ENVIRONMENTAL & ENGINEERING

IN ASSOCIATION WITH

INFRATRANS
TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING

REPORT

DUNBAR OPEN-CAST COAL MINE

TRAFFIC IMPACT ASSESSMENT

REPORT REF: P-172

APPLICATION FOR MINING RIGHTS FOR THE PROPOSED DUNBAR OPEN-CAST COAL MINE TO BE LOCATED ON PORTIONS OF THE FARMS DUNBAR 189-IS, MIDDELKRAAL 50-IS AND HALFGEWONNEN 190-IS IN MPUMALANGA PROVINCE

VERSION: FINAL DRAFT

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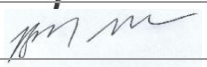
FINAL DRAFT	07/10/2019	Ryno van Wyk Pr. Eng.		Review
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Quality Control BY:

Nature of Signoff	Responsible Person	Role / Responsibility	Qualification & Professional Affiliations
Author	Pieter Jooste	Traffic Engineer Associate	B.Eng. (Civil Engineering) Candidate Professional Engineer, ECSA
Reviewer	Ryno van Wyk Pr. Eng	Traffic Engineer Director	B.Eng. Honours (Transportation Engineering) Professional Engineer (Pr. Eng.), ECSA Associate Member, SAICE Member, ITE
Client	-	-	-

DISCLAIMER:

EXPERTISE OF THE REVIEWER

Name	Ryno
Surname	van Wyk
Company	Infratrans (Pty) Ltd
Position	Director – Traffic Engineer
Location	Carob Tree Complex, Moreleta Park, Pretoria
Email	ryno@infratrans.co.za
Telephone Number	083 327 7626
Education	- B.Eng. (Civil Engineering), University of Stellenbosch - B.Eng. Honours (Transportation Engineering), University of Pretoria
Professional skills	A Senior Traffic and Transportation Engineer with 19 years' experience in the civil engineering industry with a specific focus on transportation engineering projects, and more specifically traffic engineering and transport planning components of transportation engineering projects. As Traffic Engineer and Director at Infratrans Traffic and Transportation Engineering Consulting (Pty) Ltd Ryno is responsible for business development, project management and technical delivery of transport planning and traffic engineering projects.
Skills	- Traffic Engineering Studies - Transportation Planning - Traffic Modelling - Conceptual Geometric Design of Roads and Highways - Traffic Signal Design

EXECUTIVE SUMMARY

Vandabyte (Pty) Ltd appointed Enviro-Insight CC as the Environmental Assessment Practitioner to undertake environmental authorisations associated with the proposed Dunbar Coal Mine to be situated between Hendrina and Komati in Mpumalanga Province, South Africa. Enviro-Insight CC appointed Eco-Elementum (Pty) Ltd in association with Infratrans (Pty) Ltd to undertake a Traffic Impact Assessment (TIA) for the project.

The open-cast track and shovel mining method will be used at the proposed Dunbar Coal Mine which will include the following activities:

- Removal of topsoil and soft overburden;
- Drilling, charging and blasting of hard overburden material;
- Loading and hauling of overburden and coal, and
- Tipping or dumping of coal or overburden.

The scope of this TIA includes:

- Conducting traffic surveys to determine current traffic conditions on the surrounding road network (within a defined study area);
- Quantify the impact the proposed project is expected to have on the surrounding road network;
- Determine whether it is necessary to mitigate the expected impact, and
- If required, recommend measures to mitigate such impact.

SUMMARY OF FINDINGS

Traffic operating conditions were determined and compared for the following scenarios:

- Baseline;
- Project construction phase, and
- Project operational phase

By comparing the operating conditions for the different scenarios it was concluded that the proposed project will have an insignificant traffic impact on the surrounding road network. Seeing as no traffic problems or congestion are expected as a result of the project activities no mitigation measures are required (provided that the issues discussed in **Section 7** of this report be addressed).

