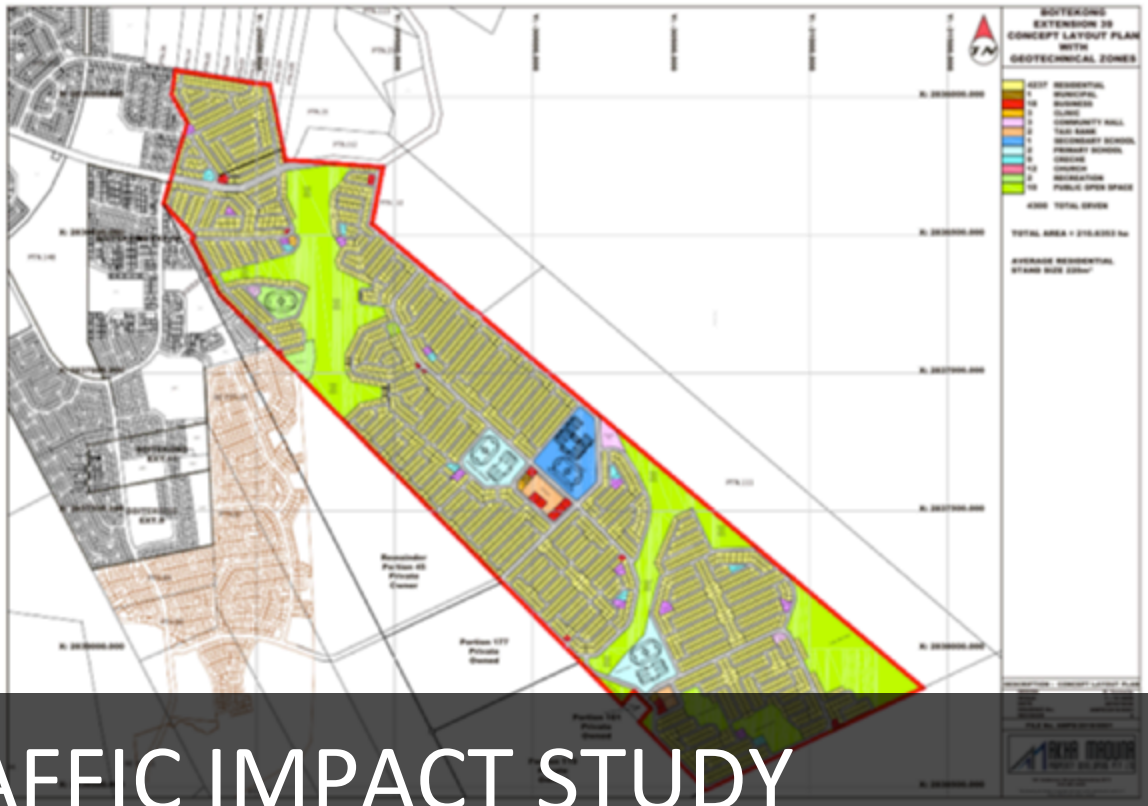

TRAFFIC IMPACT STUDY

TOWNSHIP ESTABLISHMENT FOR PROPOSED POPO MOLEFE INFORMAL SETTLEMENT (BOITEKONG EXT 39) IN RUSTENBURG MUNICIPALITY

CLIENT:

AKHA MADUNA PROPERTY DEVELOPERS
14 LIVING STONE STREET
VRYBURG

PREPARED BY:

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Rev 01

11th November 2019

CC Group Proprietary Limited
2016/143846/07

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2016/143848/07

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TABLE OF CONTENTS

| **Physical:** 251 Timbavati St, Moreleta Park, Pretoria 0181|
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List of Tables

List of Figures

| **Physical:** 251 Timbavati St, Moreleta Park, Pretoria 0181|
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DECLARATION

I certify that this TRAFFIC IMPACT STUDY – **POPO MOLEFE INFORMAL SETTLEMENT (BOITEKONG EXT 39) IN RUSTENBURG LOCAL MUNICIPALITY** was prepared by me according to the requirements of the South African Traffic and Site Traffic Assessment Manual and I have experience and training in the field of traffic and transportation engineering.

Signed……..

Date: 11 November 2019

Name	:	**Abraham Mukokanduku (PrEngTech; PrCPM)**
Qualification	:	**B.Sc. Hons Civil Engineering**
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1. INTRODUCTION

1.1. BACKGROUND

CC Group (Pty) Ltd was appointed by Akha Maduna Property Developers (Pty) Ltd in August 2019 to conduct a traffic impact assessment for Township Establishment for proposed Popo Molefe Informal Settlement (Boitekong Ext 39) in Rustenburg Local Municipality, within the Bojanala Platinum District Municipality in the North West Province.

There is an informal settlement on the proposed property and 4,300 stands have been proposed by the Town Planners for the development – in which 4,237 stands are residential.

CC Group (Pty) Ltd conducted traffic assessment at three traffic intersections as follows:

- Intersection A – R510 & Molapo Drive (25°38'02.09"S; 27°15'52.26"E),
- Intersection B – Molapo Drive & Egoli Street (25°38'01.42"S; 27°17'07.42"E), and
- Intersection C- Molapo Drive & Unknown Gravel Rd (25°38'00.13"S; 27°17'35.34 "E). for a one day manual count (Monday)

1.2. METHODOLOGY

The guidelines as outlined in the TMH 16 Vol 1 – South African traffic Impact and Site Assessment Manual were followed. Guidelines as set by the Rustenburg Local Municipality were not adopted.

In detail, the methodology followed is outlined below:

- From the one-day manual traffic count conducted at Intersection A, Intersection B and Intersection C on a weekday (Monday) current traffic flow patterns were obtained, affected accesses were noted;
- Based on TMH 17 Vol. 1 – South African Trip Data Manual, trips that will be generated by the development using applicable trip generation rates as specified in the said manual were noted;
- Taking cognisance of the proposed traffic volumes existing routes were assessed against negative impacts in terms of traffic flow;
- Traffic operation, intersection safety and the existing road condition were assessed;
- Taking into account the major findings of this study conclusions and recommendations were made.

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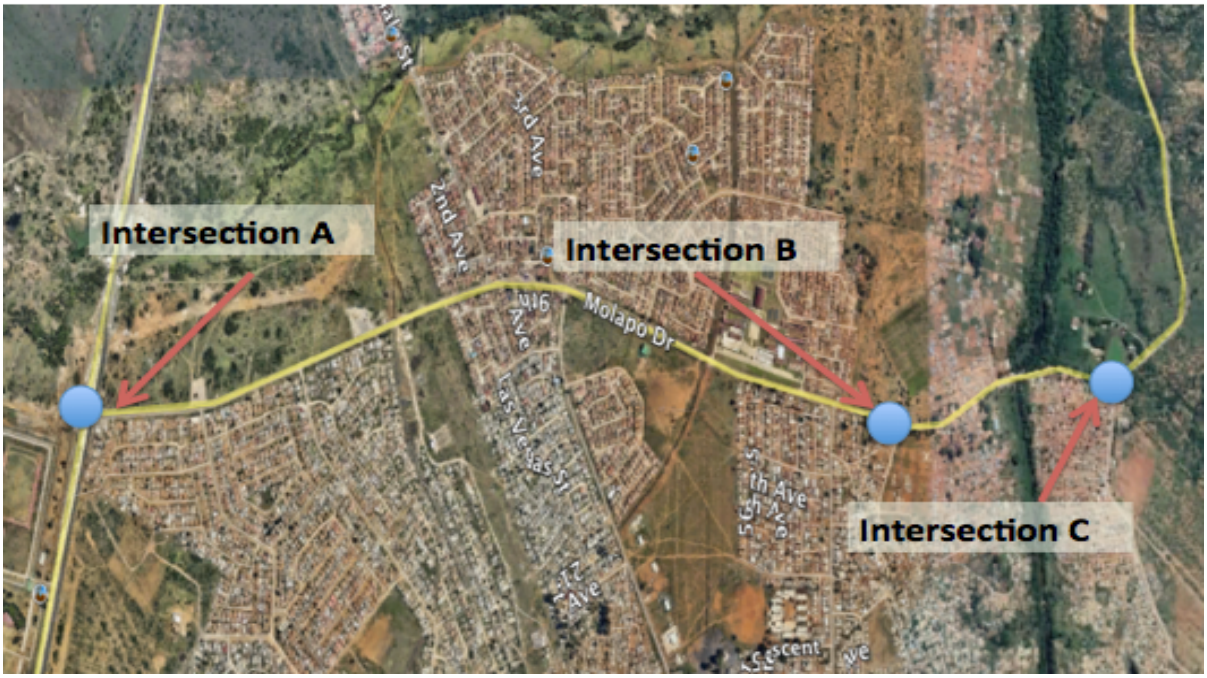
1.3. STUDY AREA

The informal settlement is on the west of Boitekong Ext 9, 10 and 11 with the main access from Molapo Drive.



Intersection Overview

Intersection **B** Molapo & Egoli Street

Intersection **C**- Molapo and Unknown Road

Figure 1 - Intersection Overview and Layout

The following intersections were investigated:

- R510 and Molapo Drive – a Three Way-signal Controlled-Junction,
- Molapo Drive and Egoli Street – a One Way-Stop Sign Controlled-Junction,
- Molapo Drive and Intersection at 25°38'00,13"S; 27°17'35.34 "E – a Three Give-Way Sign Controlled - Junction,

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- Site Access against Generated traffic.

