0	0	A	0	0.47			
114 B	WT	90	0	0	0	A	0	0.53			
T1 1	**Taelo Molosioa & Leepile St**			**17**	**0**	**A**	**0.6%**	**12.04**	**Taelo Molosioa & Leepile St**		
202	NLR	290	674	56	3	A	0.36	27.57			
204	ER	72	0	0	0	A	0	0.3			
205	ET	108	1950	14	0	A	0.01	0.45			
211	WLT	383	1950	20	0	A	0.02	2.4			
213 B	ER	90	0	0	0	A	0	0.37			
214 B	NL	90	0	0	3	A	0	8.56			
T1 2	**Taelo Molosioa & David Montoedi**			**25**	**1**	**A**	**1.9%**	**39.65**	**Taelo Molosioa & David Montoedi**		
302	NLTR	12	861	1	0	A	0	0.01			
305	ELTR	312	1950	16	0	A	0.02	1.52			
308	SLTR	245	680	36	1	A	0.1	10.11			
311	WLTR	319	1950	16	0	A	0.02	1.6			
T1 3	**Taelo Molosioa & Simon Miya St**			**21**	**1**	**A**	**0.6%**	**13.24**	**Taelo Molosioa & Simon Miya St**		
402	NTR	179	1950	9	0	A	0	0.46			
403	NL	238	1750	14	0	A	0.01	1.07			
405	ETR	161	921	21	1	A	0.03	2.32			
406	EL	32	0	0	1	A	0	0.47			
408	SLTR	181	3900	5	0	A	0	0.11			
411	WLTR	12	921	1	0	A	0	0.01			
T1 4	**Taelo Molosioa & OR Tambo**			**12**	**0**	**A**	**0.2%**	**4.44**	**Taelo Molosioa & OR Tambo**		
501	NR	243	958	25	3	A	4.52	56.75			
502	NT	311	3900	8	0	A	0	0.35			
503	NL	22	958	2	0	A	0	0.03			
504	ER	5	982	1	0	A	0	0			
505	ET	10	890	1	0	A	0	0.01			
506	EL	1	932	0	0	A	0	0			
507	SR	1	932	0	0	A	0	0			
508	ST	191	3900	5	0	A	0	0.13			
509	SL	43	1750	2	0	A	0	0.03			
510	WR	80	998	8	0	A	0	0.35			
511	WT	80	890	9	0	A	0	0.44			
512	WL	184	958	19	0	A	0.02	2.28			
T1 5	**Or Tambo & Access to Cemetery**			**12**	**1**	**A**	**2.9%**	**60.37**	**Or Tambo & Access to Cemetery**		
602	NT	517	3900	27	19	B	10.45	493.64	6	37	31
603	NL	664	1272	59	17	B	17,30 +	506.08			
604	ER	240	1800	32	7	A	4.18	80.31	43	0	47
606	EL	59	0	0	7	A	0	18.27			
607	SR	106	565	38	25	C	2.05	100.68	6	37	31
608	ST	299	3900	16	13	B	4.09	179.48	6	37	31
613 B	ST	90	0	0	7	A	0	26.48			
614 B	NT	90	0	0	10	A	(+)	24.87			
T1 6	**Or Tambo & DM Selemela**			**34**	**15**	**B**	**68.2%**	**1429.81**	**Or Tambo & DM Selemela**		
701	NR	146	449	67	40	D	3.72	212.22	6	37	31
702	NT	928	3900	53	17	B	17.84	798.51	6	37	31
703	NL	519	1360	38	1	A	0.98	22.17			
704	ER	353	1164	45	11	B	4.8	168.15	43	0	47
705	ET	373	1950	29	7	A	3.89	119.09	43	0	47
706	EL	126	1069	12	2	A	0.74	16.85			
707	SR	113	357	65	41	D	2.91	169.79	6	37	31
708	ST	461	3900	29	19	B	9.96	416.14	6	37	31
709	SL	54	1323	4	1	A	0.21	2.87			
710	WR	102	1109	14	9	A	1.14	39.7	43	0	47
711	WT	386	3900	15	6	A	3.55	106.34	43	0	47
712	WL	70	1367	5	1	A	0.2	2.96			
713 B	ST	90	0	0	13	B	0	46.22			
714 B	NT	90	0	0	17	B	0	57.06			
T1 7	**Or Tambo & M10**			**36**	**13**	**B**	**103.8%**	**2178.07**	**Or Tambo & M10**		
802	NT	1438	3900	39	0	A	0.13	11.87			
803	NL	60	1750	3	0	A	0	0.06			
804	ER	74	454	39	3	A	0.66	7.7			
806	ER	101	0	0	3	A	0	10.01			
807	SR	32	664	5	0	A	0	0.13			
808	ST	864	3900	24	0	A	0.04	3.58			
813 B	ST	90	0	0	0	A	0	0.37			
814 B	NT	90	0	0	0	A	0	0.74			
T1 8	**Or Tambo & Tannery St**			**29**	**0**	**A**	**1.6%**	**34.46**	**Or Tambo & Tannery St**		
901	NR	19	768	2	0	A	0	0.03			
902	NT	1391	3900	38	0	A	0.12	10.91			
903	NL	1	975	0	0	A	0	0			
905	ERT	10	442	2	0	A	0	0.03			
906	EL	102	674	15	0	A	0.01	1.35			
907	SR	26	0	0	0	A	0	0.13			
908	ST	919	3900	27	0	A	0.05	4.38			
909	SL	22	0	0	0	A	0	0.1			
910	WR	54	0	0	1	A	0	2.1			
911	WT	1	442	26	1	A	0.04	0.04			
912	WL	58	0	0	1	A	0	2.25			
913 B	ST	90	0	0	0	A	0	0.43			
914 B	NT	90	0	0	0	A	0	0.71			
T1 9	**Or Tambo & Hartley St**			**28**	**0**	**A**	**1.1%**	**22.46**	**Or Tambo & Hartley St**		

Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**5612.71**	**103.88**	**54.03**	**2231.34**	0	0		**2098.02**	492.66
NB Mixed		2361.41	38.26	61.72	3.69	0	0		609.25	162
NB Busses		**280.44**	**8.99**	**31.19**	**0.52**				**74.34**	**19.57**
SB Mixed		2773.94	45.9	60.44	7.35				1321.97	208
SB Busses		**196.92**	**10.73**	**18.35**	**0.77**				**92.46**	**14.76**

Note: - L = Left, T = Through, R = Righturn

Table 2.AM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

										Cycle	90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
202	NT	435	3900	13	0	A	0.01	0.87			
203	NL	2	724	0	0	A	0	0			
204	ER	95	198	48	8	A	0.22	21.72			
206	EL	60	635	9	0	A	0	0.49			
207	SR	120	485	25	1	A	0.04	4.07			
208	ST	1211	3900	33	0	A	0.08	7.77			
213 B	ST	90	0	0	0	A	0	0.18			
214 B	NT	90	0	0	0	A	0	0.58			
T2 2	**Fort Hare & Mkuhlane**			**26**	**1**	**A**	**0.1%**	**35.68**	**Fort Hare & Mkuhlane**		
501	NR	82	811	16	14	B	0.78	36.35	80	10	20
502	NTL	557	3900	42	19	B	9.12	342.9	10	40	30
505	ELTR	192	1950	22	15	B	2.91	99.49	45	75	30
507	SR	10	1065	1	7	A	0.09	2.53	80	10	20
508	ST	1271	3900	87	33	C	33.88	1339.26	10	40	30
510	WR	42	1256	7	17	B	0.66	23.99	45	75	30
511	WLT	128	1950	14	15	B	1.86	63.28	45	75	30
513 B	ST	90	0	0	29	C	0	83.6			
514 B	NT	90	0	0	33	C	0	94.82			
T2 5	**Fort Hare & Gonyane**			**58**	**26**	**C**	**6.0%**	**2086.22**	**Fort Hare & Gonyane**		
801	NR	54	344	32	46	D	1.23	76.24	79	32	43
802	NT	408	3900	26	10	B	6.28	144.3	79	32	43
803	NL	593 <	928	64	11	B	13,20 +	244.86			
804	ER	600	1687	67	30	C	12.51	584.84	32	53	21
805	ET	240	1950	41	27	C	4.88	211.6	53	79	26
806	EL	120	1750	23	25	C	2.27	96.16	53	79	26
807	SR	66	906	15	20	B	0.74	40.52	79	32	43
808	ST	1320	3900	74	24	C	34.87	1092.67	79	32	43
809	SL	24	1750	3	16	B	0.26	12.35	79	32	43
810	WR	114	1312	16	11	B	1.41	46.27	32	53	21
811	WT	720	2925	82	38	D	18.41	878.47	53	79	26
812	WL	48	974	5	6	A	0.47	11.34			
813 B	NT	90	0	0	24	C	0	70.82			
814 B	ST	90	0	0	17	B	0	54.94			
T2 8	**Fort Hare & Hamilton Rd**			**58**	**26**	**C**	**10.2%**	**3565.38**	**Fort Hare & Hamilton Rd**		
901	NR	31	1135	4	16	B	0.51	20.83	71	16	35
902	NT	437	3900	34	17	B	6.84	273.03	16	39	23
903	NL	14	1750	2	16	B	0.2	7.42	16	39	23
904	ER	16	833	6	47	D	0.38	25.49	45	50	5
905	ET	447	3900	47	32	C	10.82	550.44	50	65	15
906	EL	439	1270	42	2	A	2.16	45.04			
907	SR	1027	2080	74	18	B	22.31	848.19	71	16	35
908	ST	947	3208	89	40	D	23.95	1364.57	16	39	23
909	SL	385	1435	27	1	A	0.51	14.67			
910	WR	445	1790	83	31	C	10.66	561.28	45	50	5
911	WT	602	3900	63	25	C	14.92	621.92	50	65	15
912	WL	103	1167	9	11	B	1.8	54.34			
913 B	ER	90	0	0	1	A	0	2.89			
914 B	NL	90	0	0	19	B	0	61.59			
T2 9	**Fort Hare & Harvey**			**59**	**22**	**C**	**12.8%**	**4451.7**	**Fort Hare & Harvey**		

Table 2.AM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

Cycle **90**

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
1001	NR	175	1145	31	14	B	2.31	92.09	6	15	9
1002	NT	174	1950	22	18	B	2.62	114.17	15	44	29
1003	NL	366 <	1069	34	9	A	3,12 +	138.96			
1004	ER	211	1800	29	24	C	4.12	196.4	50	62	12
1005	ET	753	3900	56	26	C	19.06	783.55	62	0	28
1006	EL	107	1321	8	0	A	0.08	1.18			
1007	SR	20	1394	3	12	B	0.25	10.08	6	15	9
1008	STL	88	1950	11	17	B	1.38	60.7	15	44	29
1010	WR	151	959	30	13	B	2.36	96.28	50	62	12
1011	WT	1244	3900	88	20	B	31.64	938.46	62	0	28
1012	WL	267	1626	16	0	A	0.16	2.01			
1013 B	**NT**	90	0	0	24	C	0	70.11			
1014 B	**ST**	90	0	0	47	D	0	133.5			
T2 10	**Harvey & Rhodes**			**53**	**19**	B	**7.6%**	**2637.49**	**Harvey & Rhodes**		
1102	NLR	8	323	2	1	A	0.03	0.7			
1104	ER	17	493	3	0	A	0	0.06			
1105	ET	838	3900	21	0	A	0.03	2.94			
1111	WLT	1166	3900	30	0	A	0.06	6.38			
T2 11	**Harvey & Gemsbok St**			**26**	**0**	A	**0.0%**	**10.08**	**Harvey & Gemsbok St**		
1202	NLR	24	316	8	1	A	0.1	1.99			
1204	ER	6	357	2	1	A	0.02	0.34			
1205	ET	816	3900	21	0	A	0.03	2.77			
1211	WLT	1185	3900	30	0	A	0.07	6.63			
T2 12	**Harvey & Steenbok St**			**26**	**0**	A	**0.0%**	**11.73**	**Harvey & Steenbok St**		
1301	NR	25	282	9	3	A	0.13	3.88			
1303	NL	35	497	7	1	A	0.09	1.87			
1304	ER	5	368	1	3	A	0.03	0.74			
1305	ET	767	3900	20	0	A	0.02	2.41			
1311	WLT	1191	3900	31	0	A	0.07	6.72			
T2 13	**Harvey & Franken St**			**26**	**0**	A	**0.0%**	**15.62**	**Harvey & Franken St**		
1902	NT	842	3900	46	12	B	10.67	415.97	6	40	34
1903	NL	847 <	1750	93	38	D	24,73 +	1197.52	6	40	34
1905	ET	518	3900	25	12	B	7.09	268.7	68	0	22
1906	EL	205	852	24	14	B	3	117.92			
1907	SR	341	1800	36	6	A	2.3	83.57	46	62	16
1909	SL	1244	1750	76	12	B	30.53	746.49			
1913 B	**SL**	90	0	0	8	A	0	22.99			
1914 B	**NT**	90	0	0	8	A	0	35.06			
T2 19	**Fort St & Hanger**			**49**	**11**	B	**8.3%**	**2888.22**	**Fort St & Hanger**		
2004	ER	155	507	36	14	B	2.15	100.69	27	0	63
2005	ET	179	507	63	20	C	3.4	158.84	27	0	63
2008	SLT	1544	5850	90	41	D	41.66	2271.14	6	21	15
2011	WLT	421	3900	16	2	A	2.71	58.43	27	0	63
2013 B	**EL**	90	0	0	0	A	0	0.38			
2014 B	**ST**	90	0	0	23	C	0	76			
2015 B	**WT**	90	0	0	16	B	0	60.09			
T2 20	**Hanger & St Georges St**			**63**	**28**	C	**7.8%**	**2725.57**	**Hanger & St Georges St**		
2108	SLTR	1552	5850	30	0	A	0.06	5.58			
2111	WLT	104	644	16	4	A	0.82	22.5			
2114 B	**ST**	180	0	0	0	A	0	0.65			
T2 21	**Hanger & Douglas**			**26**	**0**	A	**0.1%**	**28.73**	**Hanger & Douglas**		
2202	NT	251	890	48	2	A	0.23	13.22			
2206	EL	251	852	29	14	B	3.76	150.58			
2210	WR	251	850	30	1	A	0.06	6.18			
2214 B	**ST**	180	0	0	2	A	0	9.48			
T2 22	**Harvey & Peet Ave**			**29**	**5**	A	**0.5%**	**179.46**	**Harvey & Peet Ave**		
2302	NLT	1331	3900	39	0	A	2.34	12.22			
2306	EL	48	668	7	0	A	0	0.28			
2313 B	**NT**	180	0	0	0	A	0	1.62			
T2 23	**Harvey & Douglas**			**34**	**0**	A	**0.0%**	**14.12**	**Harvey & Douglas**		

Table 2.AM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
2402	NLTR	1675	5850	54	17	B	33.08	1178.85	6	46	40
2405	ELT	283	1950	26	10	B	3.58	129.25	52	0	38
2411	WRT	363	3900	16	9	A	4.03	149.75	52	0	38
2413 B	NTR	180	0	0	13	B	0	92.5			
T2 24	**Harvey & St Georges St**			**41**	**15**	**B**	**4.5%**	**1550.35**	**Harvey & St Georges St**		
2502	NRT	1592	5850	29	0	A	0.06	5.49			
2505	ET	12	631	2	1	A	0.05	1.08			
2506	EL	38	631	6	2	A	0.19	4.02			
2510	WR	20	631	3	2	A	0.09	1.91			
2513 B	NT	90	0	0	0	A	0	0.31			
T2 25	**Harvey & Bastion**			**27**	**0**	**A**	**0.0%**	**12.81**	**Harvey & Bastion**		
1701	NR	18	739	2	0	A	0	0.03			
1702	NT	952	3900	27	0	A	0.05	4.57			
1703	NL	19	0	0	0	A	0	0.09			
1705	ELTR	47	506	9	0	A	0	0.48			
1707	SR	330	766	43	2	A	0.16	16.23			
1708	ST	973	3900	30	0	A	0.07	5.44			
1709	SL	121	0	0	0	A	0	0.68			
1711	WLTR	77	506	15	1	A	0.01	1.37			
1713 B	ST	90	0	0	0	A	0	0.5			
1714 B	NT	90	0	0	0	A	0	0.43			
T2 17	**Or Tambo & Goede Hoop**			**26**	**0**	**A**	**0.1%**	**29.82**	**Or Tambo & Goede Hoop**		
1601	NR	175	786	22	1	A	0.03	3.19			
1602	NT	975	3900	27	0	A	0.05	4.69			
1608	ST	883	3900	25	0	A	0.04	3.76			
1609	SL	114	1750	7	0	A	0	0.23			
1610	WR	28	552	5	0	A	0	0.14			
1612	WL	228	786	29	1	A	0.06	5.92			
1613 B	ST	90	0	0	0	A	0	0.38			
1614 B	NT	90	0	0	0	A	0	0.43			
T2 16	**Or Tambo & De Waal Rd**			**23**	**0**	**A**	**0.1%**	**18.74**	**Or Tambo & De Waal Rd**		
1502	NT	1034	3900	86	42	D	29.79	1565.61	15	44	29
1503	NL	155	1750	27	21	C	2.69	123.05	15	44	29
1504	ER	293	1800	31	13	B	4.22	162.62	44	0	46
1506	EL	194	1800	21	12	B	2.61	99.12	44	0	46
1507	SR	118	698	34	19	B	1.65	95.71	0	15	15
1508	ST	924	3900	52	16	B	17.18	623.74	0	15	15
1513 B	ST	90	0	0	16	B	0	42.47			
1514 B	NT	90	0	0	45	D	0	135.94			
T2 15	**Or Tambo & Voortsig**			**55**	**26**	**C**	**8.2%**	**2848.26**	**Or Tambo & Voortsig**		
1401	NR	109	385	51	37	D	2.42	148.8	0	10	10
1402	NT	768	3900	49	20	C	17.6	573.63	10	49	39
1403	NL	2	1358	0	2	A	0.01	0.23			
1404	ER	6	933	1	18	B	0.09	4.44	49	69	20
1405	ET	422	3900	44	42	D	9.86	625.93	69	0	21
1406	EL	368	1240	30	3	A	2.07	61.44			
1407	SR	371	1001	67	18	B	6.04	293.25	0	10	10
1408	ST	1200	3260	89	43	D	31.34	1830.73	10	49	39
1409	SL	298	1338	22	1	A	0.21	6.48			
1410	WR	492	2153	49	17	B	7.75	360.03	49	69	20
1411	WT	811	3900	85	43	D	21.47	1253.65	69	0	21
1412	WL	546	1423	38	1	A	0.12	11.94			
1413 B	ST	90	0	0	51	D	0	150.91			
1414 B	NT	90	0	0	15	B	0	40.58			
T2 14	**Or Tambo & Harvey**			**58**	**26**	**C**	**15.4%**	**5362.04**	**Or Tambo & Harvey**		
2601	NR	23	603	4	0	A	0	0.07			
2602	NT	755	3900	22	0	A	0.03	2.74			
2603	NL	17	0	0	0	A	0	0.06			
2605	ERT	35	452	8	1	A	0.14	2.92			
2606	EL	1	0	0	1	A	0	0.06			
2607	SR	16	811	2	0	A	0	0.02			
2608	SLT	1715	3900	46	0	A	0.2	18.93			
2611	WRT	114	452	36	6	A	1.67	33.09			
2612	WL	48	0	0	6	A	0	12.89			
2613 B	ST	90	0	0	0	A	0	0.99			
2614 B	NT	90	0	0	0	A	0	0.33			
T2 26	**Or Tambo & Francken St**			**34**	**1**	**A**	**0.2%**	**72.1**	**Or Tambo & Francken St**		