Traffic impact significance scores of 63 and 72 were calculated for the construction and operational phases of the proposed project respectively, which implies that the project can be authorized from a traffic engineering viewpoint.

CONTENTS

List of Figures

List of Tables

Appendices

PROJECT INFORMATION

Name of Applicant:	Vandabyte (Pty) Ltd
Contact Person:	-
Contact Number:	012 771 4411
Email:	-
Postal Address:	PO Box 68727, Highveld, 0169
Physical Address:	2nd Floor, Tugela House, Riverside Office Park, Centurion, 0157
File Reference Number DMR:	MP 30/5/1/1/2/10737 PR

Table 1: EAP Details

EAP Company:	Enviro-Insight CC
Postal Address:	862 Wapadrand Road, Wapadrand Security Village, Pretoria, 0050
Contact Person:	Corné Niemandt
Contact Number:	012 807 0637
Email:	corne@enviro-insight.co.za
Website:	www.enviro-insight.co.za

Table 2: Specialist Details

Specialist Company:	Eco Elementum (Pty) Ltd
Company Reg. No.:	2012/021578/07
Physical Address:	The World Bank Office Park Ground floor, Building B 442 Roderick's Road Lynnwood Pretoria 0181
Postal Address:	Post net suite 252, Private bag X025 Lynnwood Ridge 0040
Contact Person:	Vernon Siemelink
Contact Number:	072 196 9928
Email:	vernon@ecoelementum.co.za info@ecoelementum.co.za
Website:	www.ecoelementum.co.za

1. INTRODUCTION AND STUDY SCOPE

Vandabyte (Pty) Ltd appointed Enviro-Insight CC as the Environmental Assessment Practitioner to undertake environmental authorisations associated with the proposed Dunbar Coal Mine to be situated between Hendrina and Komati in Mpumalanga Province, South Africa. Enviro-Insight CC appointed Eco-Elementum (Pty) Ltd in association with Infratrans (Pty) Ltd to undertake a Traffic Impact Assessment (TIA) for the project.

The scope of this TIA includes:

- Conducting traffic surveys to determine current traffic conditions on the surrounding road network (within a defined study area);
- Quantify the impact the proposed project is expected to have on the surrounding road network;
- Determine whether it is necessary to mitigate the expected impact, and
- If required, recommend measures to mitigate such impact.

2. PROJECT OVERVIEW

2.1 LOCALITY

The proposed Dunbar Coal Mine will be situated on an area of 1 797 ha on the following farm portions located in Mpumalanga Province, South Africa:

- A portion of portion 1, portion 2 and the remaining extent of the farm Dunbar 189-IS;
- Portion 1 of the farm Middelkraal 50-IS, and
- Portion 6 of the farm Halfgewonnen 190-IS.

Details of the study site is summarized in **Table 3** below with the location indicated in **Figure 1** overleaf.

Table 3: Study Site Details

Subject Properties:	PORTION OF PORTION 1, PORTION 2 AND THE REMAINING EXTENT OF THE FARM DUNBAR 189-IS, PORTION 1 OF THE FARM MIDDELKRAAL 50-IS AND PORTION 6 OF THE FARM HALFGEWONNEN 190-IS – MPUMALANGA PROVINCE
Application Area:	~ 1 797 ha
Magisterial District:	Nkangala District Municipality Mpumalanga Province South Africa
Local Municipality	Nkangala District Municipality
Distance and direction from nearest town:	The Project Area is ~ 8 km south-east of Komati and ~ 15 km south-west of Hendrina.