The Intersection, R510 and Molapo Drive, connects to the proposed development, which is a direct route to Popo Molefe from Rustenburg, hence, a very busy intersection. By mere visual assessment on site there is no need to upgrade the signal-controlled intersection. From Rustenburg there are dedicated left and right turn lanes, with the dedicated green time for right turn. Note that the traffic lights were not working at the time of the Traffic Assessment on site.

Figure 2 - Descriptive intersection Layout

The main intersection under investigation is a 3-Give way-sign controlled-junction, with Molapo Drive being the main arterial road serving Popo Molefe and the greater part of Boitekong Communities (ext. 9, 10 and 11).On the proposed location for the development, there are informal shelters and shelters for street vendors.

In general, the area is currently being utilised for both residential and commercial purposes, with social amenities around the study area i.e. several guesthouses and Schools along the western side in close proximity to Popo Molefe Proposed Development.

Molapo Drive connects to R510, which gives access to other communities of big business interest such as Boitekong Ext 9,10 and 11. It can be assumed that any developments in those areas will generate more traffic on R510 and subsequently, at lower margins on Molapo Drive.

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However, there is a gravel road, referred to as Unknown Rd (Gravel Rd on Figure 1 above), at the North Eastern Bordering the proposed development from Molapo Drive, leading to the rest of the development and a Cemetery, which can be the preferred access to serve the proposed development. These Junctions will be analysed under traffic generated analysis, as assumed to be the preferred access and how much impact will they have on the main Junction A i.e. Cnr R510 and Molapo Drive.

There is no construction noticed that is happening besides the need of a proper taxi rank in the area for easy access to public transportation refer to Annexure A – Onsite Photos.

2. EXISTING TRAFFIC AND OPERATION SCENARIO

Traffic counts over the one-day period were conducted along both the adjacent roads on the 28th October 2019. The manual counts are attached on Annexure B and Sidra Analysis was conducted on Annexure C.

The R510/Molapo Drive junction is a signal-controlled intersection with concrete paved sidewalks on semi-mountable kerbs for stormwater drainage on tri-lateral-sides of the intersection. There is a semi-mountable kerbing along the preferred access road for stormwater.

Molapo Drive is a single carriageway with one lane in each direction, with a dedicated right turn lane with assumed dual 45sec green time and 65 sec red-time with R510. Also to note is the existing pedestrian walkways and no covered public transport facilities along the R510 to the North and South of the intersection. Figure 2 above illustartes the layout of the intersection together with associated facilities.

3. TRAFFIC DEMAND

3.1. Existing Traffic Condition

There is a total of 4 565 vehicles traversing on Molapo Drive with a total of 2 420 vehicles from Rustenburg side for Monday, and 271 veh/day from Kanana with a huge traffic flow of 1687 veh/day R510 turning right onto Molapo Drive, and a low traffic flow of 189 veh/day from Molapo Drive towards Kanana area. An average growth rate of 3,5% per annum for

urban area is utilised in the general traffic analysis. The R510 is classified as RISFSA Class R3 – Minor Arterial Road.

3.2. Existing Road Condition

The R510 and Molapo Drive intersection marks the first major intersection from Rustenburg towards Kanana on the provincial road R510.

In terms of cracking, Molapo Drive and the adjacent Egoli Street can be classified, as low to very low that is <4%.

The Visual Condition Index categorises the extent of pavement distress with low % indicating high and visible distress and 100% indicating no signs of visual distress and hence road pavement in poor to very poor condition. The VCI can be assumed to be below 40% and hence the road pavement is deemed in poor condition and upgrades to road pavement envisaged and a must to cater for the Proposed Popo Molefe development.

No AADT information obatined from a Permanent counting station along R510 hence the manual count AADT attached here-in under Annexure B below which approximately 4565veh/day were used for analysis.

3.3. Traffic Redistribution

For 4,237 units proposed onto a below 2000veh/day/lane (i.e. 1876 vehicle flow), it is assumed that most residents will walk and averagely 60% will use private cars, and 5 508 veh/day including attracted and diverting will be generated. However, a redistribution of traffic is assumed to be of higher magnitude given the nature of development and its close proximity to intended potential dwellers in the informal settlement.

With reference to SATDM and TMH 17, the expected trip generation rate is below 65%, refer to Table 1 below.

Table 1– Trip generation

Description	**Size**	**Trip Generation Rate per size**		**In / Out**		**Trips**	
		AM	**PM**	**AM**	**PM**	**AM**	**PM**
Popo Molefe Informal Settlement	4,237 sites with 6 people /site	0.60	0.60	65:35	35:65	2 754	2 754
Total						**5 508**	

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3.4. Traffic Analysis Criteria

Quantification of the traffic operational conditions has been undertaken using appropriate technology with the results of the analysis for the design peak periods under existing conditions being tabulated below showing the traffic volumes used in the analysis. The criteria for assessment are principally delay and volume to capacity ratio (V/C Ratio). A V/C ratio of say 0.5 would represent 50% spare capacity and a ratio of 1.0 would represent conditions where the road or movement is operating at its maximum capacity (i.e. actual volume equals capacity), hence suggesting an intersection upgrade.

The concept of *levels of service* uses qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers

Delay is in turn expressed in terms of Level of Service (LOS). Level of service (LOS) is a commonly used traffic engineering criteria for assessing the quality of the traffic conditions on a road and can be applicable to two-way flow or specific single directional movements. Level of Service is a qualitative measure describing operational conditions with a traffic stream and their perception/tolerance by the driver and is stated in terms of a scale from A through F, with A displaying the highest quality and F the lowest, a point at which excessive delays occur. The LOS is dependent on certain average delay thresholds when applied to intersections.

3.4.1. Peak Hours

Peak Hours were noted to coincide with morning and afternoon peak periods as below:

- Morning Peak hours: 07:00 -09:00hrs and
- Afternoon Peak hours: 15:00 – 16:45hrs

3.4.2. Peak Hour Factor

A peak hour factor of 0.95 is utilised for analysis.

3.4.3. Study Years

The following years are noted for this study:

- 2019 Base Year; and
- 2024 Design horizon

A five-year limit is intended for short term planning, no long term planning i.e. was analysed.

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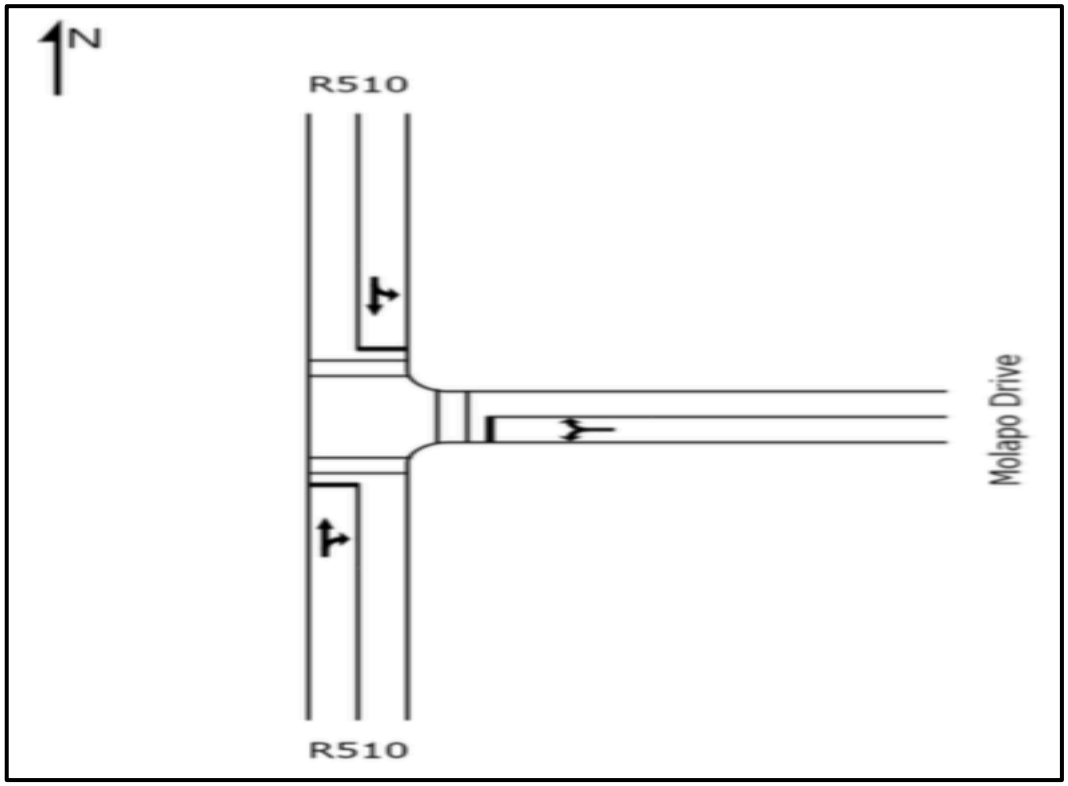

Figure 3– R510 and Molapo Existing intersection Layout

3.5. Existing Traffic Counts

The intersections were analysed in their current situation (layout). The results of the analysis of the operational efficiency of the selected intersections are tabulated below.

Table 2: Weekday (Monday) existing traffic conditions AM peak.