Table 2.AM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
2702	NT	794	3900	23	0	A	0.03	2.99			
2703	NL	5	1750	0	0	A	0	0			
2704	ER	13	485	3	1	A	0.06	1.24			
2706	EL	8	485	2	1	A	0.04	0.67			
2707	SR	8	805	1	0	A	0	0.01			
2708	ST	1462	3900	40	0	A	0.13	12.38			
2713 B	ST	90	0	0	0	A	0	0.76			
2714 B	NT	90	0	0	0	A	0	0.34			
T2 27	**Or Tambo & Watkey**			**31**	**0**	A	**0.1%**	**18.39**	**Or Tambo & Watkey**		
2802	NTL	777	3900	22	0	A	0.03	2.85			
2806	EL	5	809	1	0	A	0	0			
2808	ST	1397	3900	38	0	A	0.12	11.03			
2813 B	ST	90	0	0	0	A	0	0.71			
2814 B	NT	90	0	0	0	A	0	0.33			
T2 28	**Or Tambo & Bisseaux**			**30**	**0**	A	**0.0%**	**14.92**	**Or Tambo & Bisseaux**		
2902	NLT	772	3900	22	0	A	0.03	2.81			
2905	ER	11	481	2	0	A	0	0.03			
2908	SRT	1408	3900	38	0	A	0.12	11.25			
2913 B	ST	90	0	0	0	A	0	0.72			
2914 B	NT	90	0	0	0	A	0	0.33			
T2 29	**Or Tambo & Papenfus St**			**30**	**0**	A	**0.0%**	**15.14**	**Or Tambo & Papenfus St**		
3002	NLTR	717	3900	55	20	C	12.94	547.86	0	27	27
3004	ER	203	960	63	20	B	4.58	168.35	33	56	23
3006	ELT	379	3900	29	10	B	2.27	138.62	33	56	23
3007	SR	89	1030	11	4	A	0.79	21.11	56	0	34
3008	SLT	1301	3900	47	3	A	14.57	242.62	56	0	34
3010	WR	143	627	68	44	D	3.85	227.16	33	56	23
3011	WLT	257	1950	40	25	C	5.05	244.96	33	56	23
3013 B	ST	90	0	0	5	A	0	19.1			
3014 B	NT	90	0	0	38	D	0	112.86			
T2 30	**Or Tambo & Falck St**			**44**	**13**	B	**5.0%**	**1722.64**	**Or Tambo & Falck St**		
3102	NLT	704	1950	41	1	A	0.14	12.38			
3105	ELR	86	551	16	1	A	0.01	1.44			
3108	SRT	1157	1950	64	4	A	20.34	278.77			
3113 B	ST	90	0	0	2	A	0	10.77			
3114 B	NT	90	0	0	1	A	0	1.58			
T2 31	**Or Tambo & Cross Rd**			**49**	**2**	A	**0.9%**	**304.94**	**Or Tambo & Cross Rd**		
3201	NR	31	272	18	35	D	0.71	40.47	6	50	44
3202	NT	593	1950	55	9	A	7.64	231.97	6	50	44
3203	NL	172	978	18	4	A	1.75	38.91			
3204	ER	87	569	29	46	D	2.19	142.23	56	0	34
3205	ELT	582 <	1950	57	25	C	13,94 +	587.15	56	0	34
3207	SR	25	612	6	15	B	0.43	15.94	6	50	44
3208	ST	911 <	1950	81	24	C	23,69 +	905.06	6	50	44
3209	SL	275	978	28	5	A	2.38	73.34			
3210	WR	121	691	34	31	C	2.57	137.48	56	0	34
3211	WT	622	1950	61	18	B	11.36	457.23	56	0	34
3212	WL	64	814	8	10	B	0.77	28.1			
3213 B	ST	90 <	0	0	19	B	(+)	64.27			
3214 B	NT	90	0	0	3	A	0	11.74			
T2 32	**Or Tambo & Rhodes Ave**			**43**	**14**	B	**7.9%**	**2733.89**	**Or Tambo & Rhodes Ave**		
3302	NLTR	794	3900	23	0	A	0.03	2.98			
3305	ELTR	18	564	3	0	A	0	0.05			
3308	SLTR	1007	3900	28	0	A	0.06	5.05			
3311	WLTR	107	564	19	1	A	0.02	2.22			
3313 B	ST	90	0	0	0	A	0	0.45			
3314 B	NT	90	0	0	0	A	0	0.34			
T2 33	**Or Tambo & Goddar St**			**23**	**0**	A	**0.0%**	**11.09**	**Or Tambo & Goddar St**		
3401	NR	12	666	3	11	B	0.15	5.59	6	48	42
3402	NLT	522	1950	44	10	B	6.99	243.03	6	48	42
3407	SR	37	843	25	8	A	0.71	12.46	6	48	42
3408	ST	606	1950	51	8	A	4.92	202.27	6	48	42
3409	SL	351	1750	33	5	A	2.12	79.23	6	48	42
3410	WR	128	1800	13	10	B	1.57	57.36	54	0	36
3411	WLT	484	1950	46	14	B	7.45	284.22	54	0	36
3413 B	ST	90	0	0	5	A	0	16.32			
3414 B	NT	90	0	0	33	C	0	84.15			
T2 34	**Or Tambo & St Georges St**			**39**	**10**	B	**2.8%**	**984.63**	**Or Tambo & St Georges St**		
3502	NLR	420	1950	37	11	B	5.59	196.04	6	46	40
3505	ET	606	1950	63	24	C	13.66	564.87	52	0	38
3511	WT	317	1950	37	9	A	3.94	116.95	52	0	38
3513 B	ET	90	0	0	11	B	0	38.1			
3514 B	WT	90	0	0	23	C	0	78.39			
T2 35	**St Georges St & Fraser Ln**			**43**	**16**	B	**2.9%**	**994.35**	**St Georges St & Fraser Ln**		

Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**14382.22**	**396.26**	**36.29**	**25567.94**	0	0		**34789.26**	2025.87
NBOT Mixed		4823.11	101.52	47.51	27.55				3970.58	385
NBOTBUSSES		**406.96**	**13.59**	**29.94**	**2.37**				**305.08**	**32**
PHASE1 NB		3912.06	136.57	28.64	54.03				7243.8	392
PHASE1 SB		1559.73	55	28.36	20.66				2938.8	163
SBOT Mixed		3312.89	74.85	44.26	23.55				3201.35	269
SBOTBUSSES		**367.47**	**14.73**	**24.95**	**3.78**				**449.75**	**32**
Other										

Note: - L = Left, T = Through, R = Righturn

Table 4.PM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
202	NT	771	3900	22	0	A	0.03	2.8			
203	NL	94	742	13	1	A	1.12	5.16			
204	ER	44	307	14	1	A	0.01	1.2			
206	EL	97	561	17	1	A	0.02	1.81			
207	SR	35	411	9	0	A	0	0.4			
208	ST	383	3900	12	0	A	0.01	0.68			
213 B	ST	90	0	0	0	A	0	0.33			
214 B	NT	90	0	0	0	A	0	0.16			
T2 2	**Fort Hare & Mkuhlane**			**16**	**0**	A	**0.0%**	**12.54**	**Fort Hare & Mkuhlane**		
501	NR	104	1219	14	3	A	0.32	11.03	80	10	20
502	NTL	857	3900	61	21	C	14.02	570.68	10	40	30
505	ELTR	62	1950	7	14	B	0.86	29.27	45	75	30
507	SR	13	897	2	12	B	0.16	5.47	80	10	20
508	ST	469	3900	36	20	B	9.88	304.41	10	40	30
510	WR	40	1517	6	15	B	0.58	19.95	45	75	30
511	WLT	91	1950	10	14	B	1.3	43.84	45	75	30
513 B	ST	90	0	0	33	C	0	95.88			
514 B	NT	90	0	0	20	B	0	58.41			
T2 5	**Fort Hare & Gonyane**			**40**	**19**	B	**3.3%**	**1138.94**	**Fort Hare & Gonyane**		
801	NR	72	1085	14	23	C	1.26	54.34	79	32	43
802	NT	846	3900	49	15	B	17.26	444.63	79	32	43
803	NL	390	1638	24	0	A	0.04	3.72			
804	ER	528	2226	44	13	B	7.36	239.24	32	53	21
805	ET	180	1950	31	26	C	3.52	149.74	53	79	26
806	EL	120	1750	23	25	C	2.27	96.16	53	79	26
807	SR	60	527	23	22	C	0.67	40.98	79	32	43
808	ST	432	3900	27	19	B	10.76	292.42	79	32	43
809	SL	12	1750	1	13	B	0.12	5.02	79	32	43
810	WR	60	1411	8	11	B	0.72	22.49	32	53	21
811	WT	216	2925	25	24	C	4.12	171.66	53	79	26
812	WL	48	1425	3	1	A	0.13	1.57			
813 B	NT	90	0	0	29	C	0	83.52			
814 B	ST	90	0	0	8	A	0	27.01			
T2 8	**Fort Hare & Hamilton Rd**			**33**	**15**	B	**4.7%**	**1632.5**	**Fort Hare & Hamilton Rd**		
901	NR	62	1340	6	7	A	0.55	24.24	71	16	35
902	NT	588	3900	45	24	C	10.22	487.78	16	39	23
903	NL	19	1750	3	22	C	0.35	13.25	16	39	23
904	ER	35	1087	11	42	D	0.82	51.74	45	50	5
905	ET	443	3900	46	38	D	10.65	618.7	50	65	15
906	EL	608	1345	52	3	A	11,88 +	144.72			
907	SR	284	2253	23	8	A	3.98	119.86	71	16	35
908	ST	372	2400	46	17	B	5.22	237.88	16	39	23
909	SL	505	1519	33	2	A	6.44	70.56			
910	WR	330	1783	62	23	C	6.87	317.53	45	50	5
911	WT	401	3900	42	23	C	9	381.59	50	65	15
912	WL	67	1402	5	1	A	0.41	6.15			
913 B	ER	90	0	0	3	A	(+)	15.62			
914 B	NL	90	0	0	12	B	0	41.27			
T2 9	**Fort Hare & Harvey**			**40**	**16**	B	**7.3%**	**2530.89**	**Fort Hare & Harvey**		

Table 4.PM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs)		Green Time (sec)
									Start	End	
1001	NR	328	1449	45	16	B	4.38	195.58	6	15	9
1002	NT	23	1950	3	24	C	0.4	18.78	15	44	29
1003	NL	236	1188	20	3	A	1.21	36.1			
1004	ER	280	1800	39	12	B	3.84	145.2	50	62	12
1005	ET	821	3900	60	33	C	21.57	1030.59	62	0	28
1006	EL	16	1686	1	0	A	0	0			
1007	SR	137	1659	17	13	B	1.84	72.74	6	15	9
1008	STL	146	1950	19	18	B	2.37	104.99	15	44	29
1010	WR	19	931	4	10	A	0.22	9.45	50	62	12
1011	WT	689	3900	51	6	A	5.2	156.97	62	0	28
1012	WL	89	1574	6	0	A	0.04	0.58			
1013 B	NT	90	0	0	26	C	0	75.97			
1014 B	ST	90	0	0	48	D	0	132.99			
T2 10	**Harvey & Rhodes**			**41**	**18**	B	**5.7%**	**1979.94**	**Harvey & Rhodes**		
1102	NLR	40	601	7	0	A	0	0.24			
1104	ER	6	428	1	0	A	0	0.01			
1105	ET	1032	3900	26	0	A	0.05	4.76			
1111	WLT	781	3900	20	0	A	0.03	2.51			
T2 11	**Harvey & Gemsbok St**			**23**	**0**	A	**0.0%**	**7.52**	**Harvey & Gemsbok St**		
1202	NLR	40	362	11	1	A	0.15	2.42			
1204	ER	5	436	1	0	A	0	0.01			
1205	ET	1016	3900	26	0	A	0.05	4.59			
1211	WLT	746	3900	19	0	A	0.02	2.26			
T2 12	**Harvey & Steenbok St**			**23**	**0**	A	**0.0%**	**9.28**	**Harvey & Steenbok St**		
1301	NR	210	273	77	30	C	4.3	225.26			
1303	NL	24	846	3	0	A	0	0.04			
1304	ER	8	446	2	0	A	0	0.02			
1305	ET	1057	3900	27	0	A	0.05	5.04			
1311	WLT	702	3900	18	0	A	0.02	1.97			
T2 13	**Harvey & Franken St**			**29**	**3**	A	**0.7%**	**232.33**	**Harvey & Franken St**		
1902	NT	746	3000	53	6	A	4.33	170.88	6	40	34
1903	NL	961	2650	69	7	A	6.14	278.9	6	40	34
1905	ET	587	3900	29	12	B	8.21	311.71	68	0	22
1906	EL	374	1020	37	7	A	4.16	133.03			
1907	SR	326	1800	35	7	A	2.35	89.93	46	62	16
1909	SL	781	1750	50	1	A	13.49	76.44			
1913 B	SL	90	0	0	1	A	0	3.6			
1914 B	NT	90	0	0	1	A	0	6.23			
T2 19	**Fort St & Hanger**			**47**	**6**	A	**3.1%**	**1070.72**	**Fort St & Hanger**		
2004	ER	50	1084	15	19	B	3.14	39.79	27	0	63
2005	ET	132	1169	13	22	C	2.73	119.92	27	0	63
2008	SLT	1263	5850	74	24	C	27.36	1145.24	6	21	15
2011	WLT	599	3900	21	2	A	3.57	70.72	27	0	63
2013 B	EL	90	0	0	0	A	0	1.22			
2014 B	ST	90	0	0	7	A	0	27.06			
2015 B	WT	90	0	0	29	C	0	93.45			
T2 20	**Hanger & St Georges St**			**47**	**17**	B	**4.3%**	**1497.4**	**Hanger & St Georges St**		
2108	SLTR	1290	5850	25	0	A	0.04	3.7			
2111	WLT	100	696	14	2	A	0.57	12.02			
2114 B	ST	180	0	0	0	A	0	0.52			
T2 21	**Hanger & Douglas**			**21**	**0**	A	**0.0%**	**16.24**	**Hanger & Douglas**		
2202	NT	251	945	46	2	A	0.19	11.12			
2206	EL	251	905	28	1	A	0.05	5.31			
2210	WR	251	547	46	3	A	0.19	19.32			
2214 B	ST	180	0	0	2	A	0	7.97			
T2 22	**Harvey & Peet Ave**			**32**	**2**	A	**0.1%**	**43.72**	**Harvey & Peet Ave**		
2302	NLT	627	3900	21	0	A	0.03	2.1			
2306	EL	61	822	7	0	A	0	0.3			
2313 B	NT	180	0	0	0	A	0	0.6			
T2 23	**Harvey & Douglas**			**16**	**0**	A	**0.0%**	**3**	**Harvey & Douglas**		