Project Name: Dunbar Open-Cast Coal Mine
Client Name: Vandabyte (Pty) Ltd
Project: P-172
Figure: 1

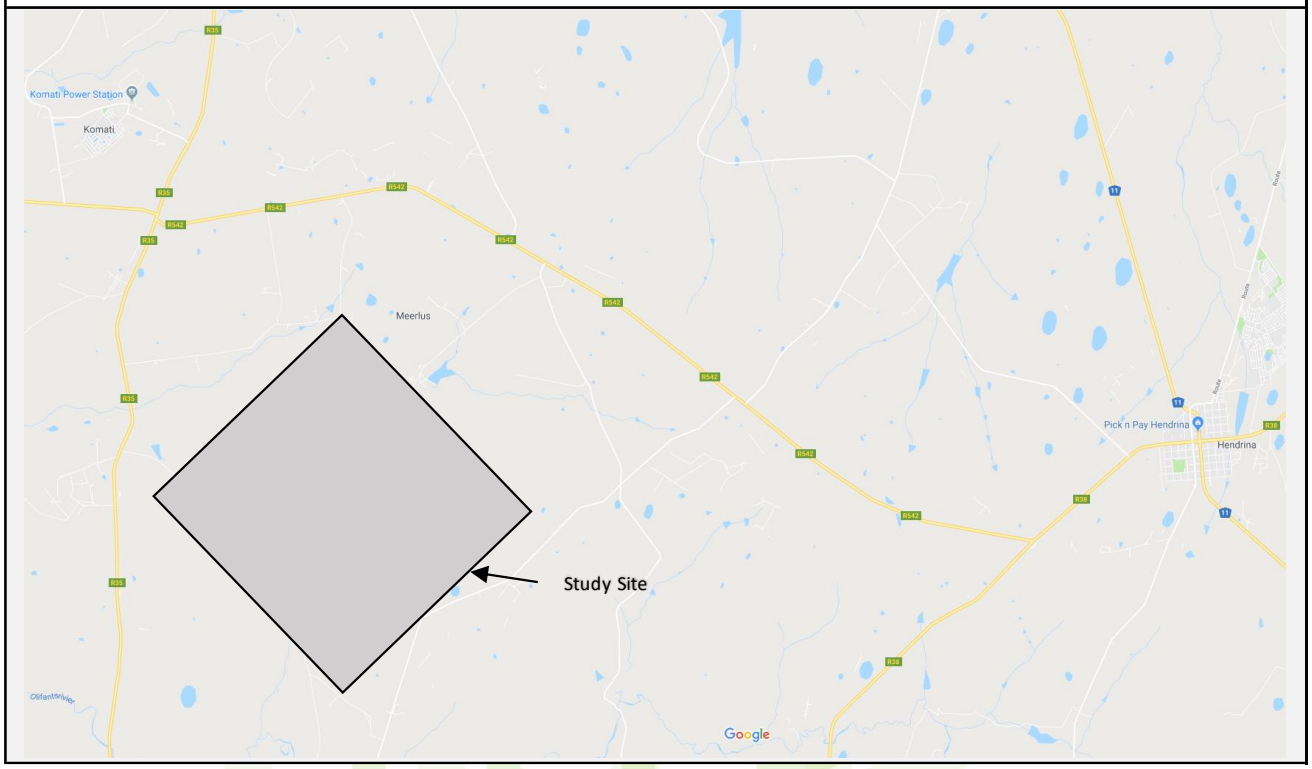


Figure 1: Location of the study site

2.2 PROJECT DESCRIPTION

The open-cast track and shovel mining method will be used at the proposed Dunbar Coal Mine which will include the following activities:

- Removal of topsoil and soft overburden;
- Drilling, charging and blasting of hard overburden material;
- Loading and hauling of overburden and coal, and
- Tipping or dumping of coal or overburden.

Figure 2 overleaf shows the proposed layout of Dunbar Coal Mine.