MOVEMENT SUMMARY

Site: R510 & Molapo DR- AM PEAK 1

R510 & Molap Dr AM Peak
Signals - Fixed Time Cycle Time = 40 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	321	5.0	0.592	9.9	LOS A	8.2	60.1	0.82	0.71	43.4
3	R	97	5.0	0.592	18.6	LOS B	8.2	60.1	0.82	0.89	42.0
Approach		418	5.0	0.593	11.9	LOS B	8.2	60.1	0.82	0.75	43.1
East: Molapo Drive											
4	L	72	0.0	0.150	20.5	LOS C	1.8	12.6	0.79	0.75	38.3
6	R	5	0.0	0.151	20.8	LOS C	1.8	12.6	0.79	0.76	38.3
Approach		77	0.0	0.150	20.5	LOS C	1.8	12.6	0.79	0.75	38.3
North: R510											
7	L	75	5.0	0.414	17.3	LOS B	6.2	45.0	0.74	0.87	42.7
8	T	254	5.0	0.414	8.9	LOS A	6.2	45.0	0.74	0.63	44.8
Approach		328	5.0	0.414	10.8	LOS B	6.2	45.0	0.74	0.68	44.3
All Vehicles		823	4.5	0.593	12.3	LOS B	8.2	60.1	0.78	0.72	43.1

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
P3	Across E approach	53	9.8	LOS A	0.0	0.0	0.70	0.70
P5	Across N approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
All Pedestrians		159	12.9				0.80	0.80

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

Processed: Friday, November 8, 2019 5:47:42 AM
SIDRA INTERSECTION 5.0.5.1510
Project: C:\Users\guest1\Documents\Molapo Township Development.sip

SIDRA INTERSECTION

The vehicle load rate is 823veh/hr for the AM peak, with 5% Heavy Traffic at an average delay of 12.3sec for an average speed of 43.1km/h culminating to LOS B.

Table 3: Weekday (Monday) existing traffic conditions PM peak.

MOVEMENT SUMMARY — **Site: R510 & Molapo Drive PM Peak**

R510 & Molapo Drive PM PEAK
Signals - Fixed Time Cycle Time = 40 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	392	5.0	0.705	12.0	LOS B	10.5	76.5	0.88	0.82	41.6
3	R	97	5.0	0.704	20.6	LOS C	10.5	76.5	0.88	0.95	40.6
Approach		488	5.0	0.705	13.7	LOS B	10.5	76.5	0.88	0.85	41.4
East: Molapo Drive											
4	L	2	0.0	0.105	20.3	LOS C	1.3	8.8	0.78	0.73	38.2
6	R	52	0.0	0.105	20.5	LOS C	1.3	8.8	0.78	0.74	38.2
Approach		54	0.0	0.105	20.5	LOS C	1.3	8.8	0.78	0.74	38.2
North: R510											
7	L	57	5.0	0.299	16.7	LOS B	4.4	32.1	0.70	0.87	43.0
8	T	180	5.0	0.299	8.4	LOS A	4.4	32.1	0.70	0.58	45.4
Approach		237	5.0	0.299	10.4	LOS B	4.4	32.1	0.70	0.65	44.8
All Vehicles		779	4.7	0.705	13.2	LOS B	10.5	76.5	0.81	0.78	42.1

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
P3	Across E approach	53	9.8	LOS A	0.0	0.0	0.70	0.70
P5	Across N approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
All Pedestrians		159	12.9				0.80	0.80

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

Processed: Friday, November 8, 2019 5:53:02 AM
SIDRA INTERSECTION 5.0.5.1510
Project: C:\Users\guest1\Documents\Molapo Township Development.sip

SIDRA INTERSECTION

The vehicle load rate is 779veh/hr for the PM peak, with 5% Heavy Traffic at an average delay of 13.2sec for an average speed of 42.1km/h culminating to LOS B.

The Volume/Capacity ratio indicates a maximum of 0.6 (**Lowest LOS C**) which shows the intersection operationg above 60%, and hence no need for an intersection upgrade. However, based on the safety issues noted during counting there is need for a raised median and a painted/lined zebra crossing.

Table 4: Weekday (Monday) existing traffic conditions AM peak.

MOVEMENT SUMMARY

Site: Molapo Drive & Unkown Road 1AM PEAK

Molapo Drive & Unkown Road 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown Road 1											
1	L	23	0.0	0.065	11.1	LOS B	0.3	2.2	0.04	0.93	46.0
3	R	37	0.0	0.065	10.9	LOS B	0.3	2.2	0.04	0.99	46.2
Approach		60	0.0	0.065	11.0	LOS B	0.3	2.2	0.04	0.97	46.1
East: Molapo Drive											
4	L	1	0.0	0.003	8.2	LOS A	0.0	0.0	0.00	0.98	49.0
5	T	5	0.0	0.003	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		6	0.0	0.003	1.4	LOS A	0.0	0.0	0.00	0.16	57.8
West: Molapo Drive											
11	T	68	0.0	0.039	0.0	LOS A	0.3	1.8	0.04	0.00	59.1
12	R	5	0.0	0.039	8.5	LOS A	0.3	1.8	0.04	1.10	48.7
Approach		74	0.0	0.039	0.6	LOS A	0.3	1.8	0.04	0.08	58.2
All Vehicles		140	0.0	0.065	5.1	NA	0.3	2.2	0.04	0.46	52.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Molapo Drive & Unkwon Rd 2 AM PEAK

Molapo Drive & Unkown Rd 2 AM Peak
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown Rd 2											
1	L	6	0.0	0.010	10.8	LOS B	0.0	0.3	0.09	0.91	46.3
3	R	4	0.0	0.010	10.6	LOS B	0.0	0.3	0.09	0.96	46.5
Approach		11	0.0	0.010	10.7	LOS B	0.0	0.3	0.09	0.93	46.4
East: Molapo Drive											
4	L	4	0.0	0.013	8.2	LOS A	0.0	0.0	0.00	0.98	49.0
5	T	20	0.0	0.013	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		24	0.0	0.013	1.4	LOS A	0.0	0.0	0.00	0.17	57.7
West: Molapo Drive											
11	T	5	0.0	0.004	0.1	LOS A	0.0	0.2	0.09	0.00	58.1
12	R	2	0.0	0.004	8.5	LOS A	0.0	0.2	0.09	0.92	48.6
Approach		7	0.0	0.004	2.5	LOS A	0.0	0.2	0.09	0.26	55.0
All Vehicles		42	0.0	0.013	3.9	NA	0.0	0.3	0.04	0.38	54.0

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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The vehicle load rate is 140veh/hr for the AM peak for Molapo and Egoli Street, with 0% Heavy Traffic at an average delay of 5.1sec for an average speed of 52.3km/h culminating to **LOS A.** It will be asumed that the AM and PM peak are directly proportional.The vehicle load rate is 42veh/hr for the AM peak for Molapo and Unknown Gravel Road, with 0% Heavy Traffic at an average delay of 3.9sec for an average speed of 54.0km/h culminating to **LOS A.**

There is no need to upgrade the intersections however, there is need to upgrade the road pavement condition as it is in poor to very poor state and ultimately the intersections.

4. FUTURE OPERATING CONDITIONS OF INTERSECTION

These assumptions were adopted:

- A phf factor of 0,95 for capacity analysis
- Queue lengths indicated are actually average lenghts.

For signalised intersections the following will apply:

Table 5: Performance measures for Signalised intersections.

Period	Maximum Volume/Capacity	Minimum Level of Service
	Left Turn /Through (Straight)	Right Turn
15min Peak	90%	95%

3.1 Traffic

Traffic growth is difficult to predict in this area. It is clear that the area has potential for residential and commercial development. Whilst traffic growth has been steady in recent years it is unlikely to continue at this rate in the medium to long-term. For this assessment, a 3,5% traffic growth over a 5-year horizon (2019 to 2024) has been applied to the existing traffic. It was noted that the traffic trends going forward will be much the same as at present with the addition of traffic growth. Only traffic for the day (Monday), as considered the highest was used for future traffic interpolation.

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Table 6 Monday 2024 Future traffic conditions AM peak.

MOVEMENT SUMMARY

Site: 510 & MOLAPO DRIVE FUTURE AM PEAK

R510 & Molapo Dr Future AM PEAk
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	417	5.0	0.780	15.0	LOS B	15.5	113.4	0.88	0.88	39.0
3	R	183	5.0	0.780	23.6	LOS C	15.5	113.4	0.88	1.00	38.1
Approach		600	5.0	0.780	17.7	LOS B	15.5	113.4	0.88	0.92	38.7
East: MOLAPO DR											
4	L	215	5.0	0.719	29.8	LOS C	9.4	68.9	0.97	0.89	33.0
6	R	95	5.0	0.719	30.0	LOS C	9.4	68.9	0.97	0.89	33.0
Approach		309	5.0	0.719	29.8	LOS C	9.4	68.9	0.97	0.89	33.0
North: R510											
7	L	142	5.0	0.297	15.8	LOS B	5.4	39.6	0.60	0.84	43.0
8	T	142	5.0	0.297	7.4	LOS A	5.4	39.6	0.60	0.51	46.1
Approach		284	5.0	0.297	11.6	LOS B	5.4	39.6	0.60	0.67	44.5
All Vehicles		1194	5.0	0.780	19.4	LOS B	15.5	113.4	0.84	0.85	38.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	18.5	LOS B	0.1	0.1	0.86	0.86
P3	Across E approach	53	8.4	LOS A	0.0	0.0	0.58	0.58
P5	Across N approach	53	18.5	LOS B	0.1	0.1	0.86	0.86
All Pedestrians		159	15.1				0.77	0.77

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

Table 7: Monday 2024 Future traffic conditions PM peak.