Table 4.PM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
2402	NLTR	1205	5850	73	30	C	30.78	1371.78	6	22	16
2405	ELT	127	1950	8	1	A	0.57	11.42	28	0	62
2411	WRT	601	3900	19	1	A	1.74	39.94	28	0	62
2413 B	NTR	180	0	0	30	C	0	187.54			
T2 24	**Harvey & St Georges St**			**48**	**20**	**C**	**4.6%**	**1610.68**	**Harvey & St Georges St**		
2502	NRT	1591	5850	29	0	A	0.06	5.48			
2505	ET	12	637	2	1	A	0.05	1			
2506	EL	89	637	14	2	A	0.48	10.68			
2510	WR	61	637	10	2	A	0.29	6.57			
2513 B	NT	90	0	0	0	A	0	0.31			
T2 25	**Harvey & Bastion**			**26**	**0**	**A**	**0.1%**	**24.04**	**Harvey & Bastion**		
1701	NR	39	803	5	0	A	0	0.13			
1702	NT	1112	3900	31	0	A	0.07	6.36			
1703	NL	2	0	0	0	A	0	0.01			
1705	ELTR	164	538	30	1	A	0.07	6.68			
1707	SR	67	735	9	0	A	0	0.46			
1708	ST	807	3900	23	0	A	0.03	3.09			
1709	SL	58	1750	3	0	A	0	0.06			
1711	WLTR	44	538	8	0	A	0	0.36			
1713 B	ST	90	0	0	0	A	0	0.34			
1714 B	NT	90	0	0	0	A	0	0.52			
T2 17	**Or Tambo & Goede Hoop**			**24**	**0**	**A**	**0.1%**	**18.01**	**Or Tambo & Goede Hoop**		
1601	NR	474	797	60	10	B	11,68 +	265.36			
1602	NT	1199	3900	33	0	A	0.08	7.59			
1608	ST	831	3900	24	0	A	0.04	3.3			
1609	SL	34	1750	2	0	A	0	0.02			
1610	WR	14	514	3	0	A	0	0.04			
1612	WL	124	797	16	0	A	0.01	1.43			
1613 B	ST	90	0	0	0	A	0	0.36			
1614 B	NT	90	0	0	0	A	0	0.57			
T2 16	**Or Tambo & De Waal Rd**			**32**	**2**	**A**	**0.8%**	**278.67**	**Or Tambo & De Waal Rd**		
1502	NT	1148	3900	65	31	C	25.7	1335.27	21	58	37
1503	NL	10	1750	1	3	A	0.05	1.27	21	58	37
1504	ER	397	1800	51	21	C	7.43	329.85	64	0	26
1506	EL	500	1800	64	24	C	10.29	472.15	64	0	26
1507	SR	82	1502	8	6	A	0.73	23.53	6	21	15
1508	ST	856	3900	37	7	A	10.62	301.62	6	21	15
1513 B	ST	90	0	0	7	A	0	19.77			
1514 B	NT	90	0	0	17	B	0	59.59			
T2 15	**Or Tambo & Voortsig**			**50**	**21**	**C**	**7.3%**	**2543.05**	**Or Tambo & Voortsig**		
1401	NR	286	634	83	51	D	8.75	522.17	0	16	16
1402	NT	829	3900	64	27	C	20.53	801.55	16	48	32
1403	NL	410	1330	31	2	A	2.67	41.68			
1404	ER	354	885	84	41	D	9,96 +	538.19	48	60	12
1405	ET	385	3900	29	31	C	8.57	444.87	60	0	30
1406	EL	229	1511	15	0	A	0.01	1.36			
1407	SR	209	1133	34	11	B	1.49	98.45	0	16	16
1408	ST	842	2932	87	42	D	23.16	1266.25	16	48	32
1409	SL	8	1524	1	0	A	0.02	0.31			
1410	WR	14	1794	2	13	B	0.18	7.79	48	60	12
1411	WT	701	3900	52	25	C	14.11	677.71	60	0	30
1412	WL	540	1133	48	9	A	6,97 +	229.96			
1413 B	ST	90	0	0	49	D	0	146.91			
1414 B	NT	90	0	0	37	D	0	114.67			
T2 14	**Or Tambo & Harvey**			**55**	**27**	**C**	**14.1%**	**4891.87**	**Or Tambo & Harvey**		
2601	NR	24	747	3	0	A	0	0.05			
2602	NT	961	3900	32	0	A	0.07	5.77			
2603	NL	192	0	0	0	A	0	1.15			
2605	ERT	6	474	2	0	A	0	0.01			
2606	EL	1	0	0	0	A	0	0			
2607	SR	1	726	0	0	A	0	0			
2608	SLT	1059	3900	29	0	A	0.06	5.68			
2611	WRT	74	474	24	2	A	0.42	5.48			
2612	WL	40	0	0	2	A	0	2.76			
2613 B	ST	90	0	0	0	A	0	0.48			
2614 B	NT	90	0	0	0	A	0	0.54			
T2 26	**Or Tambo & Francken St**			**25**	**0**	**A**	**0.1%**	**21.92**	**Or Tambo & Francken St**		

Table 4.PM: Or Tambo/ Harvey & Hanger FORECAST AM PEAK TRANSYT EVALUATION

Cycle 90

Link Number	Approach Movement	Flow into Link (PCU/H)	Saturation Flow (PCU/H)	Degree of Saturation (%)	Delay (sec)	Level of Service	Queue (PCU)	Performance Index ($/H)	Green Times (Secs) Start	Green Times (Secs) End	Green Time (sec)
2702	NT	1177	3900	32	0	A	0.08	7.26			
2703	NL	2	1750	0	0	A	0	0			
2704	ER	5	496	1	0	A	0	0.01			
2706	EL	5	721	1	0	A	0	0			
2707	SR	4	721	1	0	A	0	0			
2708	ST	935	3900	26	0	A	0.05	4.27			
2713 B	ST	90	0	0	0	A	0	0.41			
2714 B	NT	90	0	0	0	A	0	0.56			
T2 27	**Or Tambo & Watkey**			**27**	**0**	A	**0.0%**	**12.51**	**Or Tambo & Watkey**		
2802	NTL	1178	3900	33	0	A	0.08	7.27			
2806	EL	2	721	0	0	A	0	0			
2808	ST	935	3900	26	0	A	0.05	4.28			
2813 B	ST	90	0	0	0	A	0	0.41			
2814 B	NT	90	0	0	0	A	0	0.56			
T2 28	**Or Tambo & Bisseaux**			**28**	**0**	A	**0.0%**	**12.52**	**Or Tambo & Bisseaux**		
2902	NLT	1234	3900	34	0	A	0.09	8.13			
2905	ER	251	483	52	4	A	0.91	34.62			
2908	SRT	935	3900	26	0	A	0.05	4.28			
2913 B	ST	90	0	0	0	A	0	0.41			
2914 B	NT	90	0	0	0	A	0	0.59			
T2 29	**Or Tambo & Papenfus St**			**31**	**1**	A	**0.1%**	**48.03**	**Or Tambo & Papenfus St**		
3002	NLTR	1150	3900	54	11	B	14.11	516.34	6	46	40
3004	ER	184	1182	27	29	C	4.52	208.85	52	0	38
3006	ELT	332	3900	15	10	B	7.03	184.79	52	0	38
3007	SR	43	204	36	30	C	0.9	51.75	6	46	40
3008	SLT	890	3900	43	14	B	19.72	578.61	6	46	40
3010	WR	193	1341	25	15	B	2.88	117.57	52	0	38
3011	WLT	254	1950	23	10	B	3.14	113.36	52	0	38
3013 B	ST	90	0	0	21	C	0	75.49			
3014 B	NT	90	0	0	5	A	0	16.37			
T2 30	**Or Tambo & Falck St**			**38**	**13**	B	**5.4%**	**1863.13**	**Or Tambo & Falck St**		
3102	NLT	1111	1950	62	2	A	10.91	69.73			
3105	ELR	96	513	19	1	A	0.02	2.15			
3108	SRT	922	1950	52	4	A	16.4	226.57			
3113 B	ST	90	0	0	4	A	0	24.6			
3114 B	NT	90	0	0	2	A	0	5.27			
T2 31	**Or Tambo & Cross Rd**			**51**	**2**	A	**0.9%**	**328.32**	**Or Tambo & Cross Rd**		
3201	NR	44	528	13	7	A	0.25	12.32	6	50	44
3202	NT	885	1950	79	22	C	16.24	730.09	6	50	44
3203	NL	199	1153	17	3	A	1.26	34.66			
3204	ER	80	606	25	38	D	2.02	113.64	56	0	34
3205	ELT	518	1950	51	30	C	12,96 +	609.47	56	0	34
3207	SR	25	252	16	21	C	0.4	19.59	6	50	44
3208	ST	621	1950	58	8	A	4.81	204.17	6	50	44
3209	SL	334	1255	27	3	A	2.23	51.8			
3210	WR	202	803	48	32	C	4.49	241.42	56	0	34
3211	WT	599	1950	59	17	B	10.73	428.96	56	0	34
3212	WL	58	976	6	1	A	0.13	2.15			
3213 B	ST	90	0	0	2	A	0	5.41			
3214 B	NT	90	0	0	32	C	0	98.85			
T2 32	**Or Tambo & Rhodes Ave**			**52**	**17**	B	**7.3%**	**2552.53**	**Or Tambo & Rhodes Ave**		
3302	NLTR	1057	3900	29	0	A	0.06	5.65			
3305	ELTR	17	546	3	0	A	0	0.05			
3308	SLTR	825	3900	23	0	A	0.04	3.24			
3311	WLTR	70	546	13	1	A	0.15	1.72			
3313 B	ST	90	0	0	0	A	0	0.35			
3314 B	NT	90	0	0	0	A	0	0.48			
T2 33	**Or Tambo & Goddar St**			**24**	**0**	A	**0.0%**	**11.49**	**Or Tambo & Goddar St**		
3401	NR	36	612	10	14	B	0.51	20.97	6	46	40
3402	NLT	780	1950	68	16	B	13.93	528.38	6	46	40
3407	SR	31	439	47	21	C	0.79	24.69	6	46	40
3408	ST	632	1950	55	12	B	6.78	305.57	6	46	40
3409	SL	173	1750	17	5	A	1.07	39.21	6	46	40
3410	WR	114	1800	11	9	A	1.31	46.5	52	0	38
3411	WLT	370	1950	33	11	B	5.02	180.86	52	0	38
3413 B	ST	90	0	0	7	A	0	18.92			
3414 B	NT	90	0	0	44	D	(+)	133.53			
T2 34	**Or Tambo & St Georges St**			**46**	**14**	B	**3.7%**	**1298.63**	**Or Tambo & St Georges St**		
3502	NLR	1006	1950	75	13	B	17,03 +	579.54	6	55	49
3505	ET	449	1950	59	31	C	13.36	542.16	61	0	29
3511	WT	316	1950	45	19	B	7.87	249	61	0	29
3513 B	ET	90	0	0	3	A	0	9.55			
3514 B	WT	90	0	0	18	B	0	67.8			
T2 35	**St Georges St & Fraser Ln**			**60**	**18**	B	**4.2%**	**1448.05**	**St Georges St & Fraser Ln**		

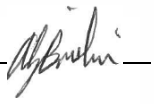
Vehicle Type		Total Distance Travelled (PCU-km/h)	Total Time Spent (PCU-hr/h)	Mean Journey Speed (km/h)	Total Delay (PCU-hrs/h)	Total Distance Travelled (Pass-km/h)	Total Time Spent (Pass-hr/h)		Total Performance Index ($/H)	Fuel Consumption (l/hr)
Total		**12466.27**	**321.2**	**38.81**	**253.15**	0	0		**34789.26**	1665.68
NBOT Mixed		3581.13	73.16	48.95	17.91				2633.41	280
NBOTBUSSES		**380.94**	**12.51**	**30.46**	**2.3**				**294.23**	**31**
PHASE1 NB		1762.66	51.01	34.56	15.57				2099.72	154
PHASE1 SB		2177.35	78.29	27.81	28.09				3754.78	215
SBOT Mixed		4217.43	91.35	46.17	26.06				3509.31	331
SBOTBUSSES		**346.76**	**14.88**	**23.31**	**3.45**				**432.69**	**30**
Other										

Note: - L = Left, T = Through, R = Righturn

I.3 Traffic Impact Study – CBD Phase 1C (Brandwag)

QUALITY REVIEW

Project Name	***:***	*IPTN Phase1C*
Project Team	***:***	*GladAfrica Consulting Engineers (Pty) Ltd*
Employer	***:***	*Mangaung Metropolitan Municipality*
Client Reference	***:***	*C447*
GladAfrica Reference	***:***	*CE0001*
Report Heading	***:***	*IPTN Phase 1C – Stage 1 Traffic Impact Assessment Report*
Date of this Issue	***:***	*2018/08/02*

Compiled by	:	**A.BRISLIN** Initials & Surname	Signature 	Date 2019/08/01
Reviewed by	:	**L.VAN GENDEREN** Initials & Surname	Signature	Date
Reviewed by	:	**N.REDDY** Initials & Surname	Signature	Date

*"I, **_ADRIAN BRISLIN Pr.Eng.**, author of this traffic impact study, hereby certify that I am a professional traffic engineer (Registration number:**980355** and that I have the required experience and training in the field of traffic and transportation engineering, as required by the Engineering Council of South Africa (ECSA), to compile this traffic impact study and I take full responsibility for the content, including all calculations, conclusions and recommendations made therein".*

Received and accepted by a duly authorised representative of the client

Client representative name:_____

Signature:_____ Date: _____

Report Status

Draft	√	Revision Number	0	I	

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Nomenclature

MMM	Mangaung Metropolitan Municipality
CBD	Central Business District
HCM	Highway Capacity Manual
TRANSYT	Traffic modelling software to optimize traffic signals in corridors or networks
LoS	Level of Service
V/C	Volume to Capacity ratio
IPTN	Integrated Public Transport Network
UFS	University of the Free State
UA	Universal Access captured in a Guideline document NTR1
NMT	Non-Motorized Transport (pedestrians and bicycles)
Mixed traffic	Traffic stream consisting of all traffic that is not Bus public transport
PRASA	Passenger Rail Authority of South Africa
SADC-RTSM	South African Development Community- Road Traffic Signs Manual.

1. EXECUTIVE SUMMARY

GladAfrica Consulting Engineers (Pty) Ltd was appointed by the Mangaung Metropolitan Municipality to undertake this Phase 1C-IPTN Traffic Assessment. This report assesses the Phase 1C- Interim IPTN Quality Bus Routes as proposed in the Central Business District. This traffic report forms an integral part of the IPTN Operations Plan, which will include further CBD routes at a later stage. A section of the report also evaluates two alternative access options for the Intermodal Facility. (to be implemented later)

The Assessment objectives are:

a) To evaluate the existing intersections along the proposed routes
b) Determine the 10 year horizon forecast traffic with bus volumes.
c) Evaluate the 10 year forecast horizon traffic at intersections and determine the modelled future mixed traffic and bus operating speeds accounting for the stops that the buses need to undertake.
d) To confirm and evaluate the Interim Starter route options and stop/station positions from a traffic engineering viewpoint and UA/NMT user viewpoint.
e) Determine the route and intersections upgrades necessary for the successful implementation of the Interim Starter IPTC Phase 1C service.

The extent of the traffic model is shown in the overall route plans for 3 Interim bus routes. The area extends from DF Malherbe Street in the west to Harvey Street in the east. The northmost extent is the Tempe military base and the southmost extent is the Hoffman Square terminal facility. The location of the bus routes are shown in **Figure 1** below.

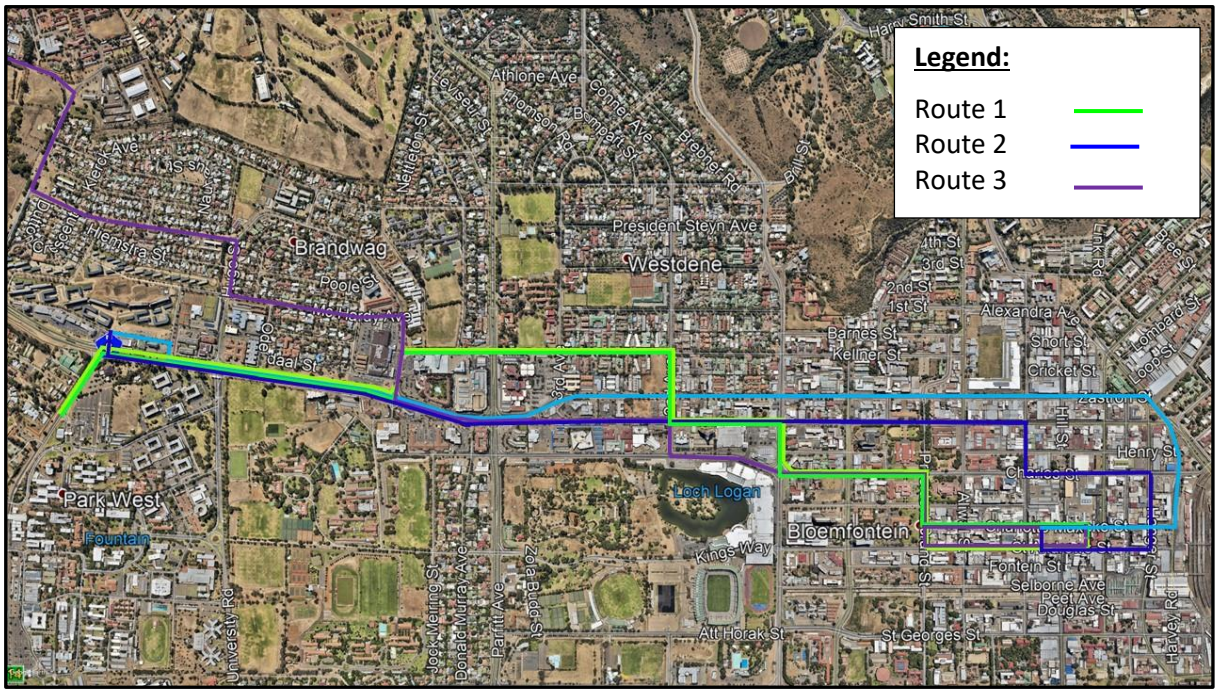

Figure 2: Overall Layout of Stage 1 Starter Service 3 Routes

For the forecast condition (2029), the optimized and co-ordinated intersection overall Level of Service is no worse than LoS C, for Route 1 and Route 2. It was also found that a new signal is warranted at the D.F Malherbe /UFS Gate 5 intersection.The above 3 intersections have been optimized and co-ordinated which has them operating at LoS C. The Existing 2018 and 2029 forecast mixed traffic and bus speeds per route are shown in **Table 1** below.