Project Name: Dunbar Open-Cast Coal Mine
Client Name: Vandabyte (Pty) Ltd
Project: P-172
Figure: 2

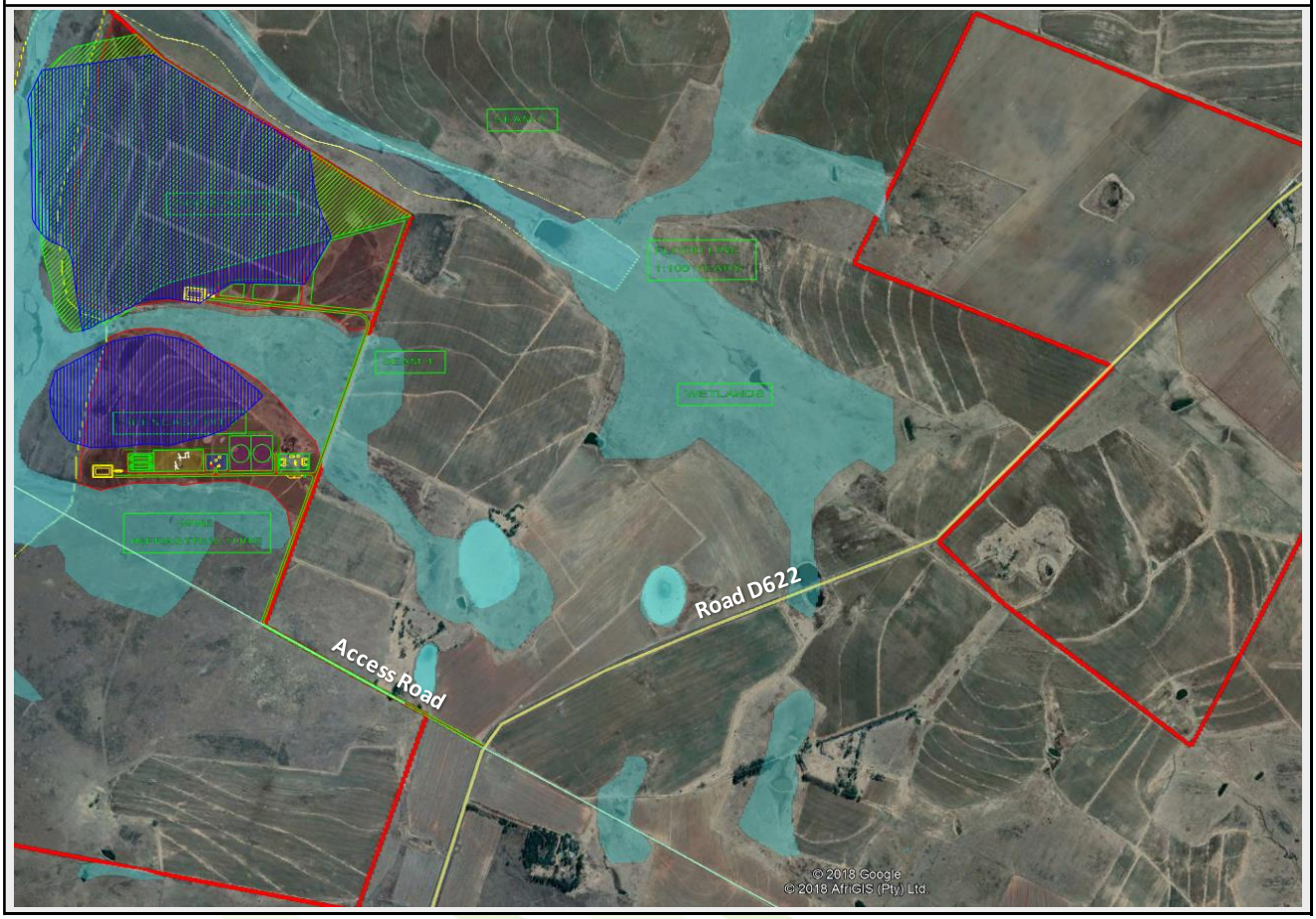


Figure 2: Proposed layout of Dunbar Coal Mine

3. OVERVIEW OF THE METHOD USED FOR ASSESSMENT

3.1 General Overview

The assessment method used are defined by the following steps:

1. Determining the traffic characteristics of the proposed project;
2. Defining the affected area (study area);
3. Collecting data to define the baseline operating conditions within the study area;
4. Determining the impact the proposed activities will have on the baseline operating conditions, and
5. Based on the expected impact, propose possible mitigation measures if necessary.