MOVEMENT SUMMARY

Site: R510 & MOLAPO DRIVE FUTURE PM PEAK

R510 & MOLAPO DR FUTURE PM PEAK
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	509	5.0	0.816	17.2	LOS B	20.8	151.6	0.87	0.89	37.7
3	R	183	5.0	0.816	25.8	LOS C	20.8	151.6	0.87	1.03	36.9
Approach		693	5.0	0.816	19.4	LOS B	20.8	151.6	0.87	0.93	37.5
East: MOLAPO DR											
4	L	155	5.0	0.791	38.4	LOS D	10.1	73.4	1.00	0.93	29.1
6	R	105	5.0	0.791	38.7	LOS D	10.1	73.4	1.00	0.93	29.1
Approach		260	5.0	0.791	38.5	LOS D	10.1	73.4	1.00	0.93	29.1
North: R510											
7	L	108	5.0	0.390	14.6	LOS B	8.3	60.8	0.54	0.91	44.4
8	T	340	5.0	0.390	6.3	LOS A	8.3	60.8	0.54	0.47	48.3
Approach		448	5.0	0.390	8.3	LOS A	8.3	60.8	0.54	0.58	47.3
All Vehicles		1401	5.0	0.816	19.4	LOS B	20.8	151.6	0.79	0.82	38.0

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	6.5	LOS A	0.0	0.0	0.47	0.47
P5	Across N approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	18.4				0.76	0.76

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).

The vehicle load rate is 1401veh/hr for the PM peak, with 5% Heavy Traffic at an average delay of 19.4sec for an average speed of 38.0km/h culminating to LOS B, and at peaks the LOS drops to LOS D. There will be an adition of 622 veh/hr.

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Table 8: Monday 2024 Future traffic conditions PM peak.

MOVEMENT SUMMARY

Site: Molapo Dr & Unkown Rd 1
FUTURE AM PEAK

Molapo Dr & Unkwon Rd 1 Future AM PEAK
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: unkown Rd Southbound											
1	L	79	5.0	0.238	14.0	LOS B	1.2	8.9	0.43	0.84	44.2
3	R	79	5.0	0.238	13.8	LOS B	1.2	8.9	0.43	1.00	44.4
Approach		158	5.0	0.238	13.9	LOS B	1.2	8.9	0.43	0.92	44.3
East: Molapo Eastbound											
4	L	26	5.0	0.095	8.3	LOS A	0.0	0.0	0.00	1.00	49.0
5	T	153	5.0	0.096	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		179	5.0	0.095	1.2	LOS A	0.0	0.0	0.00	0.15	58.1
West: Molapo Westbound											
11	T	151	5.0	0.132	0.8	LOS A	1.0	7.0	0.32	0.00	53.5
12	R	63	5.0	0.132	9.4	LOS A	1.0	7.0	0.32	0.86	48.6
Approach		214	5.0	0.132	3.4	LOS A	1.0	7.0	0.32	0.25	52.0
All Vehicles		551	5.0	0.238	5.7	NA	1.2	8.9	0.25	0.41	51.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

There must be noted that an increase on veh/hr from **140** to **551** is noted for future.

Table 9: **Monday 2024 Future traffic conditions PM peak.**

MOVEMENT SUMMARY — **Site: Molapo Dr & Unkwon Rd 2 FUTURE AM PEAK**

Molapo Dr & Unkwn Rd 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkwon Southbound											
1	L	38	0.0	0.066	11.1	LOS B	0.3	2.2	0.16	0.88	46.2
3	R	26	0.0	0.066	10.9	LOS B	0.3	2.2	0.16	0.94	46.4
Approach		64	0.0	0.066	11.0	LOS B	0.3	2.2	0.16	0.90	46.3
East: Molapo Dr Eastbound											
4	L	11	0.0	0.027	8.2	LOS A	0.0	0.0	0.00	0.96	49.0
5	T	42	0.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		53	0.0	0.027	1.6	LOS A	0.0	0.0	0.00	0.19	57.4
West: Molapo Dr Westbound											
11	T	21	0.0	0.021	0.2	LOS A	0.1	0.9	0.14	0.00	56.9
12	R	14	0.0	0.021	8.6	LOS A	0.1	0.9	0.14	0.84	48.5
Approach		35	0.0	0.021	3.5	LOS A	0.1	0.9	0.14	0.33	53.3
All Vehicles		152	0.0	0.066	6.0	NA	0.3	2.2	0.10	0.53	51.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

Though the LOS is stil A it must be noted that an increase on veh/hr from **40** to **152** is noted for future, and this inevitably calls for intersection upgrade to a two-way stop with right of way to traffic going straight along. However, for an average speed of 51.3km/hr traffic calming measures ought to be implored in terms of raised zebra crossing or rumble strips.

It is also proposed that traffic circles for Intersection B and C be envisaged and included in the municipal master plan, for implementation in the 2023/24 financial year.

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5. PUBLIC TRANSPORT AND PARKING

5.1. PUBLIC TRANSPORT

The proposed development will generate and attract public transport and provision must be made. However, public transport will or should be catered for within the municipal development. In light of the above, bus bays should be constructed.

Pedestrian movement is existing currently on the intersections. No further upgrades are needed due to the proposed developments, however safety issues are a concern to jaywalking by the residents mainly on Molapo Drive on the westernside of the intersection, a raised zebra crossing or barricaded walkway is proposed, this proposal is for future municipal development planning.

5.2. PROPOSED ROAD IMPROVEMENTS

There is a need for major improvements on and along Molapo Drive:

- The road width to be min 3.5m plus a 0.4m surfaced shoulder and 1.6m gravel shoulder;
- All culverts to have a raised wing-wall;
- A public taxi rank be constructed along Molapo Drive;
- Two (2) No. Traffic circles proposed for 2024 future year;
- Upgrade of existing traffic circle by the Sunrise View Primary and Secondary School;
- A two-way stop be upgraded at Molapo drive and Egoli street junction;
- A two-way stop be introduced at Molapo drive and Unknown Gravel junction; and
- The unknown gravel be upgraded to a paved or surfaced road as it is envisaged as the main tributary for the proposed development.

6. TRAFFIC ASSESSMENT

6.1. Traffic Operations

To ensure safe and satisfactory operations, a certain number of traffic related aspects relating to the development needs to be addressed. Roads mainly Molapo Drive require regular routine maintenance in the form of appropriate sidewalk, signage and road markings especially around the Sunrise View school.

The issue of the impact of construction-traffic during construction must be considered. During the construction phase large, heavy trucks, plant and equipment will be accessing the

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site. The impact on traffic operations will be that these vehicles, being large, take up the majority of the available roadway, particularly on roads that are only 11,0m wide. Opposing traffic will be faced with a reduction in safety and will be forced onto the verge. Whilst this condition cannot be quantified the situation will present itself to existing users on random basis. Construction traffic should where possible utilise the proposed detour during morning and afternoon off-peaks.

6.2. Access

6.2.1. Sight Distances and Visibility

When positioning an access it is important that the shoulder sight distance is adequate and meets or exceeds the minimum requirements for traffic safety reasons.

Normally the main item of concern for an un-signalised intersection is that of adequate shoulder sight distance (SSD**),** for this intersection shoulder sight distance isn't a concern since no new access is proposed. This is the distance along the road, which the driver of a vehicle exiting the access or turning right into the site needs to be able to see before pulling off from the stop line. The following table depicts the minimum shoulder sight distance requirements for light vehicles, a rigid truck (refuse vehicle, bus) and a heavy articulated truck for the two listed speeds below.

Table 10:Shoulder sight distance requirements (metres)

Vehicle Type	For Through Road Speed of:	
	40km/h	60km/h
Light vehicle (car, LDV, taxi)	75	115
Rigid vehicle (truck, bus)	130	180
Articulated truck	150	230

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7. CONCLUSIONS AND RECOMMENDATIONS

The proposed development can be supported from a traffic flow perspective.

7.1. RECOMMENDATIONS

Based on the conclusions above, it is further recommended that:

i) To ensure safe and satisfactory operations, routine maintenance for all roads and at intersections be identified along with improvements to road markings and signage;

ii) A raised median be introduced by the Municipality or Provincial Road, and such scope are not part of this proposed development.

iii) The potential of the 2024 traffic growth will require the intersections B and C to be upgraded/converted

iv) **Provided the above recommendations are adopted there is no reason of a traffic engineering nature why the proposed residential development should not be permitted to proceed.**

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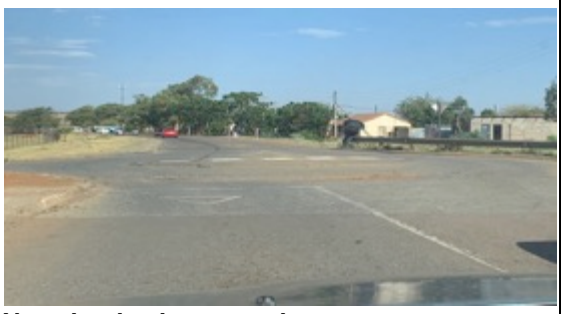
ANNEXURE A – ON SITE PHOTOS