Table 1: Results of TRANSYT Modelling Speeds for Mixed Traffic and Quality Bus

ROUTE 1				ROUTE 2			
Mixed Traffic							
Description		**Distance (km)**	**Speed (km/h)**	**Time (mins)**	**Distance (km)**	**Speed (km/h)**	**Time (mins)**
2018 AM Peak EB		5,1	29,44	10,39	5,4	13,76	23,55
2029 AM peak EB		5,1	25,97	11,78	5,4	32,62	9,93
2018 AM Peak WB		5,1	32,1	9,53	5,4	29,28	11,07
2029 AM peak WB		5,1	32,01	9,56	5,4	38,52	8,41
2018 PM Peak EB		5,1	29,24	10,47	5,4	28,01	11,57
2029 PM peak EB		5,1	27,41	11,16	5,4	37,4	8,66
2018 PM Peak WB		5,1	26,2	11,68	5,4	26,2	12,37
2029 PM peak WB		5,1	30,1	10,17	5,4	39,22	8,26
Quality BUS							
AM Peak	**Bus/ hr**	**Distance (km)**	**Speed with stops (km/h)**	**Time (mins)**	**Bus/ hr**	**Distance (km)**	**Speed with stops (km/h)**	**Time (mins)**
EB	6	5,1	11,12	27,52	4	5,4	19,38	16,72
WB	6	5,1	13,37	22,89	4	5,4	24,20	13,39
Turnaround		**10,2**	**12,14**	**50,41**		**10,8**	**21,52**	**30,11**
PM Peak								
EB	6	5,1	12,79	23,92	4	5,4	24,04	13,48
WB	6	5,1	15,26	20,05	4	5,4	25,22	12,85
Turnaround		**10,2**	**13,92**	**43,98**		**10,8**	**24,62**	**26,32**

The above resultant operating speeds (including stops) for Route 1- Hoffman Square to UFS are very low because the route turns often and does not contain significant lengths of one-way streets.

This means that the three routes would need to be re-configured so that especially the University route, which carries the highest demand, would operate at a higher bus turnaround speed.

The proposed re-configured routes for Stage 2 are shown in **Figure 2** below.

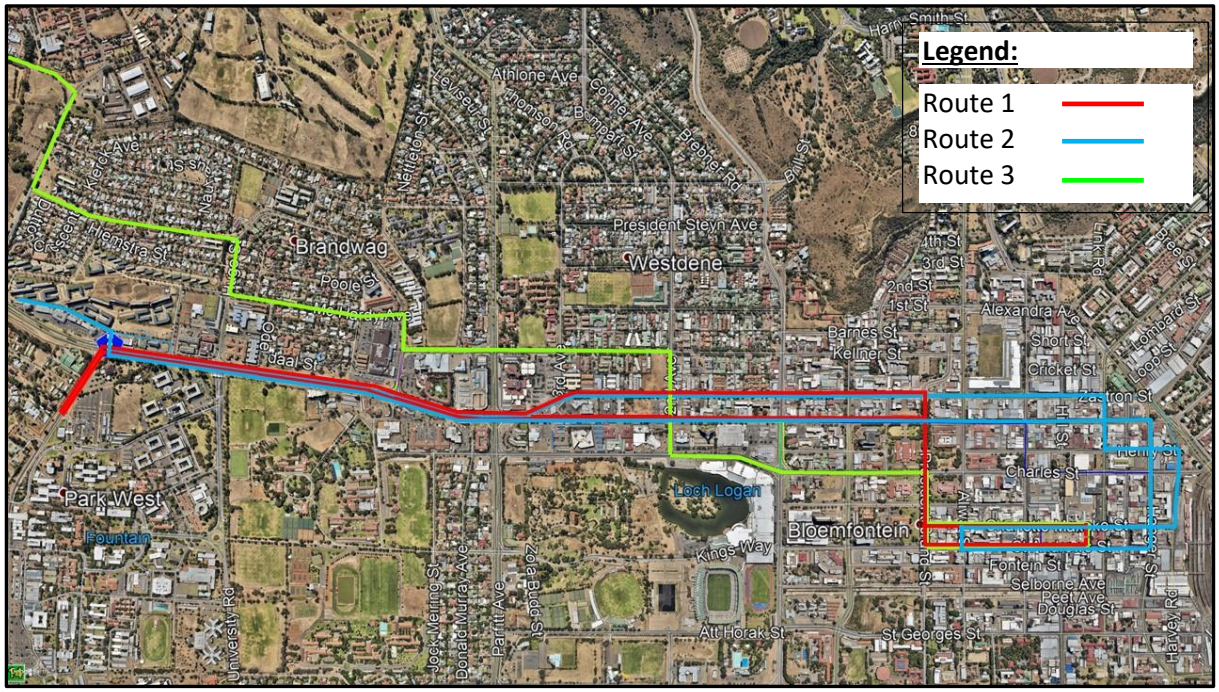

Figure 3: Proposed Starter Service Re-configuration of Routes (Source Google Earth)

These will have to be modelled in Stage 2 of the Traffic Assessment to confirm the Level of Service and bus operating speeds along the routes.

The upgrading proposed along the presently proposed routes comprises 45 traffic signals and 35 priority controlled intersections. These 80 intersections all need to be upgraded to comply with the NTR1 Universal Access standards. One new traffic signal is warranted at the D.F.Malherbe/UFS Gate 5 intersection. Although detailed in the UA report all the sidewalks along the routes will have to be upgraded by re-paving them properly where required or providing new paved sidewalks. It is proposed that the new required sidewalks are prioritized.

Furthermore the signal timings of the 46 upgraded intersections would need to be designed and co-ordinated as proposed by the forecast TRANSYT models.

36 new temporary bus stops will be required and the location of these have been finalized by site visits, UA reporting and traffic engineering inputs. In general the stops would involve removing 2 parking bays, placing temporary plastic bollards to prevent these from being used. This will provide an area of 12m long by 2,5 m wide on the leftmost side of the street. The bus will then stop within the nearmost traffic lane to pick up passengers.Subsequently this parking area will be replaced by a prototype temporary steel stop which is universally accessible and is 300mm high for the bus floor. When we are sure about the stop location this will be replaced by a concrete peninsula stop which may or may not also require a shelter.

Of note is stop 1 along Harvey Street between Charles Street and Charlotte Maxeke Street, which will require negotiations with PRASA to utilize the current parking area which has been fenced off. The UFS terminal turnaround point has been finalised choosing Option 1 of 3 options investigated, but also containing elements of Option 2. This option also still has to be negotiated with the University.

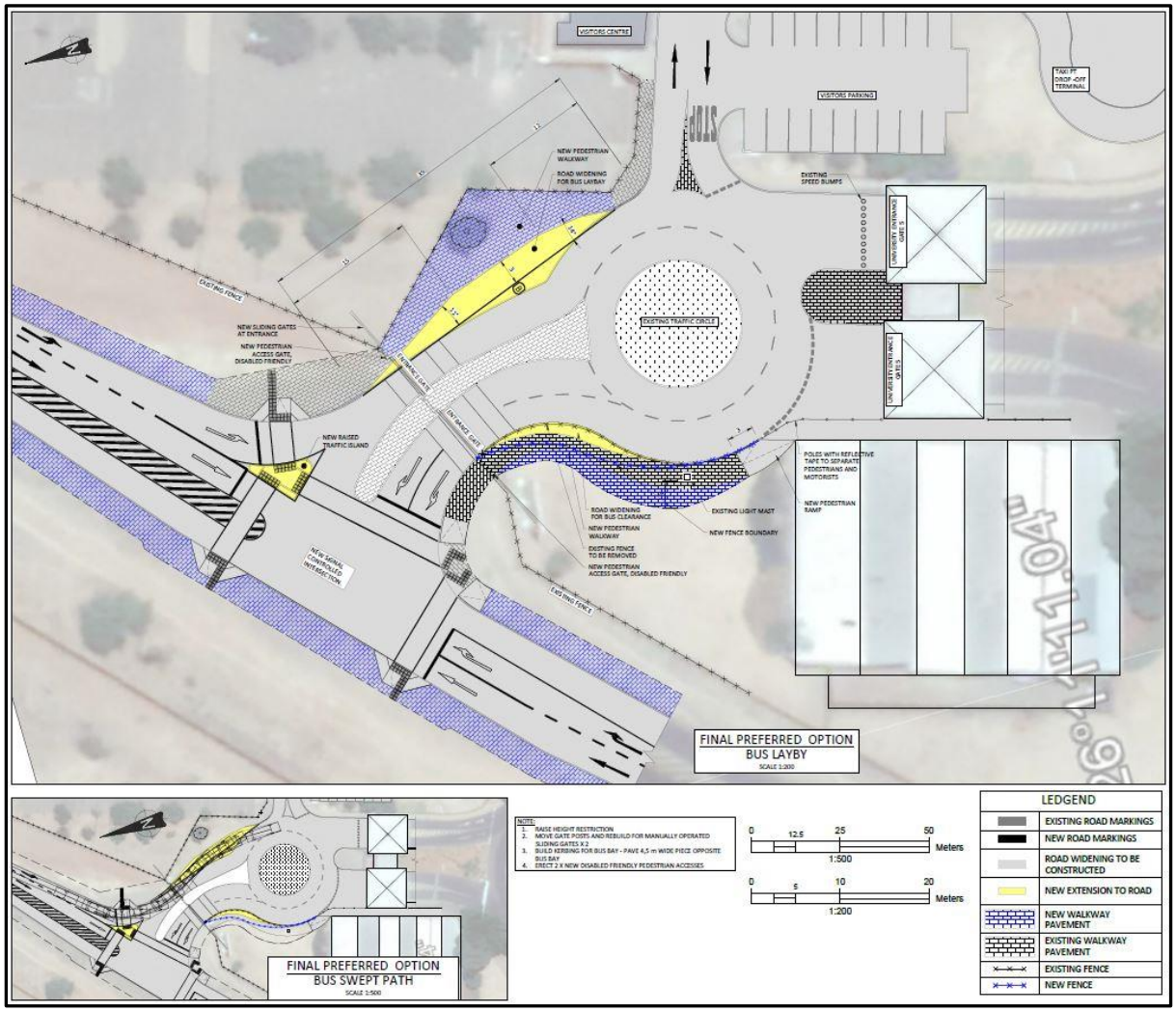

Figure 4:The Proposed Preferred Option for the UFS Gate 5 Terminal and Turnaround Facility

2. INTRODUCTION

GladAfrica Consulting Engineers (Pty) Ltd was appointed by the Mangaung Metropolitan Municipality to undertake this Phase 1C-IPTN Stage 1 Traffic Assessment. This report assesses the Phase 1C- Interim IPTN Quality Bus Routes as proposed to/from the Central Business District (CBD). Stage 1 evaluates the first proposed bus routes.

The operating speed results obtained for the Stage 1 assessment have informed the re-configuration of the three routes based on the speed results obtained. Therefore Stage 2 of the traffic Assessment report will still need to be undertaken to determine the re-configured route operating speeds.

This traffic report forms an integral part of the IPTN Operations Plan, which will include further CBD routes at a later stage. The Stage 1 report shows the 3 starter service routes assumed. The existing and forecast traffic evaluation was obtained using TRANSYT software so that the bus can be modelled in the leftmost lane and an average stop time can bhe incorporated. Each proposed station position has also been evaluated from a traffic engineering viewpoint and these results shown in **Annexure D.**

A section of the report also evaluates two alternative access options for the Intermodal Facility. (to be implemented later). Since the taxi industry is in dispute with MMM at this point in time the Intermodal facility is not used by them. It was therefore proposed that Hoffman Square be used as the central departure/arrival for the starter routes as it has shelters and docking facilities already which can be used by the IPTN.

The results of the operating speed for Route 1 which is from Hoffman Square to Gate 5 of the UFS are too low as we have a limited amount of buses for the fleet. It is therefore necessary to re-configure the routes. These would have to be evaluated and modelled in a Stage 2 assessment.

3. STUDY OBJECTIVES

The purpose of this Stage 1 Traffic Assessment report is to provide more detail on the actual traffic modelling of the proposed interim 3 Quality bus routes which form part of the Phase 1C portion of the Mangaung IPTN in the bounds of the Bloemfontein Central Business District (CBD). The assessment will confirm the proposed bus stop positions with an evaluation of the traffic engineering aspects and implications to the mixed traffic and include recommendations for the upgrading of NMT facilities along and in the vicinity of the proposed bus routes.

The Traffic Assessment report objectives consist of the following:

1) Model the Stage 1 Phase 1C Interim service three proposed Quality bus routes
2) Provide an intersection traffic evaluation of the existing route conditions to identify current route bottlenecks and how these should be upgraded
3) Determine and investigate the traffic engineering aspects and implications of the proposed bus stop positions along the Quality bus routes.
4) Model the future traffic conditions along the proposed 3 Interim service routes with the inclusion of the Quality Bus (QB) stopping at the bus stops, in order to verify future traffic operating conditions
5) Summarize the forecast traffic operations and achieved bus and mixed traffic speeds
6) Make final route upgrading recommendations, making traffic signal optimization and co-ordination

4. INTERIM IPTN QUALITY BUS ROUTES

The three proposed Stage 1 interim bus routes are summarized with their origin and destinations.

d) Route 1 – Hoffman Square to University of the Free State and return
e) Route 2 – Hoffman Square to Bloemgate shopping Centre and return
f) Route 3 – Hoffman Square to Tempe military base and return.

It is proposed that a fleet of 13 buses service the 3 routes with 9 dedicated to Route 1 and Route 2 and 4 dedicated to Route 3. These have been shown in detail in **Annexure C.**

In the weekday peaks a frequency of 15 minutes is proposed with a 30 minute frequency for the off-peak.

On a Saturday the frequency will be 30minutes throughout the day.

On Sunday and public holidays a 60 minute frequency is proposed for the whole day.

The operational hours proposed are as follows:

a. Weekdays- 05:00 to 20:00
b. Saturdays- 05:00 to 16:00
c. Sunday/public holidays- 06:00 to 15:00

Hoffman Square was chosen as the central CBD terminal since the number of destinations possible at the Intermodal facility bus level is limited. Also it is already a terminal for the IBL and mini-bus taxi services where as no taxis are currently using the Intermodal facility because of a dispute with MMM.

Hoffman Square presently also has 18 bus shelters(9 on each side north and south) with a dedicated docking public transport lane.

A diagrammatic representation of the routes is shown in **Figure 4** below.

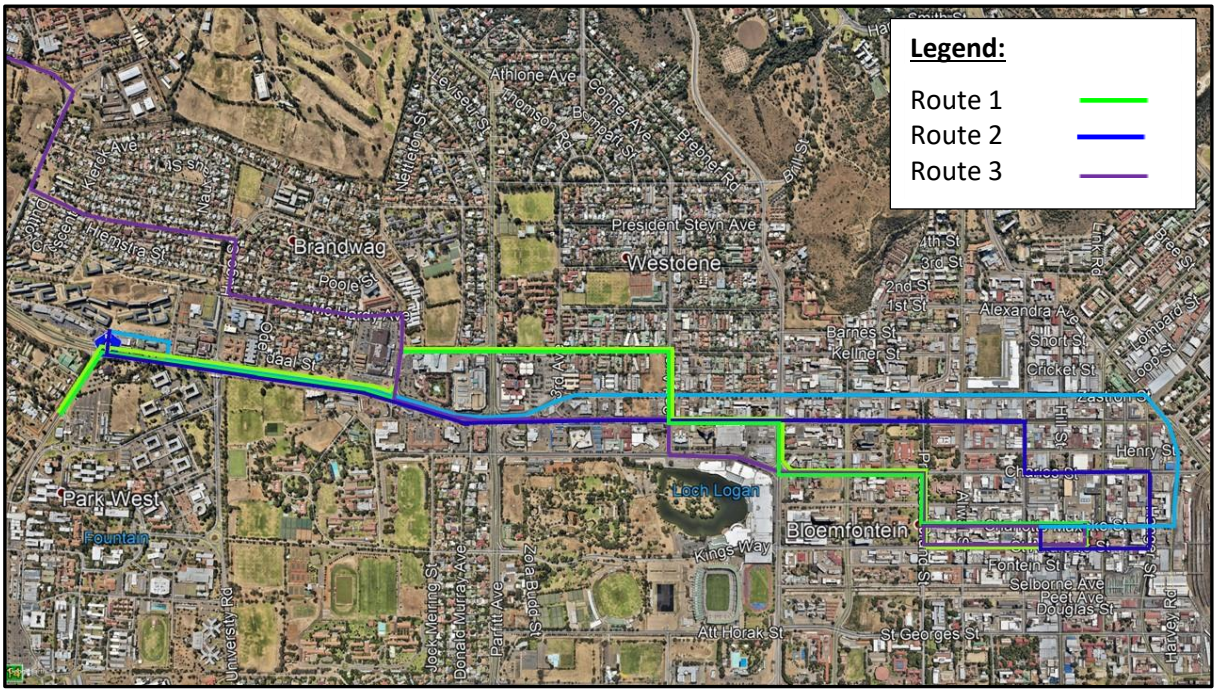

Figure 5: Proposed Stage 1- Interim Quality bus routes for CBD (Source Google Earth)

5. ROAD HIERARCHY

All the CBD Streets are classified as Class 4a as they are commercial activity streets. The Nelson Mandela/Zastron one-way pair has a slightly higher priority (Class 2) as this forms part of National Route 8 through the CBD. (Reference was also made to TRH 26 for the road classification)

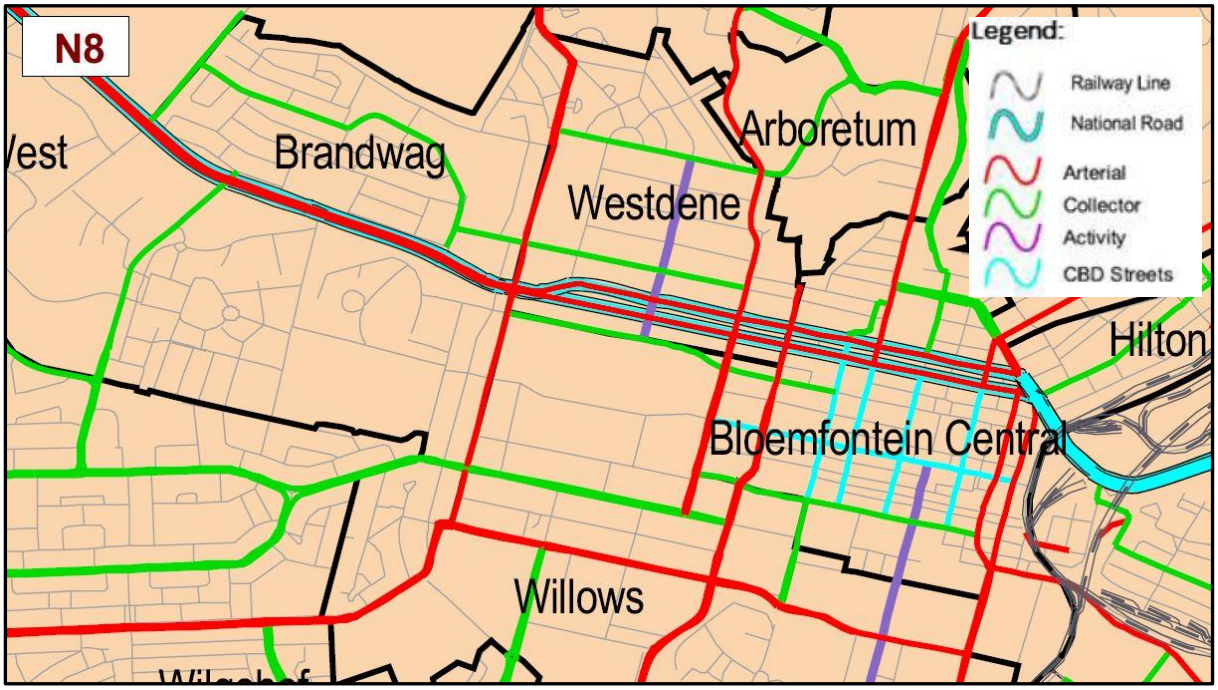

Figure 6: Bloemfontein CBD section Road Hierarchy Classification

In terms of The Mangaung Road Classification System the CBD streets can be classified as follows:

a) Arterial Road
- Nelson Mandela and Zastron Streets which form part of the N8
- Parfitt Street
- President Boshoff/Markgraaff Street
- First Avenue
- Hanger Street
- Harvey Road
- Fort Road
- Victoria Road/President Ave.

b) Collector Road
- Park Road
- Charles/Henry Street
- D.F Malherbe Street
- Furstenburg Road
- Melville Drive
- Kellner Street

c) Activity Street
    - Oliver Tambo/Kerk Street
    - Second Street

d) CBD Street
    - St. Andrews Street
    - President Brand Street
    - Oos-Burger Street
    - Wes-Burger Street
    - Aliwal Street.