These steps are further discussed in the remainder of this chapter.

3.2 Traffic Characteristics

The type, volume and the expected travel paths are determined for the traffic to be generated by the proposed activity. This is done by analysing current traffic volumes and movement patterns in the study area, considering the type of activity and its location in relation to other developments / points of interests and by consulting various guidelines. The traffic characteristics of the proposed activity are further discussed in **Section 4.2**.

3.3 Study Area

The study area is defined based on the extent and type of activities and the characteristics of the traffic expected to be generated as a result. Although the traffic impact will most probably extend beyond a chosen study area, the area to be investigated should be large enough to ensure that the degree of impact outside its boundaries is insignificant and can be ignored. The study area is defined and described in the following subsections.

3.3.1 Site Visit

As per the *TMH 16, Volume 2, South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual*[1], it is a specific requirement to undertake a site visit when conducting a traffic study. During such a site visit all relevant aspects of the study area can be observed and a better understanding of the study area can be developed.

A site visit was conducted in September 2019. All relevant developments, points of interests, transport facilities, roads and road intersections were visited and recorded.

3.3.2 Surrounding Road Network

Considering the expected number of vehicle trips to be generated as a result of the proposed activities (to be discussed in **Section 5.5**) as well as the expected distribution of these trips on the surrounding road network, the following existing roads were deemed relevant for the purpose of this study:

- Road D622: This road can be classified as a Class 3 road (minor arterial road) and fall under the jurisdiction of the provincial roads authority. Access to the Dunbar Coal Mine is proposed directly off this road.
- Road R541 (P182/1): This road can be classified as a Class 2 (major arterial road) and also fall under the jurisdiction of the provincial roads authority. This road links Road R38 (to Hendrina) with the R35 (to Komati), and

- R35: This road can also be classified as a Class 2 road (major arterial road) and fall under the jurisdiction of the South African National Roads Authority Limited (SANRAL). This road links Komati to Bethal.

Drawing D001 attached as **Appendix A** at the back of this document presents the above roads in relation to the subject site. The classification of these roads is based on the *TRH 26, South African Road Classification and Access Management Manual*[2].

3.3.3 Intersections Investigated

As per the *TMH 16, Volume 2, South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual*[1], the study area should include all routes and intersections within a maximum distance of 1.5 km from the access to the site measured along the shortest routes to the access. At least one intersection with an arterial route should also form part of the study area.

By considering these guidelines as well as the expected number of vehicle trips to be generated as a result of the proposed activity (discussed in **Section 5.5**), the following intersections where deemed relevant for investigation:

- Road D622 / Proposed Access to Dunbar Coal Mine;
- Road D622 / Road R542 (P182/1), and
- Road R542 (P182/1) / R35.

The boundaries of the study area are therefore limited to the location of these intersections.

3.3.4 Vulnerabilities / Sensitivities

From a traffic engineering and transportation planning perspective no vulnerabilities or sensitivities have been identified in the study area. Due to the existing mines located in and around the study area the relevant road network have been designed to cater for heavy vehicles.

3.4 Data Collection

To determine the existing traffic demand on the nearby road network 13-hour manual classified traffic surveys (distinguishing between light vehicles, taxis, heavy vehicles and busses) were conducted on Wednesday 18 September 2019 at the key intersections previously discussed. A more detailed discussion follows in **Section 4.2**.

3.5 Impact and Mitigation

By using the data collected and observations made during the site visit traffic operating conditions were determined by means of traffic engineering software, namely SIDRA INTERSECTION 8. Operating conditions were determined and compared for the following three scenarios:

1. Existing conditions (baseline);
2. During the implementation of the proposed project (construction phase), and
3. After implementation of the proposed project (operational phase).

Based on the results obtained the need for mitigation measures is discussed.

4. EXISTING TRAFFIC STATE (ENVIRONMENTAL BASELINE)

4.1 SITE ACCESS

Access to the Dunbar Coal Mine is proposed directly off Road D622. The proposed layout and traffic flow control of the intersection are shown on **Drawing D001** attached as **Appendix A** at the back of this document.