R510 & Molapo Drive Junction

R510 & Molapo Drive Junction – Bus Median

Open space for Taxi Rank

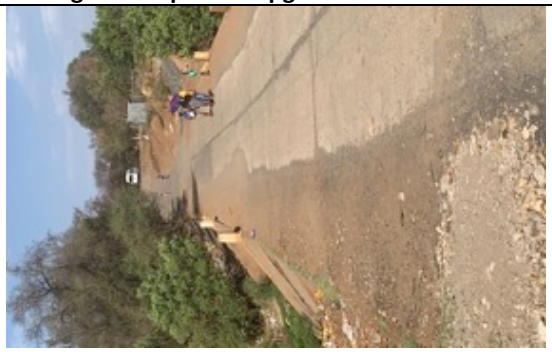


No raised zebra crossing

Circle to be upgraded esp. paving

Damaged Hump to be upgraded

Built-up Informal Settlements



Molapo Road surface in need of Upgrade

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Molapo & Unknown Rd Junction C

Molapo & Unknown Rd Junction C

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ANNEXURE B – MANUAL COUNTS

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Location - Molapo&R510							28/10/2019
12 Hour Count	TOTAL VEHICLES						Monday
AM PEAK	07:00 - 08:45	TRUCK = 3.5 PCU					14:45 - 16:15
		CAR = 1 PCU					
TIME	1 STRAIGHT	1. TURN RIGHT	2. TURN LEFT	2. STRAIGHT	3. TURN LEFT	3. TURN RIGHT	HOURLY
AM PEAK	304,5	91,5	0	240,5	68	5	**709,5**
morning	3205,5	840	0	2832	788,5	65	
afternoon	6467	1579,5	0	5023	898,5	124	
PM PEAK	372	91,5	0	170,5	49	2	**685**
TOTAL	**9672,5**	**2419,5**	**0**	**7855**	**1687**	**189**	**21823**
06:00							
06:15							
06:30							
06:45							
07:00							
07:15							
07:30							
07:45	144	71,5		240,5	68	3	
08:00	304,5	91,5		142	56	5	
08:15	210,5	59		150,5	34		
08:30	214,5	40		158,5	49	2	
08:45	164	45		170,5	43	2	
09:00	210	52,5		155	42	2	
09:15	194	56		141,5	34	5	
09:30	143,5	34,5		161,5	39	4	
09:45	162	44		136	39	1	
10:00	174	34,5		146,5	52,5	8,5	
10:15	202	32		187,5	51	7,5	
10:30	211,5	46		240,5	51	8,5	
10:45	171	57		180	49	7,5	
11:00	157	33,5		178	48	1	
11:15	166	67,5		125	43	2	
11:30	231,5	54,5		159,5	44		
11:45	145,5	21		159	46	6	
12:00	219,5	50		170	37	5	
12:15	185	49		255	27	7,5	
12:30	206,5	62		188,5	39	4	
12:45	198	55,5		171,5	20	4	
13:00	231,5	71		185	42	9	
13:15							
13:30							
13:45	221	51		191	46	7	
14:00	254	47		203	37	4	
14:15	254,5	50		235,5	40	3	
14:30	230,5	39		211	38	5	
14:45	363,5	80		265	40	8	
15:00	347	84		362	43,5	4	
15:15	372	84		250,5	31	3	
15:30	300	60		295	44	7,5	
15:45	293,5	100		168,5	45	5	
16:00	323	85		265	36	4	
16:15	328,5	91		219	34	5	
16:30	346,5	98		250	46	3	
16:45	353,5	83		260	45	5	
17:00	344,5	80,5		283,5	58	7	
17:15	343	90		174	52	8	
17:30	366,5	93,5		235,5	49	10	
17:45	385	76		184,5	49	6	
18:00							

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12 Hour Count	TOTAL VEHICLES						Monday
AM PEAK	07:00 - 08:45	TRUCK = 3.5 PCU					14:45 - 16:15
		CAR = 1 PCU					
TIME	1 STRAIGHT	1. TURN RIGHT	2. TURN LEFT	2. STRAIGHT	3. TURN LEFT	3. TURN RIGHT	HOURLY
AM PEAK	68	0	0	5	22	35	**130**
morning	788,5	0	0	65	246,5	222	
afternoon	990,5	0	0	140	459	366	
PM PEAK	45	0	0	2	19	35	**101**
TOTAL	**1779**	**0**	**0**	**205**	**705,5**	**588**	**3277,5**
06:00							
06:15							
06:30							
06:45							
07:00							
07:15							
07:30							
07:45	68			3	22	19	
08:00	56			5	9	11	
08:15	34				19	35	
08:30	49			2	15,5	9	
08:45	43			2	18	10	
09:00	42			2	12	13	
09:15	34			5	7	8	
09:30	39			4	10	17	
09:45	39			1	11	4	
10:00	52,5			8,5	15	11	
10:15	51			7,5	11	9	
10:30	51			8,5	14	11	
10:45	49			7,5	18	11	
11:00	48			1	22	14	
11:15	43			2	15	16	
11:30	44				14	11	
11:45	46			6	14	13	
12:00	37			5	12	12	
12:15	27			7,5	13	10	
12:30	39			4	11	9	
12:45	20			4	21	7	
13:00	42			9	15	6	
13:15	45			8	14	7	
13:30	47			8	9	8	
13:45	46			7	3	2	
14:00	37			4	15	17	
14:15	40			3	21	18	
14:30	38			5	18	24	
14:45	40			8	21	18	
15:00	43,5			4	21	19	
15:15	31			3	21	14	
15:30	44			7,5	19	11	
15:45	45			5	16	6	
16:00	36			4	28	17	
16:15	34			5	21	19	
16:30	46			3	31	17	
16:45	45			5	26	21	
17:00	58			7	24	15	
17:15	52			8	22	25	
17:30	49			10	22	24	
17:45	49			6	35	40	
18:00							

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Location - Molapo&R510							28/10/2019
12 Hour Count	TOTAL VEHICLES						Monday
AM PEAK	07:00 - 08:45	TRUCK = 3.5 PCU					14:45 - 16:15
		CAR = 1 PCU					
TIME	**1 STRAIGHT**	**1. TURN RIGHT**	**2. TURN LEFT**	**2. STRAIGHT**	**3. TURN LEFT**	**3. TURN RIGHT**	**HOURLY**
AM PEAK	5	0	0	19	0	0	**24**
morning	44	0	0	224	0	0	
afternoon	57	0	0	387	0	0	
PM PEAK	4,5	0	0	19	0	0	**23,5**
TOTAL	**101**	**0**	**0**	**611**	**0**	**0**	**712**
06:00							
06:15							
06:30							
06:45							
07:00							
07:15							
07:30	3						
07:45	1			19			
08:00	2			18			
08:15	2			7			
08:30	4			10			
08:45	5			19			
09:00	4			10			
09:15	3			8			
09:30	3			11			
09:45	3			13			
10:00	5			19			
10:15	1			25			
10:30	1			8			
10:45	2			12			
11:00	1			10			
11:15	1			12			
11:30	1			8			
11:45	2			15			
12:00	2			13,5			
12:15	1			26			
12:30	1			11			
12:45	1			23,5			
13:00	1			13			
13:15	2			29,5			
13:30	1			9			
13:45	2			16			
14:00	2			30,5			
14:15	2			14,5			
14:30	2			18			
14:45	2			14			
15:00	4			18			
15:15	4			13			
15:30	2			9			
15:45	3			14			
16:00	3,5			26,5			
16:15	4,5			18			
16:30	1			9			
16:45	3			18			
17:00	2			8			
17:15	2			13			
17:30	1			19			
17:45	3			3			
18:00	5						

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ANNEXURE C – SIDRA ANALYSIS

MOVEMENT SUMMARY

Site: Molapo Drive & Unkown Road 1AM PEAK

Molapo Drive & Unkown Road 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown Road 1											
1	L	23	0.0	0.065	11.1	LOS B	0.3	2.2	0.04	0.93	46.0
3	R	37	0.0	0.065	10.9	LOS B	0.3	2.2	0.04	0.99	46.2
Approach		60	0.0	0.065	11.0	LOS B	0.3	2.2	0.04	0.97	46.1
East: Molapo Drive											
4	L	1	0.0	0.003	8.2	LOS A	0.0	0.0	0.00	0.98	49.0
5	T	5	0.0	0.003	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		6	0.0	0.003	1.4	LOS A	0.0	0.0	0.00	0.16	57.8
West: Molapo Drive											
11	T	68	0.0	0.039	0.0	LOS A	0.3	1.8	0.04	0.00	59.1
12	R	5	0.0	0.039	8.5	LOS A	0.3	1.8	0.04	1.10	48.7
Approach		74	0.0	0.039	0.6	LOS A	0.3	1.8	0.04	0.08	58.2
All Vehicles		140	0.0	0.065	5.1	NA	0.3	2.2	0.04	0.46	52.3

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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MOVEMENT SUMMARY

Site: Molapo Dr & Unkown Rd 1
FUTURE AM PEAK

Molapo Dr & Unkwon Rd 1 Future AM PEAK
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: unkown Rd Southbound											
1	L	79	5.0	0.238	14.0	LOS B	1.2	8.9	0.43	0.84	44.2
3	R	79	5.0	0.238	13.8	LOS B	1.2	8.9	0.43	1.00	44.4
Approach		158	5.0	0.238	13.9	LOS B	1.2	8.9	0.43	0.92	44.3
East: Molapo Eastbound											
4	L	26	5.0	0.095	8.3	LOS A	0.0	0.0	0.00	1.00	49.0
5	T	153	5.0	0.096	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		179	5.0	0.095	1.2	LOS A	0.0	0.0	0.00	0.15	58.1
West: Molapo Westbound											
11	T	151	5.0	0.132	0.8	LOS A	1.0	7.0	0.32	0.00	53.5
12	R	63	5.0	0.132	9.4	LOS A	1.0	7.0	0.32	0.86	48.6
Approach		214	5.0	0.132	3.4	LOS A	1.0	7.0	0.32	0.25	52.0
All Vehicles		551	5.0	0.238	5.7	NA	1.2	8.9	0.25	0.41	51.2