6. 2018 BASE YEAR TRAFFIC EVALUATION

6.1 Data Collection

Most of the intersection turning movements during both the AM and PM peak hours were undertaken in September and October of 2018. Where necessary these have been supplemented with 2018 counts from other sources. A summary of the turning traffic counts are shown diagrammatically in **Annexure A** for Route 1 and Route 2 for the AM peak and PM peak respectively.

6.2 Descriptions of Key Intersections

The lane configurations of the intersections were obtained using Google Earth and the current signal timing plans were obtained from the Mangaung traffic engineers.

6.3 TRANSYT Modelling Assumptions

a) The future mixed traffic growth on the CBD corridors will be 1,8%p.a. growth rate for 11 years

b) The CBD operating speed limit of the trunk routes is 50 km/h. The actual operating speed is between 25 to 35 km/h.

c) The TRANSYT model was broken up into the separate proposed Bus routes. The current signal timings were used for the existing analysis. Only the key intersections have been modelled.

d) Bus dwell times were calculated per route and stop using 85% of the total demand of 850 passengers per hour sub-divided per route as follows:

- Route 1 -6 buses per hour
- Route 2- 4 buses per hour
- Route 3 -3 buses per hour

Using 2 seconds per passenger boarding/alighting through the one front access door. To this wa then added 5 seconds for deceleration and 5 seconds for acceleration to obtain a total dwell time. This was calculated to be a maximum of 16 seconds, apart from Hoffman Square where 30 seconds was allowed.

e) The off-peak direction carries 15% of the total peak hour demand.

f) The PM peak was simply modelled as the reverse of the AM peak hour. Interesting is that the peak passenger direction in the AM peak is outbound of the CBD.

6.4 Traffic Evaluation Results 2018

The overall intersection results along the routes of the traffic evaluation are shown in diagrams in **Annexure B**. The TRANSYT results for the 2018 existing traffic demand, as determined and balanced are summarised in **Annexure B**.

Table 2: HCM Level of Service Criterion

Level of Service	Control delay per vehicle in seconds (d)		
	Signals	Roundabout	Sign Control
A	d ≤ 10	d ≤ 10	d ≤ 10
B	10 < d ≤ 20	10 < d ≤ 20	10 < d ≤ 15
C	20 < d ≤ 35	20 < d ≤ 35	15 < d ≤ 25
D	35 < d ≤ 55	35 < d ≤ 50	25 < d ≤ 35
E	55 < d ≤ 80	55 < d ≤ 70	35 < d ≤ 50
F	80 < d	70 < d	50 < d

The intersection evaluation uses the delay shown in **Table 2** above to determine the Level of Service of a particular approach or turning movement.

6.5 Summary of Evaluation Results

In general, the existing (2018) overall intersection Level of Service is better than or equal to LoS C, which is highly satisfactory. There are 3 exceptions to this which operate at LoS F, these being:

a) D.F Malherbe St. and Nelson Mandela Drive
b) Parfitt Ave and Nelson Mandela Drive
c) Markgraaff St. and Nelson Mandela.Drive

These problemeatic movements which are operating at LoS F were also observed on site to do so.

7. PHASE 1C IPTN STATION LOCATIONS AND TRAFFIC ASSESSMENT

7.1 Proposed Phase 1C IPTN Bus Stops

A detailed layout with properties and upgrading requirements has been undertaken for each of the 36 Starter Service stations. Traffic input regarding the location relative to streets in the vicinity together with nearby traffic signal and NMT requirements has been provided.

This has been captured in detail in **Annexure D**

8. FORECAST YEAR TRAFFIC EVALUATION

8.1 Evaluation of Intersections

For the forecast conditions (2029), the optimized and co-ordinated intersection overall Level of Service is no worse than **LoS C**, for Route 1 and Route 2. It was also found that a new signal is warranted at the D.F Malherbe /UFS Gate 5 intersection.The problematic 3 intersections have been optimized and co-ordinated which has them operating at **LoS C**.

A summary of the overall intersection Levels of Service along Route ! and Route 2 for the forecast scenario is shown in **Annexure C**.

8.2 Analysis of TRANSYT Model Operating Speeds

The Existing 2019 and 2029 forecast mixed traffic and bus speeds per route are shown in **Table 3** below.

Table 3: Results of TRANSYT Modelling Speeds for Mixed Traffic and Quality Bus

ROUTE 1				ROUTE 2			
Mixed Traffic							
Description		**Distance (km)**	**Speed (km/h)**	**Time (mins)**	**Distance (km)**	**Speed (km/h)**	**Time (mins)**
2019 AM Peak EB		5,1	29,44	10,39	5,4	13,76	23,55
2029 AM peak EB		5,1	25,97	11,78	5,4	32,62	9,93
2019 AM Peak WB		5,1	32,1	9,53	5,4	29,28	11,07
2029 AM peak WB		5,1	32,01	9,56	5,4	38,52	8,41
2019 PM Peak EB		5,1	29,24	10,47	5,4	28,01	11,57
2029 PM peak EB		5,1	27,41	11,16	5,4	37,4	8,66
2019 PM Peak WB		5,1	26,2	11,68	5,4	26,2	12,37
2029 PM peak WB		5,1	30,1	10,17	5,4	39,22	8,26
Quality BUS							
AM Peak	**Bus/ hr**	**Distance (km)**	**Speed with stops (km/h)**	**Time (mins)**	**Bus/ hr**	**Distance (km)**	**Speed with stops (km/h)**	**Time (mins)**
EB	6	5,1	11,12	27,52	4	5,4	19,38	16,72
WB	6	5,1	13,37	22,89	4	5,4	24,20	13,39
Turnaround		**10,2**	**12,14**	**50,41**		**10,8**	**21,52**	**30,11**
PM Peak								
EB	6	5,1	12,79	23,92	4	5,4	24,04	13,48
WB	6	5,1	15,26	20,05	4	5,4	25,22	12,85
Turnaround		**10,2**	**13,92**	**43,98**		**10,8**	**24,62**	**26,32**

The above resultant speeds for Route 1- Hoffman Square to UFS are very low because the route turns often and does not contain significant lengths of one-way streets.

This means that the three routes would need to be re-configured so that especially the University route, which carries the highest demand, would operate at a higher bus turnaround speed.

8.3 Proposed Re-configuration of Starter Routes

As a result of the operating speed determination shown above it is necessary to re-configure the 3 Starter Routes and this will be analysed in Stage 2 of the Traffic Assessment.

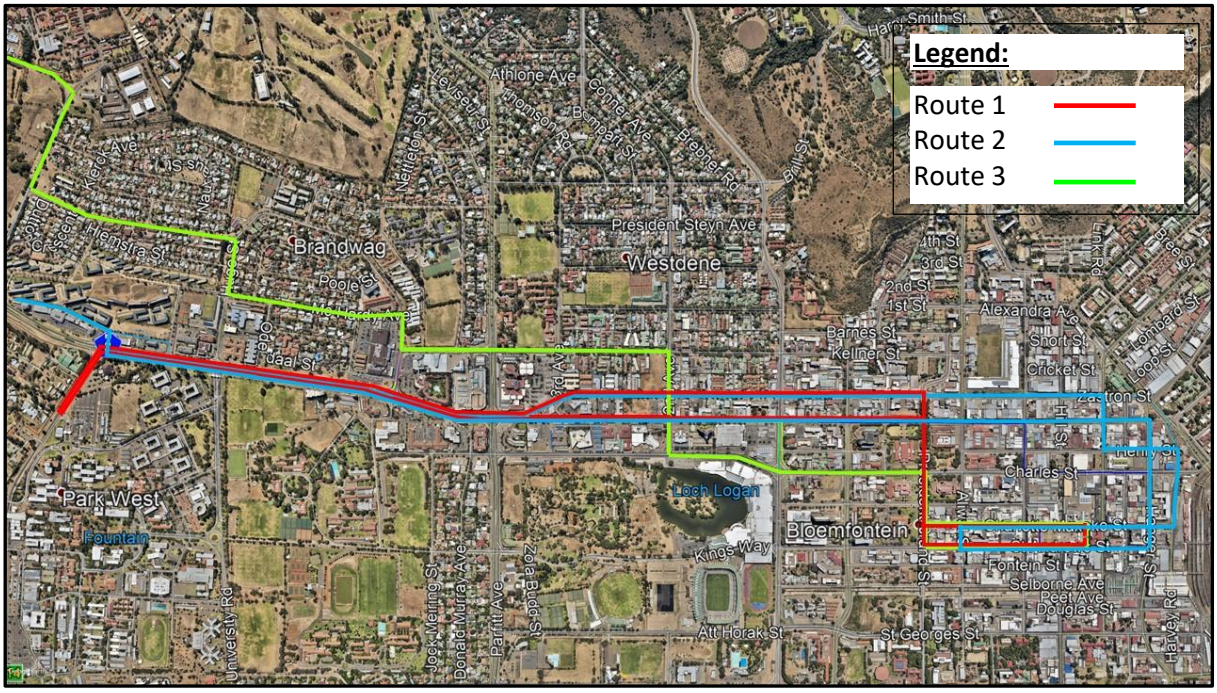

Figure 7: Re-configuration of Starter Service Bus Routes for Stage 2 Evaluation

9. INTERMODEL FACILITY TRAFFIC EVALUATION

The Intermodal Facility, which has already been constructed but is not presently in use because of a dispute between the Taxi Associations and the MMM. The location is shown in **Figure 6**.

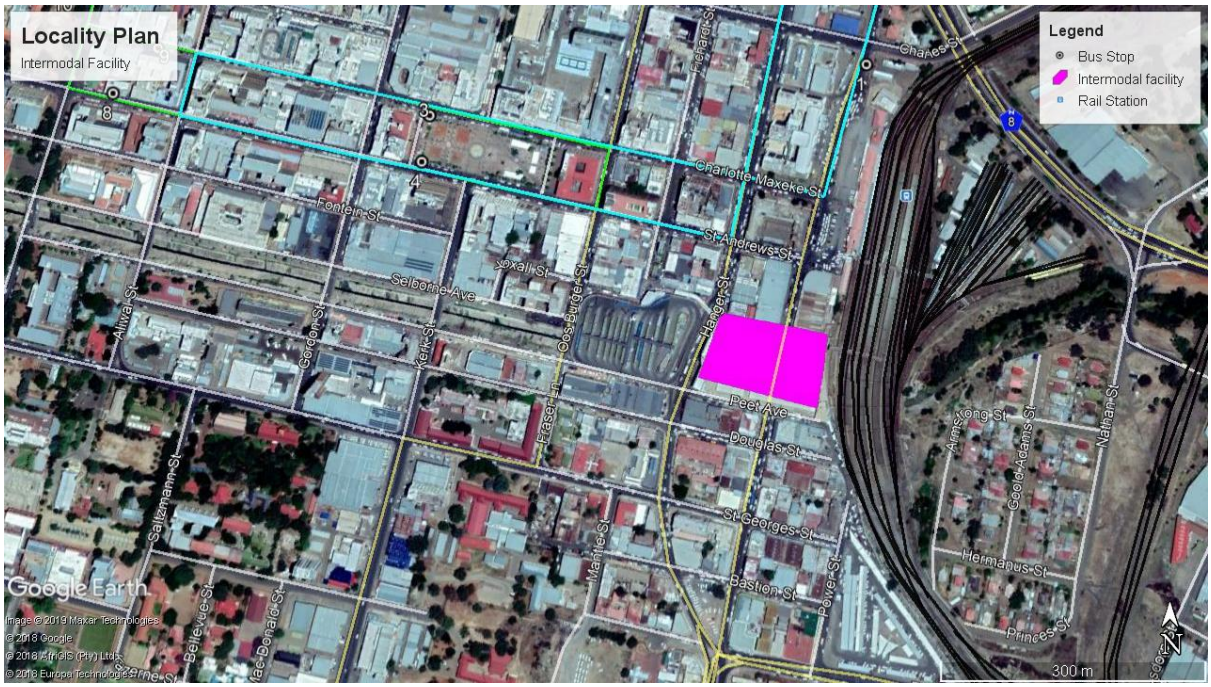

Figure 8: Location of Intermodal Facility (Source Google Earth)

The investigation has been captured in a slide show which is shown in **Annexure G.**

This investigation explores two options in terms of taxi traffic flow within the facility since the capacity impact at the intersection of Hanger and Peet Avenue and Harvey and Peet Avenue is so critical. The options are compared and a recommendation made together with what traffic enforcement measures need to be implemented for the successful utilization of the facility.

Hanger Street and Harvey Road are two of the most important one-way arterials running nort-south in the eastern sector of the Bloemfontein CBD.

10.CONCLUSIONS AND RECOMMENDATIONS

1) The IPTN Phase 1C Starter Service will consist of 3 routes serving the following destinations
   a) Route 1 – Hoffman Square to University of the Free State and return
   b) Route 2 – Hoffman Square to Bloemgate shopping Centre and return
   c) Route 3 – Hoffman Square to Tempe military base and return.

2) Turning count data was collected in the latter part of 2018 at each of the key intersections along the proposed routes.

3) The 2018 existing traffic modelling indicates a highly satisfactory Level of Service not exceeding LoS C with the exception of the following intersections which operate at Los F:
   a) D.F Malherbe St. and Nelson Mandela Drive
   b) Parfitt Ave and Nelson Mandela Drive
   c) Markgraaff St. and Nelson Mandela.Drive

4) Each of the proposed Starter Service bus stops have been evaluated from a traffic engineering viewpoint to provide recommendations for their implenmentation. This is detailed in **Annexure D** for each bus stop.

5) The forecast traffic evaluation was undertaken for 2029 assuming a background mixed traffic growth of 1,8% p.a. for 11 years.

6) The forecast TRANSYT operating speeds determined for the bus is acceptable for Route 2, but is very slow for Route 1-Hoffman Square to UFS gate 5.

7) As a result of the above the 3 interim routes require re-configuration since the highest demand will be for Route 1. This is shown in section 8.3 **Figure 6.**

8) The recommendation from the Intermodal Facility investigation is that the clockwise taxi circulation in and around the facility is the best option. The Investigation is detailed in **Annexure G.**

9) It is therefore recommended that Stage 2 of the Traffic Assessment be undertaken for the re-configured starter routes.

11.REFERENCES

1) TRANSYT 15 Manual

2) Highway Capacity Manual 2010- Federal Hihway Authority of USA

3) Volume 3- SARTSM

4) TRH 26- Road Access Classification for Urban and Rural Roads

I.4 Waaihoeg Bridge Study

PROJECT: MANGAUNG, WAAIHOEK PRECINCT, PHASE1.1 – CONSTRUCTION OF ROAD OVER RAIL BRIDGE AND ASSOCIATED ACCESS ROADS: INVESTIGATION OF ALTERNATIVE ROUTES

2016/10/06 Revised: 2016/10/13

Quality Management

Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks				
Date	06 October 2016	13 October 2016		
Prepared by	PJ Pretorius	PJ Pretorius		
Signature				
Checked by	P Pretorius	P Pretorius		
Signature				
Authorised by	M E Goosen	M E Goosen		
Signature				
Project number	19645	19645		
Report number	Alternative	Alternative		
File reference	/11	/11		

PROJECT: MANGAUNG, WAAIHOEK PRECINCT, PHASE1.1 – CONSTRUCTION OF ROAD OVER RAIL BRIDGE AND ASSOCIATED ACCESS ROADS: INVESTIGATION of ALTERNATIVE ROUTEs

2016/10/06

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Table of Contents

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Executive Summary

Improvement of access into the CBD from the eastern side of the Metro has been identified as one of the major catalysts in the redevelopment of the Bloemfontein Central Business District as a major attraction for development, and providing a people-friendly city.