Considering expected traffic volumes to be generated by the Dunbar Coal Mine (to be discussed in **Section 5.5**) as well as the proposed layout of the site (presented in **Figure 2**) it is concluded that the possibility of the traffic traveling along Road D622 being influenced by access control problems at the site is very unlikely.

4.2 EXISTING TRAFFIC FLOWS

To determine the existing traffic demand on the surrounding road network 13-hour manual traffic surveys were conducted on Wednesday 18 September 2019 at the key intersections previously discussed in **Section 3.3.3**.

From these surveys it was determined that the common peak traffic hours occurred between 06h15-07h15 for the AM peak hour and between 16h15-17h15 for the PM peak hour with the PM peak hour being more critical (even though only slightly). These existing 2019 peak hour traffic volumes are shown in **Figure 3** overleaf. The surveys also indicated the following relevant information:

- The R542 / Road D622 intersection is currently exposed to an estimated Average Daily Traffic (ADT) volume of approximately 2 900 vehicles per day;
- The R35 / R542 intersection is currently exposed to an estimated Average Daily Traffic (ADT) volume of approximately 5 400 vehicles per day, and
- The heavy vehicle proportion of the traffic on the surrounding road network is approximately 40%.

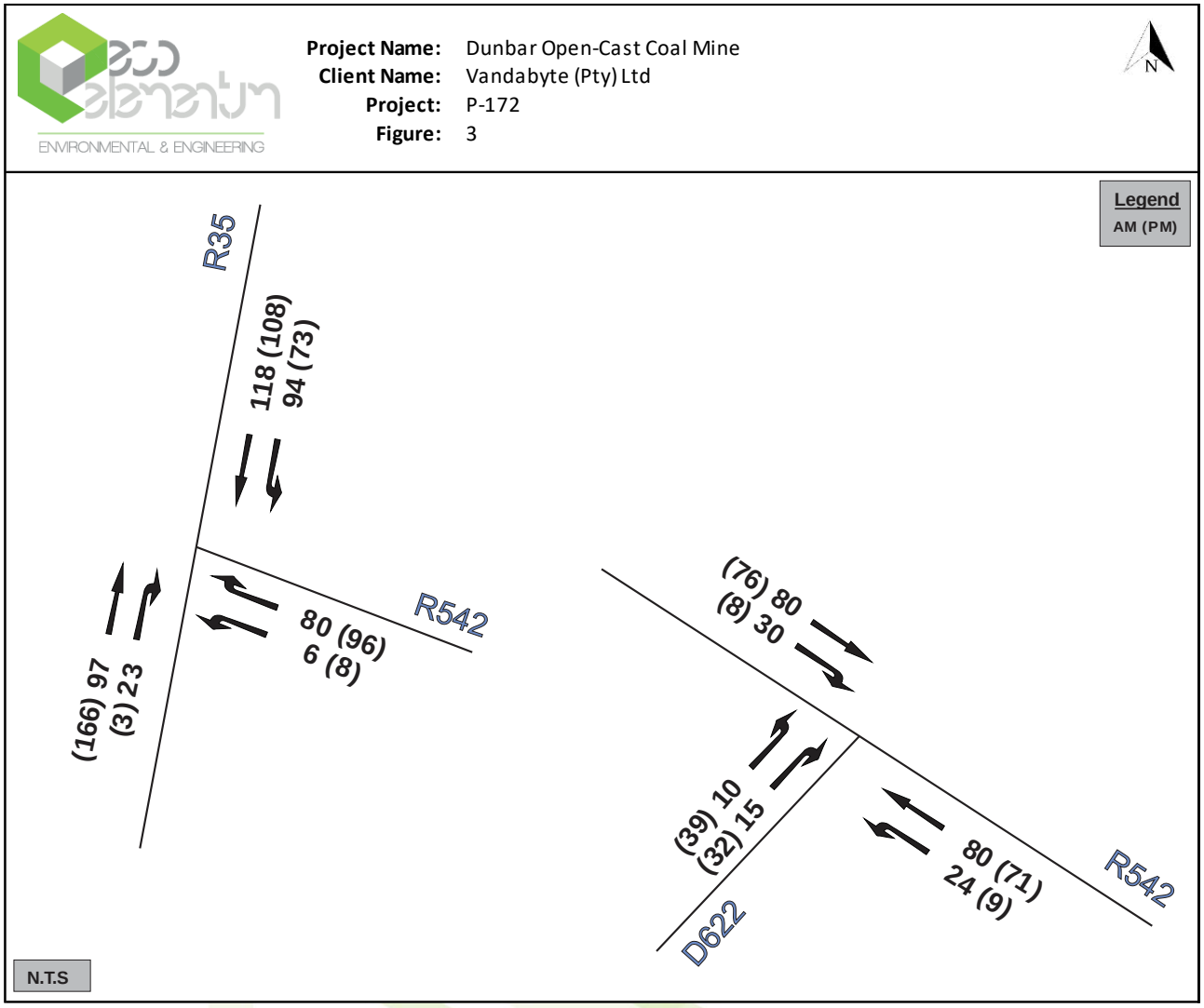


Figure 3: Existing 2019 Peak Hour Traffic Volumes

4.3 Baseline Operating Conditions

The baseline operating conditions for the key intersections are summarized in **Table 4** overleaf with the detailed SIDRA outputs attached as **Appendix B**. These operating conditions are based on the existing 2019 peak hour traffic volumes (as per **Figure 3** above) as well as the existing intersection layouts and traffic control (as per **Drawing D001**).