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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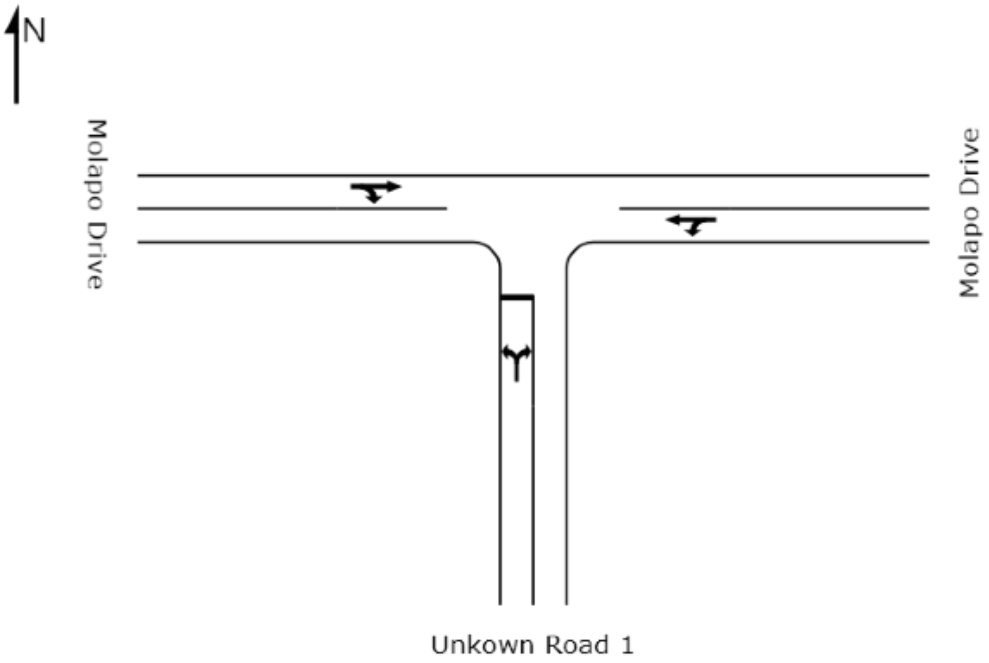

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MOVEMENT SUMMARY

Site: Molapo Dr & Unkown Rd 1 FUTURE PM PEAK

Molap Drive & Unkown Rd 1 FUTURE PM PEAK
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown Rd 1Southbound											
1	L	63	5.0	0.204	12.7	LOS B	1.1	7.9	0.23	0.84	45.1
3	R	95	5.0	0.204	12.5	LOS B	1.1	7.9	0.23	0.97	45.3
Approach		158	5.0	0.204	12.5	LOS B	1.1	7.9	0.23	0.92	45.2
East: Molapo Dr Eastbound											
4	L	21	5.0	0.032	8.3	LOS A	0.0	0.0	0.00	0.89	49.0
5	T	38	5.0	0.032	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		59	5.0	0.032	3.0	LOS A	0.0	0.0	0.00	0.32	55.5
West: Molapo Westbound											
11	T	100	5.0	0.111	0.2	LOS A	0.7	5.2	0.16	0.00	56.4
12	R	79	5.0	0.111	8.9	LOS A	0.7	5.2	0.16	0.82	48.4
Approach		179	5.0	0.111	4.0	LOS A	0.7	5.2	0.16	0.36	52.6
All Vehicles		396	5.0	0.204	7.3	NA	1.1	7.9	0.16	0.58	49.7

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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MOVEMENT SUMMARY

Site: Molapo Drive & Unkwon Rd 2 AM PEAK

Molapo Drive & Unkown Rd 2 AM Peak
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown Rd 2											
1	L	6	0.0	0.010	10.8	LOS B	0.0	0.3	0.09	0.91	46.3
3	R	4	0.0	0.010	10.6	LOS B	0.0	0.3	0.09	0.96	46.5
Approach		11	0.0	0.010	10.7	LOS B	0.0	0.3	0.09	0.93	46.4
East: Molapo Drive											
4	L	4	0.0	0.013	8.2	LOS A	0.0	0.0	0.00	0.98	49.0
5	T	20	0.0	0.013	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		24	0.0	0.013	1.4	LOS A	0.0	0.0	0.00	0.17	57.7
West: Molapo Drive											
11	T	5	0.0	0.004	0.1	LOS A	0.0	0.2	0.09	0.00	58.1
12	R	2	0.0	0.004	8.5	LOS A	0.0	0.2	0.09	0.92	48.6
Approach		7	0.0	0.004	2.5	LOS A	0.0	0.2	0.09	0.26	55.0
All Vehicles		42	0.0	0.013	3.9	NA	0.0	0.3	0.04	0.38	54.0

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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MOVEMENT SUMMARY

Site: Molapo Drive & Unkown Road 1 PM PEAK 4

Molapo Drive & Unkown Rd 1 PM PEAK
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown Road 1											
1	L	20	0.0	0.062	11.1	LOS B	0.3	2.1	0.17	0.86	46.2
3	R	37	0.0	0.062	10.9	LOS B	0.3	2.1	0.17	0.91	46.4
Approach		57	0.0	0.062	11.0	LOS B	0.3	2.1	0.17	0.90	46.4
East: Molapo Dr											
4	L	6	0.0	0.028	8.2	LOS A	0.0	0.0	0.00	1.01	49.0
5	T	47	0.0	0.028	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		54	0.0	0.028	1.0	LOS A	0.0	0.0	0.00	0.12	58.5
West: Molapo Drive											
11	T	7	0.0	0.006	0.2	LOS A	0.0	0.3	0.14	0.00	56.9
12	R	3	0.0	0.006	8.6	LOS A	0.0	0.3	0.14	0.88	48.6
Approach		11	0.0	0.006	2.7	LOS A	0.0	0.3	0.14	0.26	54.2
All Vehicles		121	0.0	0.062	5.8	NA	0.3	2.1	0.09	0.50	51.8

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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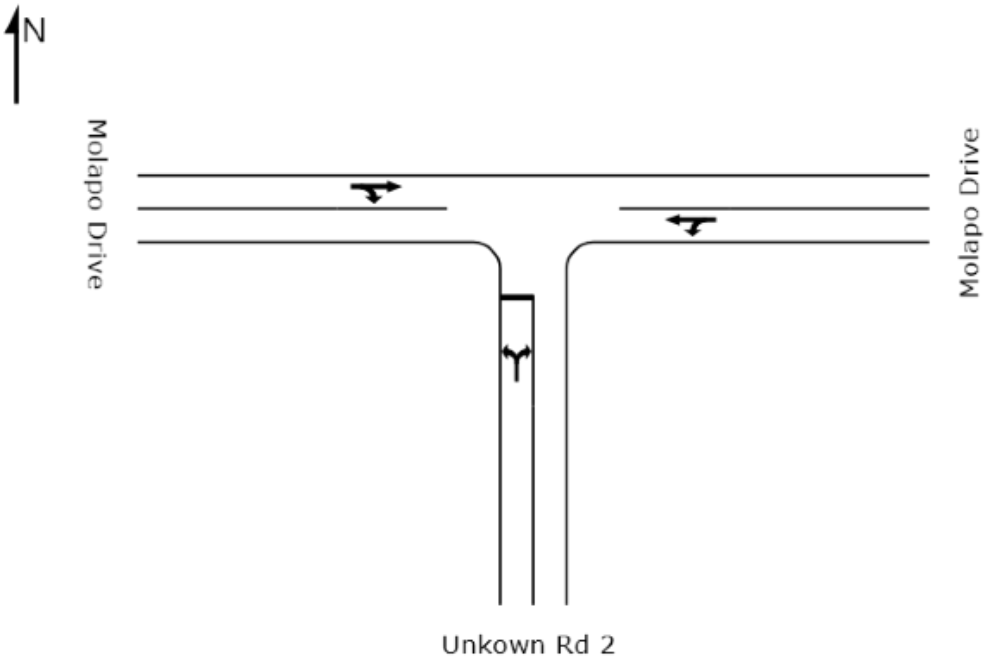

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MOVEMENT SUMMARY

Site: Molapo Drive & Unkown Rd 2
PM PEAK

Molapo and Unkwon 2 PM PEAK
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown S											
1	L	7	0.0	0.011	10.8	LOS B	0.1	0.4	0.09	0.91	46.4
3	R	4	0.0	0.011	10.6	LOS B	0.1	0.4	0.09	0.96	46.5
Approach		12	0.0	0.011	10.7	LOS B	0.1	0.4	0.09	0.93	46.4
East: Molapo E											
4	L	4	0.0	0.013	8.2	LOS A	0.0	0.0	0.00	0.98	49.0
5	T	20	0.0	0.013	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		24	0.0	0.013	1.4	LOS A	0.0	0.0	0.00	0.17	57.7
West: Molapo W											
11	T	5	0.0	0.003	0.1	LOS A	0.0	0.2	0.09	0.00	58.1
12	R	1	0.0	0.003	8.5	LOS A	0.0	0.2	0.09	0.99	48.7
Approach		6	0.0	0.003	1.5	LOS A	0.0	0.2	0.09	0.16	56.3
All Vehicles		42	0.0	0.013	4.0	NA	0.1	0.4	0.04	0.38	53.9