Such a link is the construction of a new bridge across the railway lines effectively extending St Georges Street to meet up with MacKenzie Street in the industrial area.

The design team was requested to investigate three alternative options to which St Georges Street would connect with a road over rail bridge to either Mackenzie Street or via Atherstone street to Mc Gregor Street.

All three options are meeting all the design criteria.

Option 1 has three properties that must be acquired or relocated and will take the longest to go out on construction. There are numerous accesses to businesses that are operational that cannot be closed during the construction period.

Option 2 has one business stand and three additional private residential properties that must be acquired that influence overall cost of the option and an increased time frame for the construction to commence. The relocation of the existing business that must be acquired to new erven could also be considered. There are numerous accesses to businesses that are operational that cannot be closed during the construction period.

Option 3 has no new properties that must be acquired. There is some realignment required of the access into the petrol filling station on the corner of Atherstone and McGregor Streets. Alterations to the layout of the Municipal Waste Management Centre will be required if this option is accepted. There are only a few accesses along Atherstone Street which will cause less disruption to businesses during construction.

A summary of the cost for the various options is given in the table below:

Option	**Description**	**Cost (Excl. VAT)**
Option 1	Buy out of properties 1478, 1479 & 1480	R 322,237,083.00
Option 1	Relocate of properties 1478, 1479 & 1480	R 309,667,083.00
Option 2	Buy out of properties 21512, 89/1964, 84/1964, and 83/1964	R 309,637,083.36
Option2	Relocate of properties 21512 and buy out of properties 1478, 1479 & 1480	R 308,167,083.36
Option 3	Atherstone street	R 298,152,183.36

It is recommended that Option 3 be accepted by the authorities for inclusion as the preferred route and instruction be given to the design team to carry out a full design for inclusion in the tender document.

1 Introduction

1.1 Project Introduction and Background

The Mangaung CBD Urban hub initiative and the proposed redevelopment of the Waaihoek Precinct is focused on the development of a Mangaung Central Business District while connecting it to the greater context of its surroundings. The area, although, close to the CBD has constrained access as a result of numerous impediments, of which the following are the main obstructions:

- The main north south railway line linking Gauteng with Cape Town runs through the area with only limited road linkages crossing the railway line.
- Road-over-rail or rail-over-road bridges are of limited width.
- Underdeveloped buffer strips and significant topographic changes in level hamper connectivity.
- The road network is historically not ideal with limited provision for main roads, substandard spacing of intersections and angled intersections.

Pedestrian facilities in the area are in general lacking. Aspects hampering pedestrian movement in the area are as follows:

- Mentioned aspects hampering general connectivity also hamper pedestrian movement.
- Sidewalk widths are in general limited
- Sidewalks are mostly not pedestrian friendly with paving not conducive for walking.
- Informal trading on sidewalks limits pedestrian space.
- Security concerns discourage walking.

The construction of a new bridge across the railway lines effectively extending St Georges Street to meet up with McKenzie Street in the industrial area has been identified as a link between the CBD and the eastern parts of the Metro. This road will be upgraded and extended up to the M10 and possibilities exist to extend this road to the airport and N8 corridor development. This new link into the CBD will also link the N8 directly into the CBD alleviating some of the congestion on the N8 entering and exiting the CBD via Nelson Mandela and Zastron streets.

1.2 Extent of the Project

The project starts at the intersection of McGregor Street and McKenzie Street in the east. The upgrading of McKenzie Street from McGregor Street to Maroela Street. Construction of a new dual carriageway from Maroela Street to Nathan Street and along Hermanus Street until Armstrong Street. The construction of a Road over Rail Bridge from the intersection of Hermanus Street and Armstrong Street over the railway line

to the intersection of St George Street and Power Street. The upgrading of St Georges Street to a dual carriageway from the intersection of St George Street and Power street to the intersection of St George Street and Hanger Street in the west.

1.3 Phasing of the project

Phase 1.1 has been divided into three phases, namely.

- Phase 1.1.A: being the demolition of acquired properties and moving of services to construct the bridge.
- Phase 1.1.B: is for the construction of the bridge.
- Phase 1.1.C: access roads linking bridge with N8 and MacKenzie Street.

1.4 Appointment and Terms of Reference

Phethogo Consulting has been appointed by Mangaung Metro Municipality to provide professional engineering services for the implementation of the neighbourhood development programme - Contract number: T1315.

Funds have been made available by Treasury as detailed in the appointment letter with reference MNG_UNS_Bridge: McKenzie & St Georges Street_PPIP_2015-04-15 received on 5 May 2015 for **Phase 1.1 – Construction of new bridge across railway lines** which includes an access bridge over railway line to provide a link between the City and eastern parts of Bloemfontein and to connect it to the broader city network, the N8, the South Eastern industrial areas and areas like Batho, Heidedal and Grasslands.

1.5 Approved budget.

The approved budget is summarised below (VAT Excluded).

- Approved construction cost R246 531 300.90
- Approved Professional Fees R 34 515 782.46

It must however be noted that the current appointment from National Treasury for professional fees is only up to stage 4.1.

Approved budget (Excl. VAT)	**Sub Total**	**R 281,057,083.36**

2 Aim of Document

Due to the costs associated with the acquiring of business properties for **Phase 1.1.C Options 1** Phethogo was requested to investigate alternative routes for linking the bridge over the railway line from St Georges Street to McKenzie Street.

Three options were identified:

a) Option 1 – This is the option going along Mackenzie street acquiring properties 1478, 1479 & 1480.

b) Option 2 – This option also runs along Mackenzie street acquiring property 21512 and additional properties in Buitesig.

c) Option 3 – This option runs along Atherstone Street and no business properties needs to be acquired other that the private properties in Buitesig identified for the bridge construction. Alterations to the Municipal Waste Management Centre.

The following aspects will be discussed during the investigation:

§ Design considerations

§ Properties to be acquired for construction of the access roads.

§ Cost implications on the alternative options.

3 Design

3.1 Requirements

The following requirements were given by Mangaung Metro Municipality:

- Arterial route.
- Design speed 60km/h.
- 2 Lanes, 3.4m wide in each direction.
- 2.5m wide paved sidewalks.

3.2 Preliminary Design Considerations

3.2.1 Arterial road

The prime function of an arterial road is the movement of traffic. More specifically the arterial road should cater for longer distance movements in the urban system.

To perform its ideal function satisfactorily an arterial road required the following provisions:

- No access to the road from adjacent properties
- Intersections spacing of 350m or more
- Intersection spacing to aid traffic signal coordination
- Design speed of 70 to 90km/h
- Adequate lane width to accommodate all types of vehicles including trucks and buses.

Taken from Geometric design of urban arterial roads, UTG1, Pretoria, South Africa 1986.

3.2.2 Design speed

The concept of design speed developed by the American Association of State Highway and Transportation Officials (AASHTO) is used by many designers to achieve a balanced design for a given roadway or roadway network. This is particularly true for rural roads or for roads through lightly developed areas.

AASHTO defines speed as the maximum safe speed that can be maintained over a specified section of highway where conditions are so favourable that the design features of the highway govern.

The design speed Table 3-1 is taken from Table 2.2 of UTG1 with condition 3 being used for the design due to the existing accesses along the route.

Table 3-1 - Design speeds for arterials (Table 2.2 of UTG1)

Conditions prevailing	Design speed (km/h)
1. Expressway type. No property access. At-grade intersections spacing ≥ 500 m	80-100
2. No property access. At-grade intersections spacing ≥ 500 m No grade separated intersections	70-90
3. Property access unavoidable but limited to low density residential land use or infrequently from commercial developments. Intersection spacing ≥ 100 m	60-70
4. Property access unavoidable from residential or commercial land use. Intersection spacing ≥ 100 m	50-60*
5. Central area arterial street. Close intersection spacing with traffic signal control. Pedestrian activity.	50-60*

Source: Adapted from Ref. 8, p. 14.

* The higher design speed should be used for preference.

3.2.3 Stopping sight distance (SSD)

Stopping distance involves the capability of the driver to bring his vehicle safely to a standstill, and is thus based on speed, driver reaction time and skid resistance. The total distance travelled in bringing the vehicle to a stop comprises two components:

- the distance covered during the driver's reaction period
- the distance required to decelerate to 0 km/h

The stopping distance is expressed as

$$s = 0{,}7v + v^2/254f$$

where s = total distance travelled (m)

v = speed (km/h)

f = brake-force coefficient

Stopping sight distances for a 60km/h design speed on a level terrain is 80m (Table 3.4, UTG1).

Stopping sight distance is measured from an eye height of 1.05 m to an object height of 0,15 m. This object height is used because an obstacle of a lower height would not normally present a significant hazard. Object height is taken into account because measuring the site distance to the road surface would substantially increase the length of the vertical curve and hence the earthworks required.

The gradient has a marked effect on the stopping sight distance requirements. Gradient (G) modifies the stopping sight distance formula to

$S = 0,7v + v^2/254(f \pm G)$

where G is the percent of grade divided by 100.

American Association of State Highway and Transport Officials (AASHTO), assume v equal to the design speed for downgrade conditions and v equal to a running speed which is less than design speed for upgrade conditions. Similarly, TRH 17, Geometric Design of Rural Roads presents values of stopping sight distance on grades with built-in assumptions concerning operating speed being less than design speed when road surfaces are wet.

Figure 3-1 is a direct graphical representation of the formula to show stopping sight distance on grades between -10 % and +10 % for running speeds (v) between 40 km/h and 130 km/h taken from UTG1 Figure 3.4).

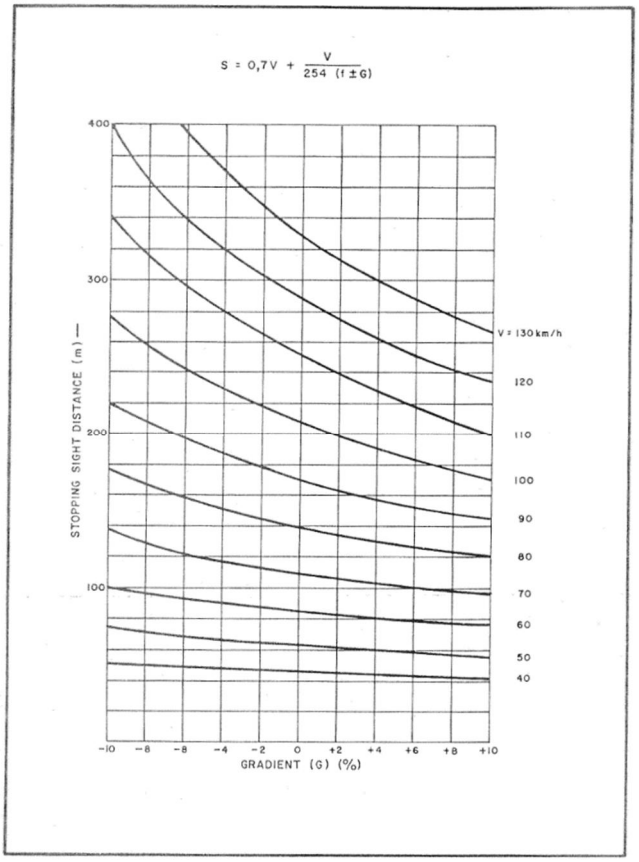

Figure 3-1 – Stopping site distance (Table 3.4 UTG1)

3.2.4 Horizontal curve radius

When taking a design speed of 60km/h and a superelevation of +0.04 the minimum radius for a horizontal curve is 150m.

Table 3-2- Minimum radius for horizontal curves (m) (TABLE 9.1 UTG1)

Design speed km/h	Side friction factor (f)	Minimum radius for maximum superelevation rates (e)					
		−0,02	0	+0,02	+0,04	+0,06	+0,08
50	0,16	140	125	110	100	90	—
60	0,15	220	190	170	150	135	125
70	0,15	300	260	230	205	185	170
80	0,14	425	365	315	280	255	230

The recommended design practise is to use, where possible, large radius curves without superelevation. Where large radius curves are not possible, superelevation can be introduced to offset the side friction forces of small radius curves.

The margin of safety in Table 3-2 is quite high as the friction factors used relate to driver comfort rather than to limiting factors between tyres and roadway. Friction factors based on driver comfort were measured in the 1930s and 1940s. Since then there have been many innovations in vehicle suspension, steering mechanisms and tyres, all of which make driving and particularly cornering more comfortable. Due to these

a radius of up to 30% less could be selected in some situations and will still provide reasonable design. The minimum radii of 150m then can come down to 105m at 4% superelevation.

3.2.5 Vertical curvature

The rate of vertical curvature, called K, is the distance required to effect a 1 percent change of grade. Vertical curves are specified in terms of this factor, K.

$$K = \frac{L}{A}$$

where L = length of vertical curve in metres

and A = the algebraic difference between grades in percentage.

The minimum rate of curvature is determined by sight distance, of which the stopping sight distance are most frequently used, as well as by considerations of comfort and of comfort of operation and aesthetics.

Values of K, based on stopping sight distance in the case of crest curves, and headlight illumination distance in the case of sag curves, are given in Table 3-3.

Table 3-3 - Minimum values of K for vertical curves (Table 9.3 UG1)

Design speed (km/h)	Stopping sight distance (m)*	K		
		Crest	Sag	
			Headlight	Comfort
40	45	6	6	4
50	65	11	11	6
60	80	16	17	8
70	95	23	24	12
80	115	33	31	16
90	135	46	49	20

4 Alignment Option 1

4.1 Alignment characteristics

The alignment connects St Georges road with Mackenzie Street with the proposed road over rail bridge. An intersection will connect the proposed Transnet road with the St Georges / Mackenzie extension. Figure 4.1 shows the proposed alignment for option 1.

Figure 4-1: Layout option1 - Alignment

Figure 4-2: View from old railway line of Transnet towards MacKenzie Street

Figure 4-3: Approaching corner of MacKenzie Street and Maroela Street

Figure 4-4: Intersection of Mackenzie Street and Maroela Street

Figure 4-5: Intersection of Mackenzie Street and Coro Street

Figure 4-6: Intersection of Mackenzie Street and Barrett Kraal Street

Figure 4-7: Intersection of MacKenzie Street and Pine Street

Figure 4-8: Approaching intersection of Mackenzie Street and McGregor Street

Figure 4-9: Intersection of MacKenzie Street and McGregor Street

4.2 Design characteristics

4.2.1 Design speed

The design speed of 60km/h as chosen was used during this design. There was no reason to adjust the design speed for the proposed alignment.

4.2.2 Stopping sight distance (SSD)

A detailed design was done for this option. The stopping sight distance was checked according to the proposed vertical alignment design. The proposed vertical alignment did comply with the stopping sight distance of 80m which is given in Table 3.4, UTG1.

4.2.3 Horizontal curve radius

The alignment consists of three horizontal curves. The radii of these curves are between 200m and 345.5m. The minimum recommended radius is 150m at a superelevation of 4%. The radii used for the alignment are thus more than adequate.

4.2.4 Vertical curvature

The vertical alignment consists out of three sag curves and four crest curves. The sag curves K-values are between 8 and 120.255. The minimum K-value needs to be 8 for a sag curve. Thus the values according to

the design are according to the proposed design criteria. The crest curve K-values are ranging from 16 to 1500. The proposed value is 16. The design thus also complies with the minimum proposed K-value.

4.3 Land Acquisition

The proposed new bridge and access roads is situated over various properties that must be acquired by the Municipality. Figure 4-10 below provides the locality of the proposed alignment of access roads and bridge position. It also provides the locality of the properties that must be acquired.

Figure 4-10: Land acquisition option 1

The table 4-1 show the effected properties and the owner of each property.

Table 4-1: Effected Properties

Properties effected by the project		
MMM	**TRANSNET**	**OTHERS**
5052	1964	1124
21470	25/1964	1125
12/1964	31/1964	1126
20/1964	32/1964	1166
35/1964	RE/1964	1175
		1176
		1478
		1479
		1480
		13390
		13465
		21486
		22096
		1/1119
		36/1964
		37/1964
		38/1964
		39/1964
		40/1964
		41/1964
		42/1964
		43/1964
		45/1964
		46/1964
		47/1964
		48/1964
		49/1964

This report focuses on acquiring the following properties: 1478, 1479, 1480.

4.4 Costs for option 1

4.4.1 Buy out of properties 1478, 1479 & 1480

The approved costs are summarised below (VAT Excluded).

- Approved construction cost R246 531 300.90
- Approved Professional Fees R 34 515 782.46

It must however be noted that the current appointment from National Treasury for professional fees is only up to stage 4.1.

Approved budget (Excl. VAT)	**Sub Total**	**R 281,057,083.36**

There are three business properties that must be acquired for the alignment as indicated in Figure 4-10. Property 1478 is the Bosch franchise and 1479 and 1480 are one owner running a scrap yard.

Mackenzie Properties		
1478 – Bosch		**R30,000,000.00**
1479 – Scrap Yard		**R 9,100,000.00**
1480 – Scrap Yard		**Included**
	Sub Total	**R39,100,000.00**

Note: Costs indicated in table above is estimated figures based on available information available from MMM and must be confirmed during the negotiation phase.

Additional cost to facilitate the acquisition of the property and completing all the legal requirements:

Additional Costs		
Lawyer (Property Administration)		**R 2,080,000.00**
	Sub Total	**R 2,080,000.00**

The TOTAL cost for **Option 1 - Buy out of properties 1478, 1479 & 1480** is **R 322,237,083.00** (Excl. VAT).