The Level of Service (LOS) parameter is determined by the V/C ratio (ratio between the traffic volume and traffic capacity per movement, both measured in veh/h) and delay (time delay experienced, measured in seconds) values. LOS values can vary between "A" and "F" with "F" being the worst operating condition. A LOS of "D" or better is deemed acceptable with a LOS of "E" only acceptable for right-turn traffic movements if storage lanes with adequate lengths are provided.

Table 4: Baseline operating conditions

Intersection & approach definitions	Peak hour	Analysis parameters	Intersection capacity analysis results								
			Approach 1			Approach 2			Approach 3		
			L	T	R	L	T	R	L	T	R
R542 / Road D622 App 1: R542 SE App 2: R542 NW App 3: Road D622 SW	Week AM	V/C	0.02	0.06	-	-	0.07	0.07	0.04	-	0.04
		Delay (s)	6	0	-	-	1	7	7	-	9
		LOS	A	A	-	-	A	A	A	-	A
	Week PM	V/C	0.01	0.06	-	-	0.05	0.05	0.12	-	0.12
		Delay (s)	6	0	-	-	1	7	7	-	9
		LOS	A	A	-	-	A	A	A	-	A
R35 / R542 App 1: R35 S App 2: R542 E App 3: R35 N	Week AM	V/C	-	0.07	0.07	0.22	-	0.22	0.07	0.09	-
		Delay (s)	-	1	8	11	-	15	6	0	-
		LOS	-	A	A	B	-	C	A	A	-
	Week PM	V/C	-	0.09	0.09	0.29	-	0.29	0.06	0.08	-
		Delay (s)	-	0	8	11	-	17	6	0	-
		LOS	-	A	A	B	-	C	A	A	-

Notes: L=left, T=through, R=right, V/C=volume/capacity, LOS=Level of Service, red text indicates unacceptable performance

The baseline operating conditions tabulated in **Table 4** above indicate that good traffic operating conditions are currently experienced at the key study intersections. These conditions would be influenced by the following variables:

- Traffic volumes;
- Intersection geometry, and
- Intersection traffic control.

4.4 Non-Motorised and Public Transport

A public transportation and non-motorised transport assessment were carried out as part of this study.