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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MOVEMENT SUMMARY

Site: Molapo Dr & Unkown Rd 2
FUTURE PM PEAK

Molapo Drive & Unkown Rd 2 future pm peak
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkwon Rd 2 southbound											
1	L	36	0.0	0.058	11.1	LOS B	0.3	1.9	0.17	0.88	46.2
3	R	21	0.0	0.058	10.9	LOS B	0.3	1.9	0.17	0.94	46.4
Approach		57	0.0	0.058	11.1	LOS B	0.3	1.9	0.17	0.90	46.3
East: Molapo Drive Eastbound											
4	L	13	0.0	0.031	8.2	LOS A	0.0	0.0	0.00	0.96	49.0
5	T	47	0.0	0.031	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		60	0.0	0.031	1.7	LOS A	0.0	0.0	0.00	0.20	57.3
West: Molapo Drive Westbound											
11	T	26	0.0	0.027	0.2	LOS A	0.2	1.1	0.15	0.00	56.6
12	R	18	0.0	0.027	8.7	LOS A	0.2	1.1	0.15	0.83	48.5
Approach		44	0.0	0.027	3.6	LOS A	0.2	1.1	0.15	0.34	53.0
All Vehicles		161	0.0	0.058	5.5	NA	0.3	1.9	0.10	0.48	51.8

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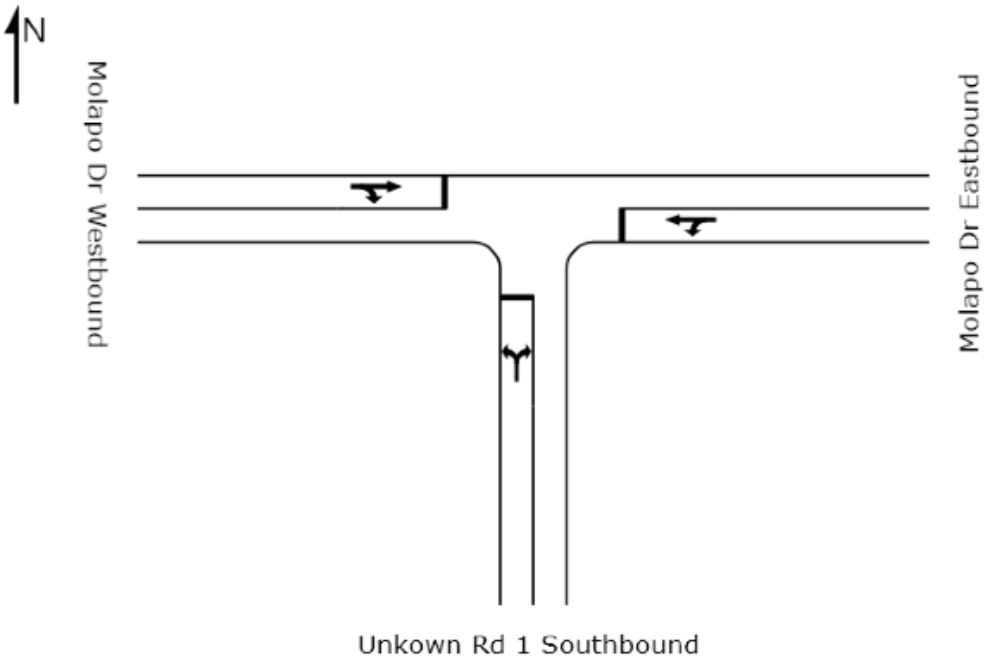

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MOVEMENT SUMMARY

Site: Molapo Dr & Unkwon Rd 1
Option 1 AM PEAK

Molapo & Unkown Rd 1 AM PEAK
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: Unkown Rd 1 Southbound											
1	L	163	0.0	0.362	17.9	LOS C	1.4	9.9	0.80	1.21	41.4
3	R	79	0.0	0.362	17.7	LOS C	1.4	9.9	0.80	1.22	41.6
Approach		242	0.0	0.362	17.8	LOS C	1.4	9.9	0.80	1.21	41.4
East: Molapo Dr Eastbound											
4	L	26	0.0	0.134	17.8	LOS C	0.5	3.2	0.79	1.16	41.5
5	T	47	0.0	0.133	17.3	LOS C	0.5	3.2	0.79	1.16	41.8
Approach		74	0.0	0.133	17.5	LOS C	0.5	3.2	0.79	1.16	41.7
West: Molapo Dr Westbound											
11	T	151	0.0	0.250	16.0	LOS C	0.9	6.0	0.72	1.18	42.7
12	R	37	0.0	0.249	16.2	LOS C	0.9	6.0	0.72	1.19	42.7
Approach		187	0.0	0.250	16.0	LOS C	0.9	6.0	0.72	1.18	42.7
All Vehicles		503	0.0	0.362	17.1	LOS C	1.4	9.9	0.77	1.19	42.0

MOVEMENT SUMMARY

Site: Molapo Dr & Unkown Rd 1
Option PM PEAK

Molapo & Unkown 1 Opt 1 PM PEAK
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: RoadName											
1	L	63	5.0	0.367	22.2	LOS C	1.5	11.2	0.92	1.22	38.5
3	R	95	5.0	0.367	22.0	LOS C	1.5	11.2	0.92	1.22	38.7
Approach		158	5.0	0.368	22.1	LOS C	1.5	11.2	0.92	1.22	38.6
East: Molapo Dr Eastbound											
4	L	21	0.0	0.163	21.8	LOS C	0.6	4.2	0.91	1.16	38.8
5	T	38	0.0	0.163	21.3	LOS C	0.6	4.2	0.91	1.16	39.0
Approach		59	0.0	0.163	21.5	LOS C	0.6	4.2	0.91	1.16	38.9
West: Molapo Dr Westbound											
11	T	100	5.0	0.328	16.9	LOS C	1.2	8.9	0.76	1.20	42.1
12	R	137	5.0	0.327	17.2	LOS C	1.2	8.9	0.76	1.21	42.1
Approach		237	5.0	0.328	17.1	LOS C	1.2	8.9	0.76	1.21	42.1
All Vehicles		454	4.4	0.368	19.4	LOS C	1.5	11.2	0.83	1.20	40.4

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.

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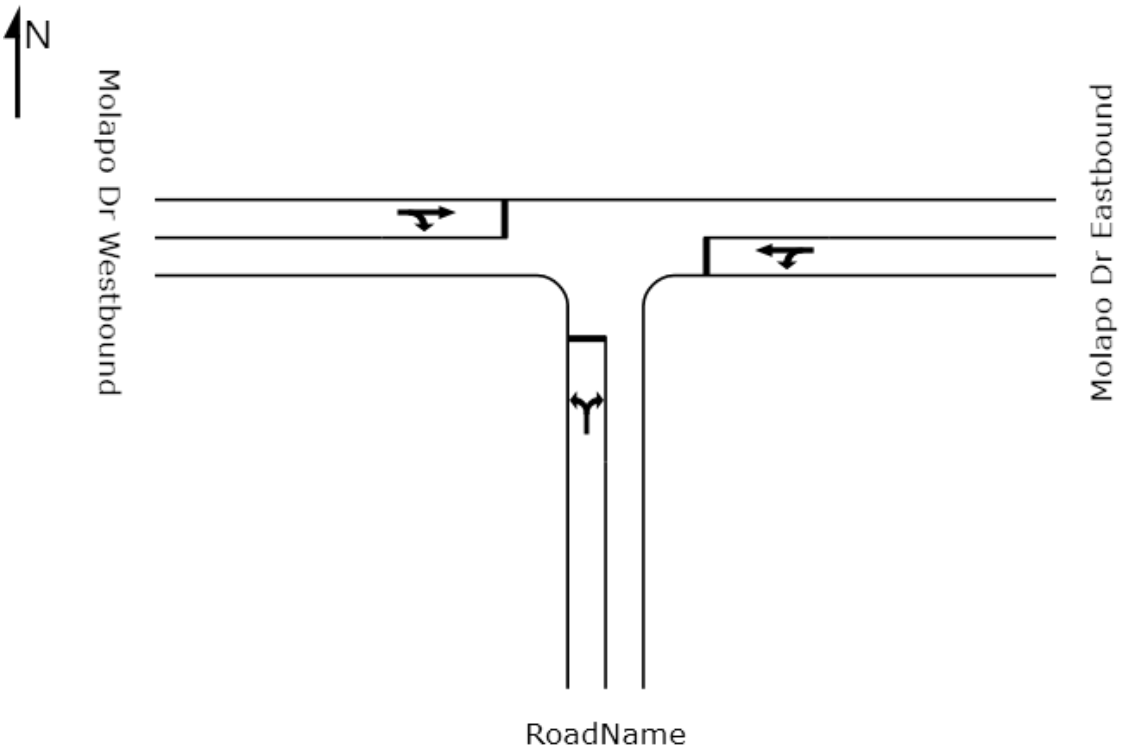