4.4.2 Relocate of business entities on erven 1478, 1479 & 1480

The approved costs are summarised below (VAT Excluded).

- Approved construction cost R246 531 300.90
- Approved Professional Fees R 34 515 782.46

It must however be noted that the current appointment from National Treasury for professional fees is only up to stage 4.1.

Approved budget (Excl. VAT)	**Sub Total**	**R 281,057,083.36**

The other scenario that was looked at was the relocation of the business entities to suitable properties in the area. Figure 4-11 indicates new township development that could be carried out on the acquired property and the other available open areas. properties that could be developed once the road construction is completed.

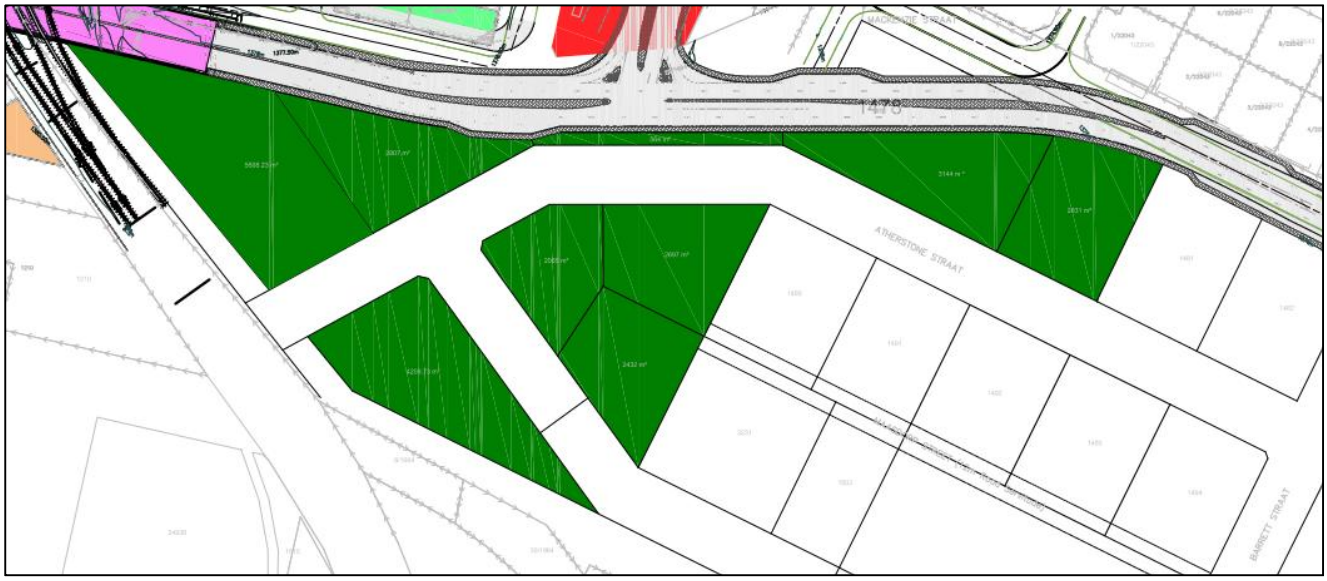

Figure 4-11 – New township development options

The cost of the relocation is as follows:

Mackenzie Properties		
1478 – Bosch – Consolidate Erf		**R10,000,000.00**
1479 – Scrap Yard – Relocate to new site		**R 5,500,000.00**
1480 – Scrap Yard		**Included**
	Sub Total	**R15,500,000.00**

Note: Costs indicated in table above is estimated figures based on available information available from MMM and must be confirmed during the negotiation phase.

Additional cost for township development:

Additional Costs		
Lawyer (Property Administration)		**R 2,080,000.00**
Town Planning		**R 950,000.00**
Services – Road		**R 6,500,000.00**
Services – Water Sewer		**R 3,500,000.00**
Survey		**R 45,000.00**
Geotechnical		**R 35,000.00**
	Sub Total	**R 13,110,000.00**

The TOTAL cost for **Option 1 - Relocate of properties 1478, 1479 & 1480** is **R 309,667,083.00** (Excl. VAT).

The selling of the remaining erven is not taken into consideration.

5 Alignment Option 2

5.1 Alignment characteristics

This alignment option is also linking St Georges street with Mackenzie Street with a proposed road over rail bridge. The proposed Transnet road also intersects with the proposed alignment. The Transnet Road connects the National Road, N8 with the proposed road upgrade.

Figure 5-1: Option 2 proposed alignment.

Figure 5-2: Corner Hermanus Street and Armstrong Street

Figure 5-3: Intersection Hermanus Street and Nathan Street crossing over old side of Transnet

Figure 5-4: View from old railway line of Transnet towards Mackenzie Street

5.2 Design characteristics

5.2.1 Design speed

The design speed of 60km/h as chosen was used during this design. There was no reason to adjust the design speed for the proposed alignment.

5.2.2 Stopping sight distance (SSD)

Only a preliminary design was done on this option. The proposed alignment does not seem to have an issue with regard to the stopping sight distance.

5.2.3 Horizontal curve radius

The horizontal alignment of the Transnet Road linking the N8 with MacKenzie consisted of one horizontal curve, this had to be increased to three horizontal curves. The minimum recommended radius is 150m at a superelevation of 4%. The minimum curve radius on the Transnet alignment had to be altered by the 30% allowed for by the UTG from 150m to 105m. The radii used range from 105m to 150m. It is however not recommended to reduce the radii by 30% as this is an arterial route.

The St Georges Street/ MacKenzie Street still have three horizontal curves on the alignment which ranges from 150m to 337.882m.

5.2.4 Vertical curvature

The preliminary Vertical alignment for the St Georges Street / MacKenzie Street section did not change significantly from option 1 with all the K-values within allowable ranges with regards to the proposed design standards.

The Transnet Road's vertical alignment preliminary design also shows no problem with regards to obtaining suitable K-values for the crest and sag curves.

5.3 Land Acquisition

The proposed new bridge and access roads is situated over various properties that must be acquired by the Municipality. Figure 5-5 provides the position of the proposed alignment of the access roads and bridge position. It also provides the locality of the properties that must be acquired.

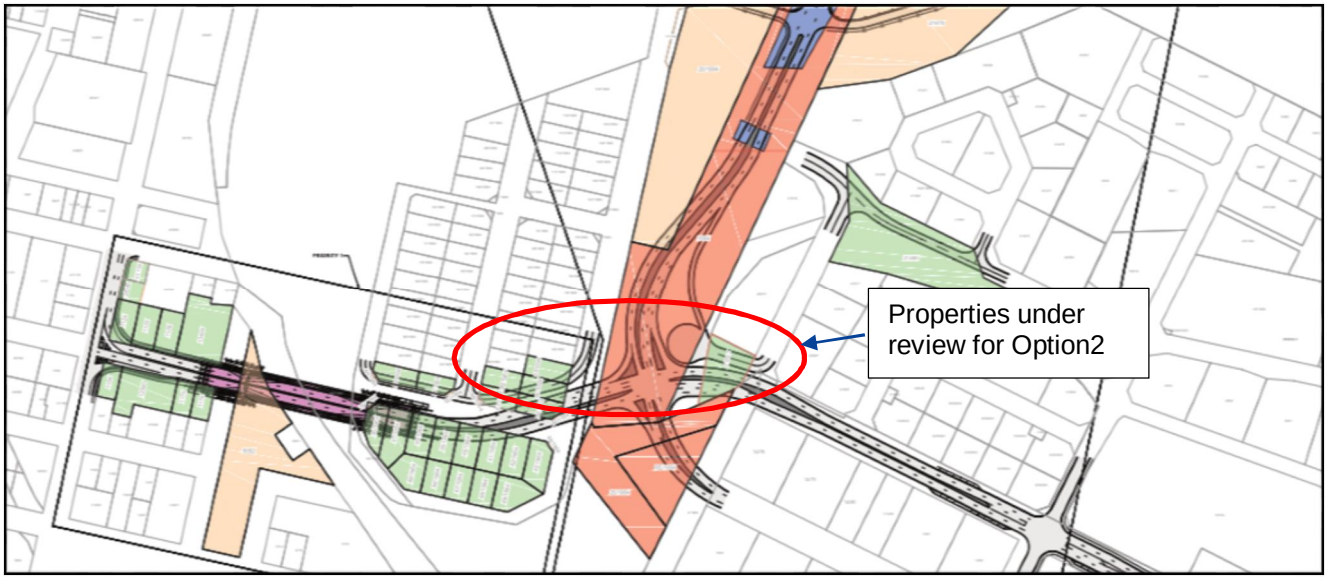

Figure 5-5: Land acquisition option 2

Table 5-1 shows the effected properties and the owners of each property.

Table 5-1 - Effected Properties

Properties effected by the project		
MMM	**TRANSNET**	**OTHERS**
5052	1964	1124
20/1964	25/1964	1125
44/1964	31/1964	1126
62/1964	32/1964	1166
64/1964	RE/1964	1175
RES/654		1176
		3295
		13390
		13465
		21512
		22096
		1/1119
		36/1964
		37/1964
		38/1964
		39/1964
		40/1964
		41/1964
		42/1964
		43/1964
		45/1964
		46/1964
		47/1964
		48/1964
		49/1964
		61/1964
		63/1964

This report focuses on acquiring the following properties: 21512, 89/1964, 84/1964, and 83/1964.

5.4 Costs for option 2

5.4.1 Buy out of properties 21512, 89/1964, 84/1964, and 83/1964

The approved costs are summarised below (VAT Excluded).

- Approved construction cost R246 531 300.90
- Approved Professional Fees R 34 515 782.46

It must however be noted that the current appointment from National Treasury for professional fees is only up to stage 4.1.

Approved budget (Excl. VAT)	**Sub Total**	**R 281,057,083.36**

The required changes to the alignment and additional accesses road into the industrial area has a cost implication on the original estimate of option1.

Additional cost due to realignment and additional road		
New alignment and additional access road		**R 5,000,000.00**
	Sub Total	**R 5,000,000.00**

There is one business property that must be acquired for the alignment as indicated in figure 6. There are also an additional three residential properties that must be acquired in Buitesig other than that allowed for in the option1 design. They are 89/1964, 84/1964, and 83/1964ro Property 21512 is the Bosch franchise and 1479 and 1480 are one owner running a scrap yard.

MacKenzie Properties		
21512		**R20,000,000.00**
83/1964		**R 500,000.00**
84/1964		**R 500,000.00**
89/1964		**R 500,000.00**
	Sub Total	**R21,500,000.00**

¨ Note: Costs indicated in table above is estimated figures based on available information available from MMM and must be confirmed during the negotiation phase.

Additional cost to facilitate the acquisition of the property and completing all the legal requirements:

Additional Costs		
Lawyer (Property Administration)		**R 2,080,000.00**
	Sub Total	**R 2,080,000.00**

The TOTAL cost for **Option 2 - Buy out of properties 21512, 89/1964, 84/1964, and 83/1964 is R 309,637,083.36** (Excl. VAT)

5.4.2 Relocate of business entity on erven 21512

The approved costs are summarised below (VAT Excluded).

- Approved construction cost R246 531 300.90
- Approved Professional Fees R 34 515 782.46

It must however be noted that the current appointment from National Treasury for professional fees is only up to stage 4.1.

Approved budget (Excl. VAT)	**Sub Total**	**R 281,057,083.36**

The other scenario that was looked at was the relocation of the business entity to a suitable property in the area. New township development that could be carried out on areas that are not utilized could be developed once the road construction is completed.

Figure 5-6: New township development options

The required changes to the alignment and additional access road into the industrial area has a cost implication on the original estimate of option1.

Additional cost due to realignment and additional road		

New alignment and additional access road		**R 5,000,000.00**
	Sub Total	**R 5,000,000.00**

The cost of the relocation is as follows:

Mackenzie Properties		
21512 – Auto Gear – Relocate		**R 7,500,000.00**
83/1964 – Private property - buy out		**R 500,000.00**
84/1964– Private property - buy out		**R 500,000.00**
89/1964– Private property - buy out		**R 500,000.00**
	Sub Total	**R 9,000,000.00**

Additional cost for township development:

Additional Costs		
Lawyer (Property Administration)		**R 2,080,000.00**
Town Planning		**R 950,000.00**
Services – Road		**R 6,500,000.00**
Services – Water Sewer		**R 3,500,000.00**
Survey		**R 45,000.00**
Geotechnical		**R 35,000.00**
	Sub Total	**R 13,110,000.00**

The TOTAL cost for **Option 2 - Relocate of properties 21512** and buy out of properties **1478, 1479 & 1480** is **R 308,167,083.36** (Excl. VAT).

The selling of the remaining erven is not taken into consideration.

6 Alignment Option 3

6.1 Alignment characteristics

The alignment links St Georges Street with a Road-over-Rail bridge with Atherstone Street. A new intersection between Atherstone Street and Mc Gregor Street needs to be designed. MacKenzie Street also needs to be relocated to intersect with the new intersection.

Figure 6-1: Option 3 proposed alignment

Figure 6-2: View from the intersection of Maroela and Atherstone towards McGregor

Figure 6-3: View from the intersection of Barret Kraal Street and Atherstone Street towards McGregor Street

Figure 6-4: View in Atherstone of existing entrances

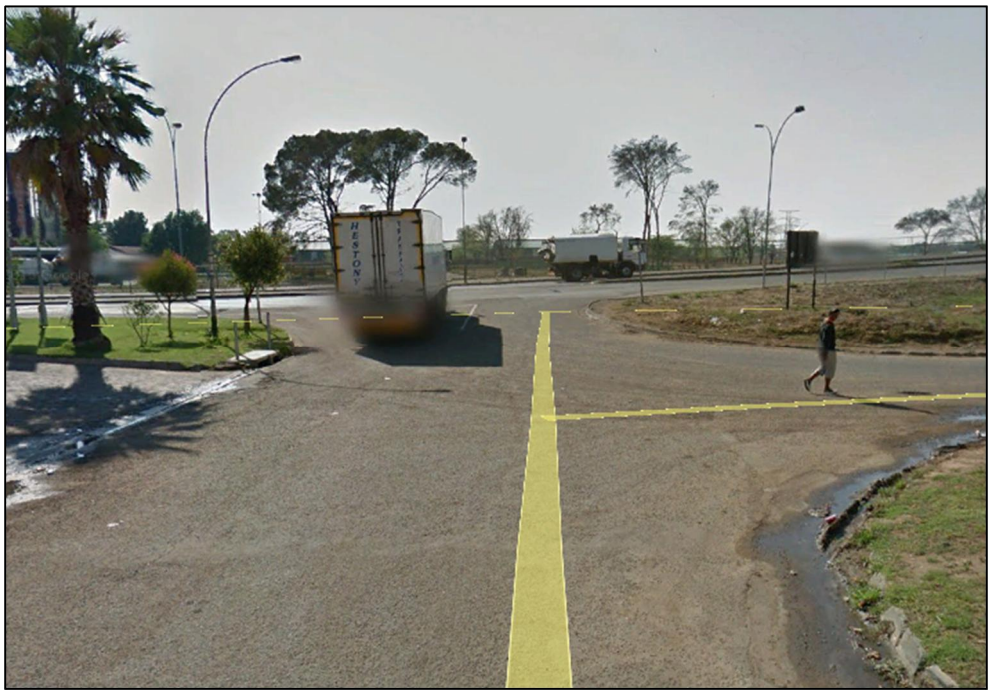

Figure 6-5: Intersection of Atherstone Street with McGregor Street.

Figure 6-6: Intersection of Atherstone Street and McGregor Street looking towards Mackenzie Street

6.2 Design characteristics

6.2.1 Design speed

The design speed of 60km/h as chosen was used during this design. There was no reason to adjust the design speed for the proposed alignment.

6.2.2 Stopping sight distance (SSD)

Only a preliminary design was done on this option. The proposed alignment does not seem to have an issue with regard to the stopping sight distance. Mc Gregor Street does not have any sight distance issues as it is constructed at the moment. Figure 6-8 indicates the stopping sight distance of Mc Gregor Street as it is without any alterations done to the vertical alignment.

Figure 6-7: Intersection of Atherstone Street and McGregor Street looking towards existing railway bridge

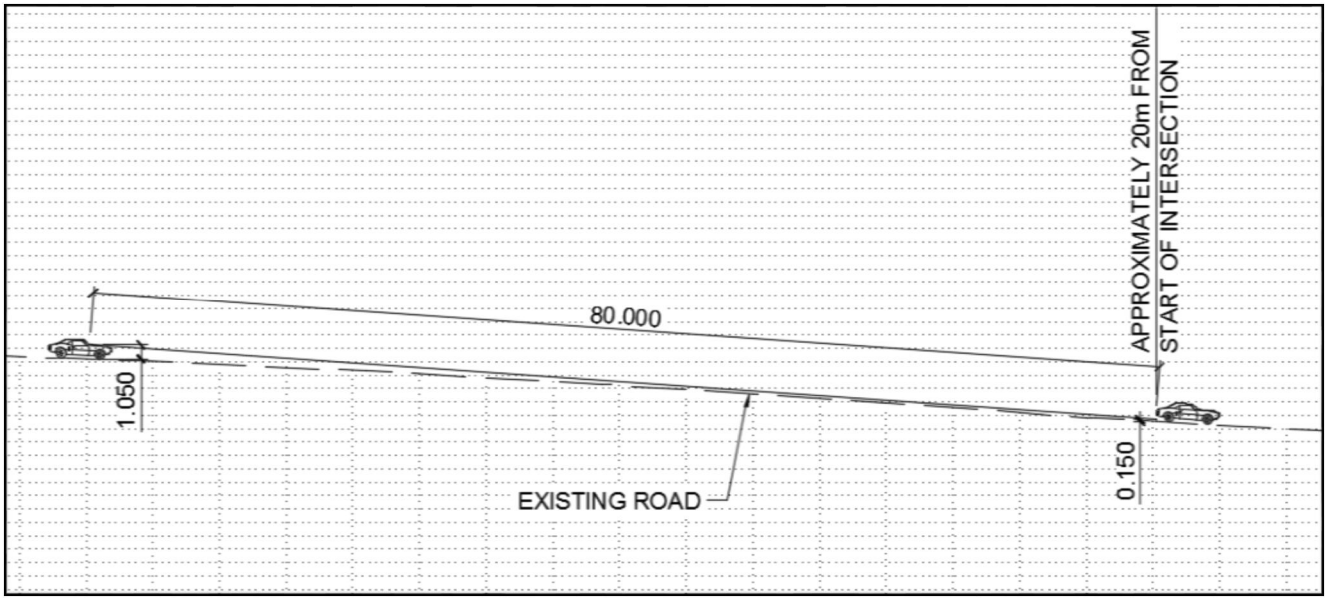

Figure 6-8: Stopping sight distance of Mc Gregor Street before the proposed intersection.

To increase the situation for the intersection the vertical alignment will have to be amended. The alignment is raised by approximately 500mm to ensure that the grade 20m before the start of the intersection is at a 4%. This will assist with the stopping of vehicles in wet weather.

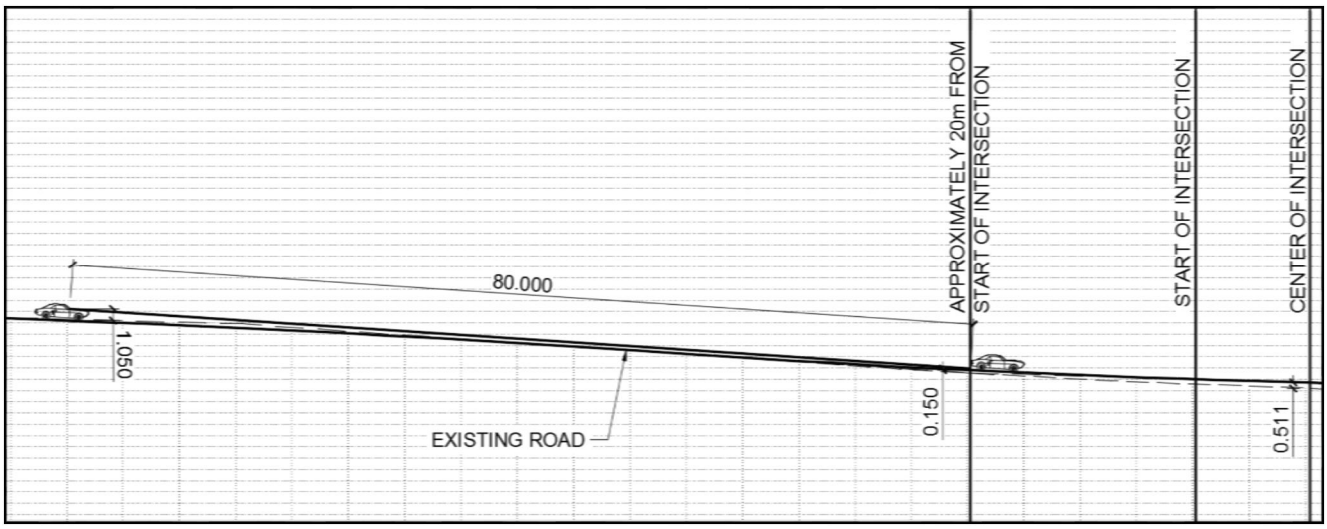

Figure 6-9: Stopping sight distance of Mc Gregor Street and the proposed intersection with raised vertical alignment.

6.2.3 Horizontal curve radius

This alignment provides a more direct route from the road over rail bridge to the intersection with Mc Gregor Street with only one horizontal curve. A s-curve is needed to re-align MacKenzie Street to the new intersection. All of the horizontal curves are larger than the proposed standard of 150m. The curves are ranging from 210m to 400m.

6.2.4 Vertical curvature

The preliminary vertical alignment done from St Georges Street to MacKenzie Street does not have any difficulty to conform with the proposed design standards. The amendment on the existing vertical alignment of Mc Gregor Street discussed in paragraph 6.2.3 would also confirm to the proposed design standards.

Figure 6-10: View of Engen garage on the corner of Atherstone Street and McGregor Street

Figure 6-11 provides layout of property 3292 which is an existing Engen service station. The impact of the raised McGregor street vertical alignment with regards to the entrances of the service station were assessed.

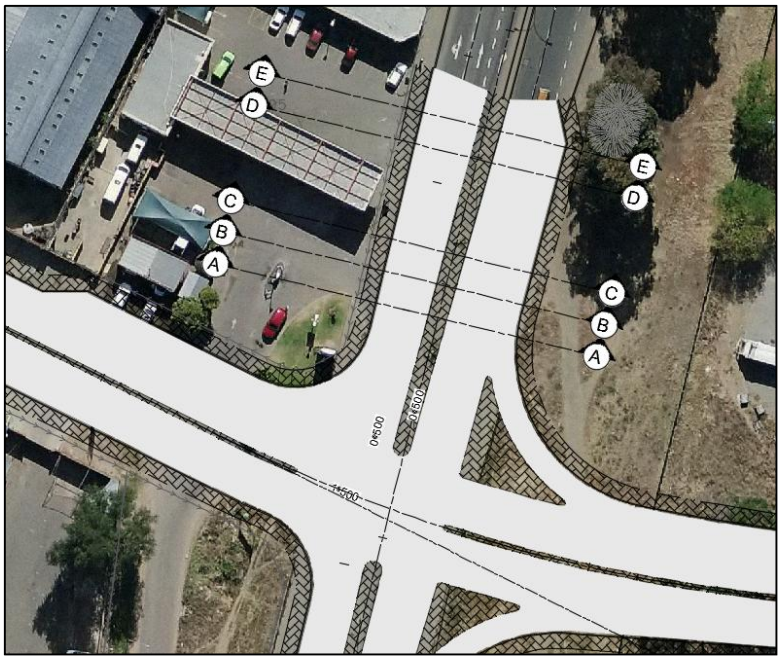

Figure 6-11: Property 3292 on the corner of McGregor and Atherstone street

The entrances could be raised and would not exceed the maximum slope of 10%. Cross sections were done on the left hand side of McGregor street next to the property in question and are shown in the Figure 6- 12.

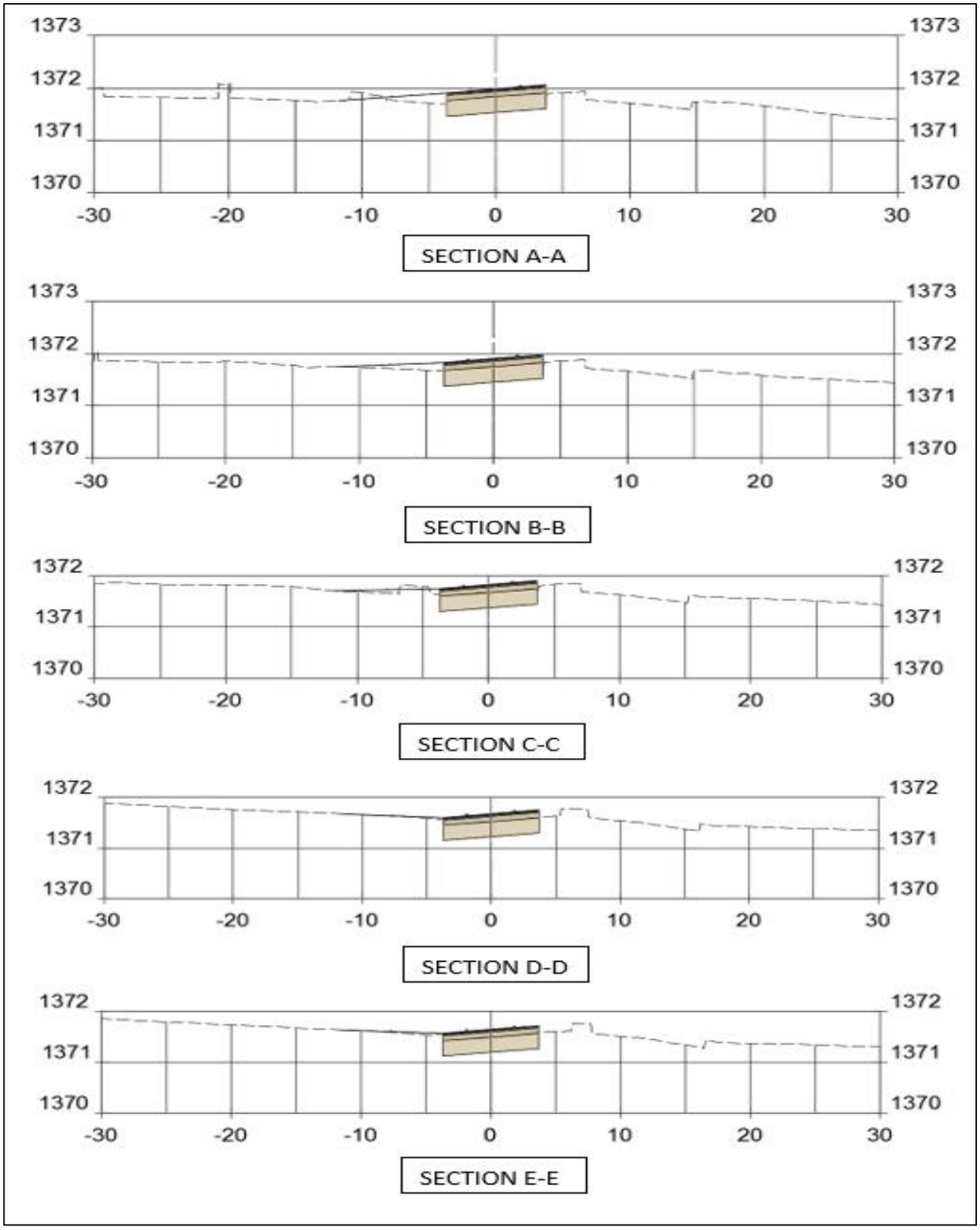

Figure 6-12: Cross sections

Drainage will be provided along McGregor Street to make sure that the storm water does not flow into the property. Unfortunately, the only problem which exists is that the wash-bay of the service station is in the way of the intersection's left turn lane. The wash-bay would have to be removed or relocated.

6.3 Land Acquisition

Figure 6-13 provides the locality of the proposed alignment of access roads and bridge position. It also provides the locality of the properties that must be acquired. No new private properties are affected by this option.

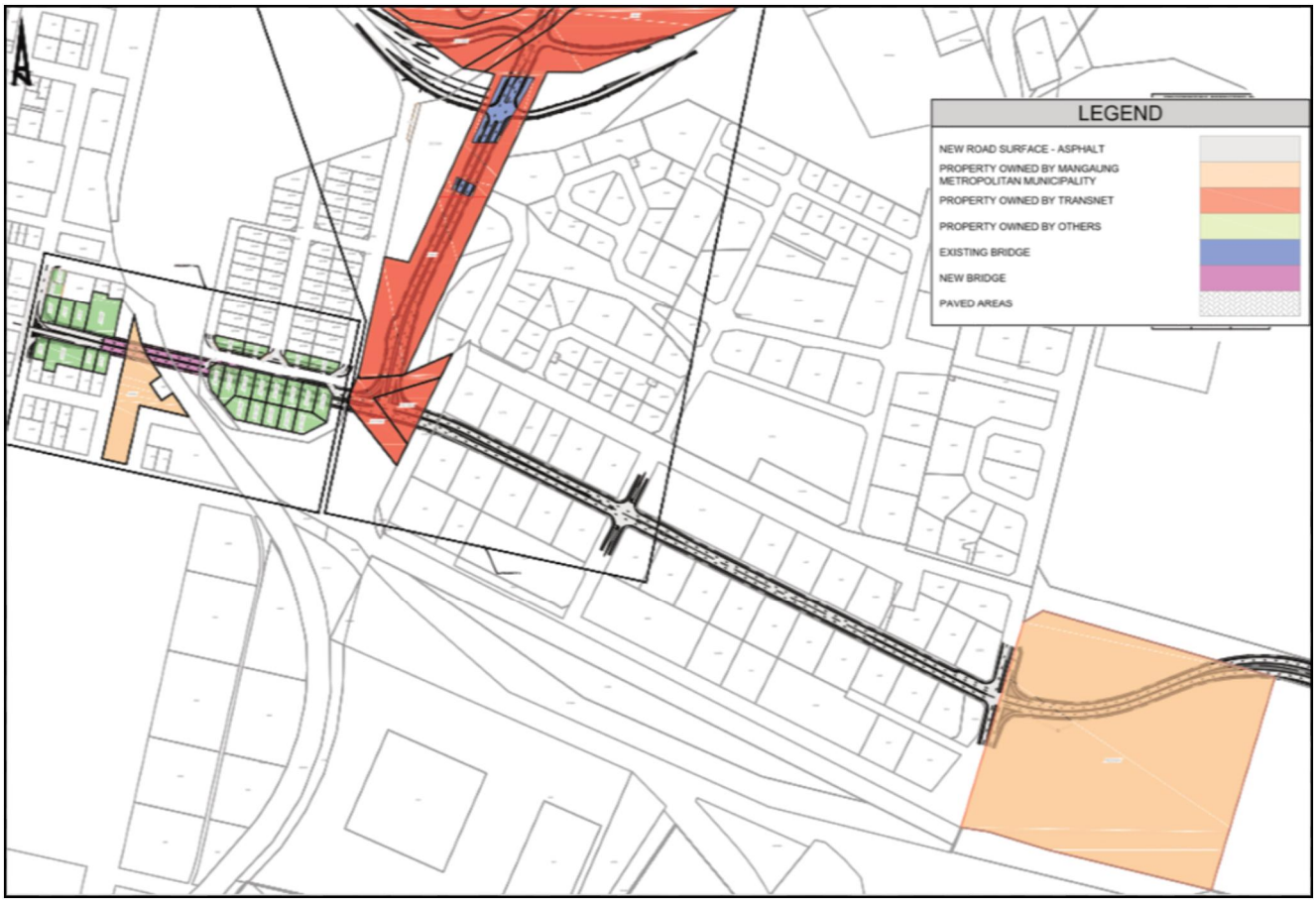

Figure 6-13: Land acquisition option 3

The only affected property is erfen 1/1459 which is utilising a portion of Atherstone street. The agreement that the owner has with the Municipality must be determined (See Figure 6-14).

Figure 6-14: View in Atherstone Street being occupied by AFROX, owner of property 1/1459

The parking layout of the Solid Waste Management Facility on the corner of McKenzie/McGregor Street must be revised or the property must be relocated (See Figure 6-15).

Figure 6-15: Intersection of Atherstone Street and McGregor Street looking towards Municipal Solid Waste Management Centre.

6.4 Costs for option 3

6.4.1 Atherstone Street

The approved costs are summarised below (VAT Excluded).

- Approved construction cost R246 531 300.90
- Approved Professional Fees R 34 515 782.46

It must however be noted that the current appointment from National Treasury for professional fees is only up to stage 4.1.

Approved budget (Excl. VAT)	**Sub Total**	**R 281,057,083.36**

There are no additional properties that must be acquired for the alignment as indicated in Figure 6-13.

Additional cost for the design and construction the new Atherstone street:

Additional Costs		
Estimated construction cost		**R 31,000,000.00**
Professional Fees (7.71%)		**R 2,390,100.00**
Lawyer (Property Administration)		**R 2,080,000.00**
Afrox investigation / Compensation		**R 1,000,000.00**
Survey		**R 45,000.00**
Geotechnical		**R 35,000.00**
Traffic modelling (Vissim)		**R 45,000.00**
	Sub Total	**R 36,595,100.00**

An amount of R19,500,000.00 was allowed for in Option1 for changes and reconstruction to MacKenzie from Maroela street to McGregor Street that will not be required if this option is accepted.

The TOTAL cost for **Option 3 – Atherstone street** is **R 298,152,183.36** (Excl. VAT).

7. Summary

The three options meet all the design criteria.

Option 1 has the longest horizontal radii and best intersection layouts but due to the properties that must be acquired is the most expensive and will take the longest to go out on tender. The relocation of the existing businesses that must be acquired to new erven could also be considered. There are numerous accesses to businesses that are operational that cannot be closed during the construction period. Existing services are also a major concern when rehabilitating MacKenzie Street.

Option 2 has the smallest horizontal radii coming over the bridge and linking with MacKenzie Street and as well as on the new road to be constructed to the N8. Earthworks for this option is also a lot more than option 1 and 3 hence the additional cost for revised alignment. There is one business stand and three additional private residential properties that must be acquired that influence overall cost of the option and an increased time frame for the construction to commence. The relocation of the existing business that must be acquired to new erven could also be considered. There are numerous accesses to businesses that are operational that cannot be closed during the construction period. Existing services are also a major concern when rehabilitating MacKenzie Street.

The radii for option 3 falls between that of option 1 and option 2. No new properties need to be acquired. There is some realignment required of the access into the property operating as a filling station on the corner of Atherstone and McGregor Streets. Additional warning signs over the Road-over-Rail bridge on McGregor Street will have to be installed informing motorists of the new signalised intersection at Atherstone street. Alterations to the layout of the Municipal Waste Management Centre will be required if this option is accepted. There are only a few accesses along Atherstone Street to contend with during the construction phase as well as very few existing services could be expected.

Table 7-1

Option	Description	Cost (Excl. VAT)
Option 1	Buy out of properties 1478, 1479 & 1480	R 322,237,083.00
Option 1	Relocate of properties 1478, 1479 & 1480	R 309,667,083.00
Option 2	Buy out of properties 21512, 89/1964, 84/1964, and 83/1964	R 309,637,083.36
Option2	Relocate of properties 21512 and buy out of properties 1478, 1479 & 1480	R 308,167,083.36
Option 3	Atherstone street	R 298,152,183.36

Option 3 is the most cost effective and will have the shortest time laps before construction can commence.

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