MOVEMENT SUMMARY

Site: R510 & Molapo DR- AM PEAK 1

R510 & Molap Dr AM Peak
Signals - Fixed Time Cycle Time = 40 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	321	5.0	0.592	9.9	LOS A	8.2	60.1	0.82	0.71	43.4
3	R	97	5.0	0.592	18.6	LOS B	8.2	60.1	0.82	0.89	42.0
Approach		418	5.0	0.593	11.9	LOS B	8.2	60.1	0.82	0.75	43.1
East: Molapo Drive											
4	L	72	0.0	0.150	20.5	LOS C	1.8	12.6	0.79	0.75	38.3
6	R	5	0.0	0.151	20.8	LOS C	1.8	12.6	0.79	0.76	38.3
Approach		77	0.0	0.150	20.5	LOS C	1.8	12.6	0.79	0.75	38.3
North: R510											
7	L	75	5.0	0.414	17.3	LOS B	6.2	45.0	0.74	0.87	42.7
8	T	254	5.0	0.414	8.9	LOS A	6.2	45.0	0.74	0.63	44.8
Approach		328	5.0	0.414	10.8	LOS B	6.2	45.0	0.74	0.68	44.3
All Vehicles		823	4.5	0.593	12.3	LOS B	8.2	60.1	0.78	0.72	43.1

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
P3	Across E approach	53	9.8	LOS A	0.0	0.0	0.70	0.70
P5	Across N approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
All Pedestrians		159	12.9				0.80	0.80

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: 510 & MOLAPO DRIVE FUTURE AM PEAK

R510 & Molapo Dr Future AM PEAk
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	417	5.0	0.780	15.0	LOS B	15.5	113.4	0.88	0.88	39.0
3	R	183	5.0	0.780	23.6	LOS C	15.5	113.4	0.88	1.00	38.1
Approach		600	5.0	0.780	17.7	LOS B	15.5	113.4	0.88	0.92	38.7
East: MOLAPO DR											
4	L	215	5.0	0.719	29.8	LOS C	9.4	68.9	0.97	0.89	33.0
6	R	95	5.0	0.719	30.0	LOS C	9.4	68.9	0.97	0.89	33.0
Approach		309	5.0	0.719	29.8	LOS C	9.4	68.9	0.97	0.89	33.0
North: R510											
7	L	142	5.0	0.297	15.8	LOS B	5.4	39.6	0.60	0.84	43.0
8	T	142	5.0	0.297	7.4	LOS A	5.4	39.6	0.60	0.51	46.1
Approach		284	5.0	0.297	11.6	LOS B	5.4	39.6	0.60	0.67	44.5
All Vehicles		1194	5.0	0.780	19.4	LOS B	15.5	113.4	0.84	0.85	38.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	18.5	LOS B	0.1	0.1	0.86	0.86
P3	Across E approach	53	8.4	LOS A	0.0	0.0	0.58	0.58
P5	Across N approach	53	18.5	LOS B	0.1	0.1	0.86	0.86
All Pedestrians		159	15.1				0.77	0.77

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

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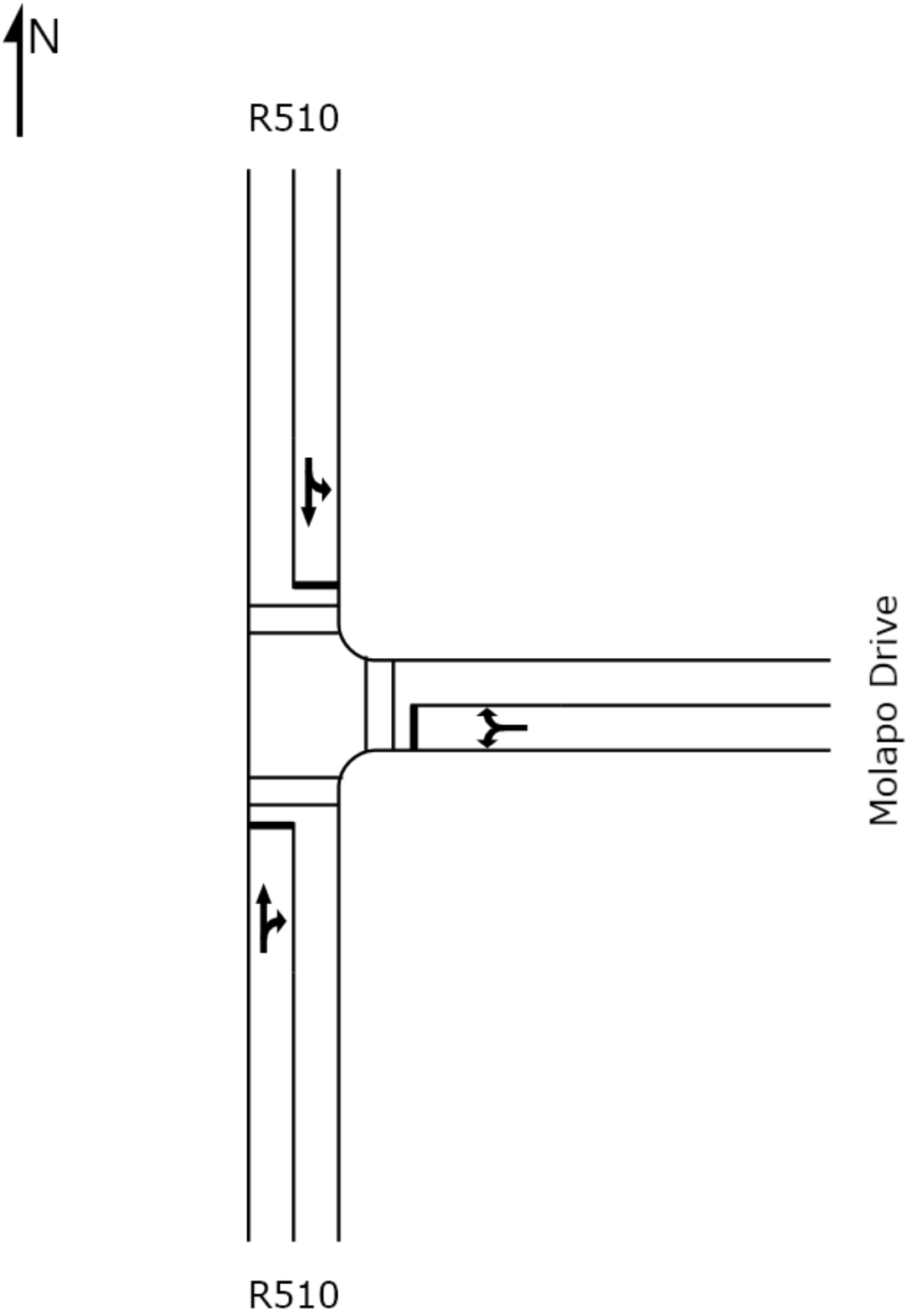

MOVEMENT SUMMARY

Site: R510 & Molapo Drive PM Peak

R510 & Molapo Drive PM PEAK
Signals - Fixed Time Cycle Time = 40 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	392	5.0	0.705	12.0	LOS B	10.5	76.5	0.88	0.82	41.6
3	R	97	5.0	0.704	20.6	LOS C	10.5	76.5	0.88	0.95	40.6
Approach		488	5.0	0.705	13.7	LOS B	10.5	76.5	0.88	0.85	41.4
East: Molapo Drive											
4	L	2	0.0	0.105	20.3	LOS C	1.3	8.8	0.78	0.73	38.2
6	R	52	0.0	0.105	20.5	LOS C	1.3	8.8	0.78	0.74	38.2
Approach		54	0.0	0.105	20.5	LOS C	1.3	8.8	0.78	0.74	38.2
North: R510											
7	L	57	5.0	0.299	16.7	LOS B	4.4	32.1	0.70	0.87	43.0
8	T	180	5.0	0.299	8.4	LOS A	4.4	32.1	0.70	0.58	45.4
Approach		237	5.0	0.299	10.4	LOS B	4.4	32.1	0.70	0.65	44.8
All Vehicles		779	4.7	0.705	13.2	LOS B	10.5	76.5	0.81	0.78	42.1

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
P3	Across E approach	53	9.8	LOS A	0.0	0.0	0.70	0.70
P5	Across N approach	53	14.5	LOS B	0.1	0.1	0.85	0.85
All Pedestrians		159	12.9				0.80	0.80

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: R510 & MOLAPO DRIVE FUTURE PM PEAK

R510 & MOLAPO DR FUTURE PM PEAK
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow 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: R510											
2	T	509	5.0	0.816	17.2	LOS B	20.8	151.6	0.87	0.89	37.7
3	R	183	5.0	0.816	25.8	LOS C	20.8	151.6	0.87	1.03	36.9
Approach		693	5.0	0.816	19.4	LOS B	20.8	151.6	0.87	0.93	37.5
East: MOLAPO DR											
4	L	155	5.0	0.791	38.4	LOS D	10.1	73.4	1.00	0.93	29.1
6	R	105	5.0	0.791	38.7	LOS D	10.1	73.4	1.00	0.93	29.1
Approach		260	5.0	0.791	38.5	LOS D	10.1	73.4	1.00	0.93	29.1
North: R510											
7	L	108	5.0	0.390	14.6	LOS B	8.3	60.8	0.54	0.91	44.4
8	T	340	5.0	0.390	6.3	LOS A	8.3	60.8	0.54	0.47	48.3
Approach		448	5.0	0.390	8.3	LOS A	8.3	60.8	0.54	0.58	47.3
All Vehicles		1401	5.0	0.816	19.4	LOS B	20.8	151.6	0.79	0.82	38.0

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on average delay for all vehicle movements.

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	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	6.5	LOS A	0.0	0.0	0.47	0.47
P5	Across N approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		159	18.4				0.76	0.76

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS C. LOS Method for individual pedestrian movements: Delay (HCM).