Public transport in the study area is mainly provided by minibus taxis and busses where taxis and busses were observed travelling along Road D622, Road R542 as well as Road R35.

The proposed development is expected to generate a considerable demand for non-motorised and public transport, but due to the remote location of the study site no new facilities are recommended. It is however recommended that transport be provided to and from the site during both the construction and operational phases of the project.

5. TRAFFIC IMPACT DUE TO PROJECT ACTIVITIES

5.1 STATUS OF IMPACT

The impact of the project activities (discussed in **Section 2.2**) is investigated for the following project phases:

- Construction phase, and
- Operational phase.

Based on the traffic characteristics of the project activities and considering **Table 5** below the status of the impact during both the project phases can be described as "negative".

Table 5: Listing of the descriptors for the status of the impact

Impact nature descriptors	Definitions
Positive	A benefit to the receiving environment
Neutral	No determined cost or benefit to the receiving environment
Negative	At cost to the receiving environment

5.2 SPATIAL EXTENT OF IMPACT

Although some of traffic generated during the construction or operational phases will be destined regionally or even nationally the impact (as determined by the defined study area) will be concentrated locally. The traffic influence outside the boundaries of the study area is expected to be insignificant. As per **Table 6** below the extent of the impact can be described as "local" for both the project phases, and a rating of 3 can be adopted.

Table 6: Listing of the descriptors for the extent of the impact

Extent descriptors	Definitions	Rating
Very low	Site Specific – impacts confined within the project site boundary	1
Low	Proximal – impacts extend to within 1 km of the project site boundary	2
Medium	Local – impacts extend beyond to within 5 km of the project site boundary	3
High	Regional – impacts extend beyond the site boundary and have a widespread effect - i.e. > 5 km from project site boundary	4
Very high	Global – impacts extend beyond the site boundary and have a national or global effect	5

5.3 DURATION OF IMPACT

The traffic impact due to the construction phase will only last for the duration of the activity which is estimated to be 2-3 years. The traffic impact of the operational phase will however last for the entire operational life span of the project.

According to **Table 7** overleaf a duration rating of 3 can thus be adopted for the construction phase and 4 for the operational phase.

Table 7: Listing of the descriptors for the duration of the impact

Duration descriptors	Definitions	Rating
Very low	Project duration – impacts expected only for the duration of the project or not greater than 1 year	1
Low	Short term – impacts expected on a duration timescale of 1 to 2 years	2
Medium	Medium term – impacts expected on a duration timescale of 2-5 years	3
High	Long term – impacts expected on a duration timescale of 5-15 years	4
Very high	Permanent – impacts expected on a duration timescale exceeding 15 years	5

5.4 Frequency of Impact

Traffic will be generated on a daily bases during both the construction and operational phases

According to **Table 8** below a frequency rating of 5 can thus be adopted for both the construction phase and operational phase.

Table 8: Listing of the descriptors for the frequency of the impact

Duration descriptors	Definitions	Rating
Very low	Annually or less	1
Low	6 monthly	2
Medium	Monthly	3
High	Weekly	4
Very high	Daily	5

5.5 Severity of Impact

5.5.1 Impact during Construction Phase

To determine the traffic impact during construction the following construction activity assumptions are made:

- A maximum of 300 construction workers will be on site;
- 80% of the construction workers will make use of public transport or transport provided by the contractor;
- The remaining 20% will make use of private transport which is assumed to have a vehicle occupancy of 1.5 occupants per vehicle during the peak traffic hours, and
- An in:out traffic split of 80%:20% and 20%:80% is assumed for the AM and PM peak traffic hours respectively.

Based on the assumptions above the construction phase is expected to generate peak hour traffic volumes as per **Table 9** overleaf.

Table 9: Expected traffic to be generated during the construction phase

Peak Hour	Vehicle Trips Generated (Vehicles / hour)		
	In	Out	Total
AM	40	10	50
PM	10	40	50

Figure 4 below presents the expected peak hour traffic volumes at the key study intersections during the construction phase.

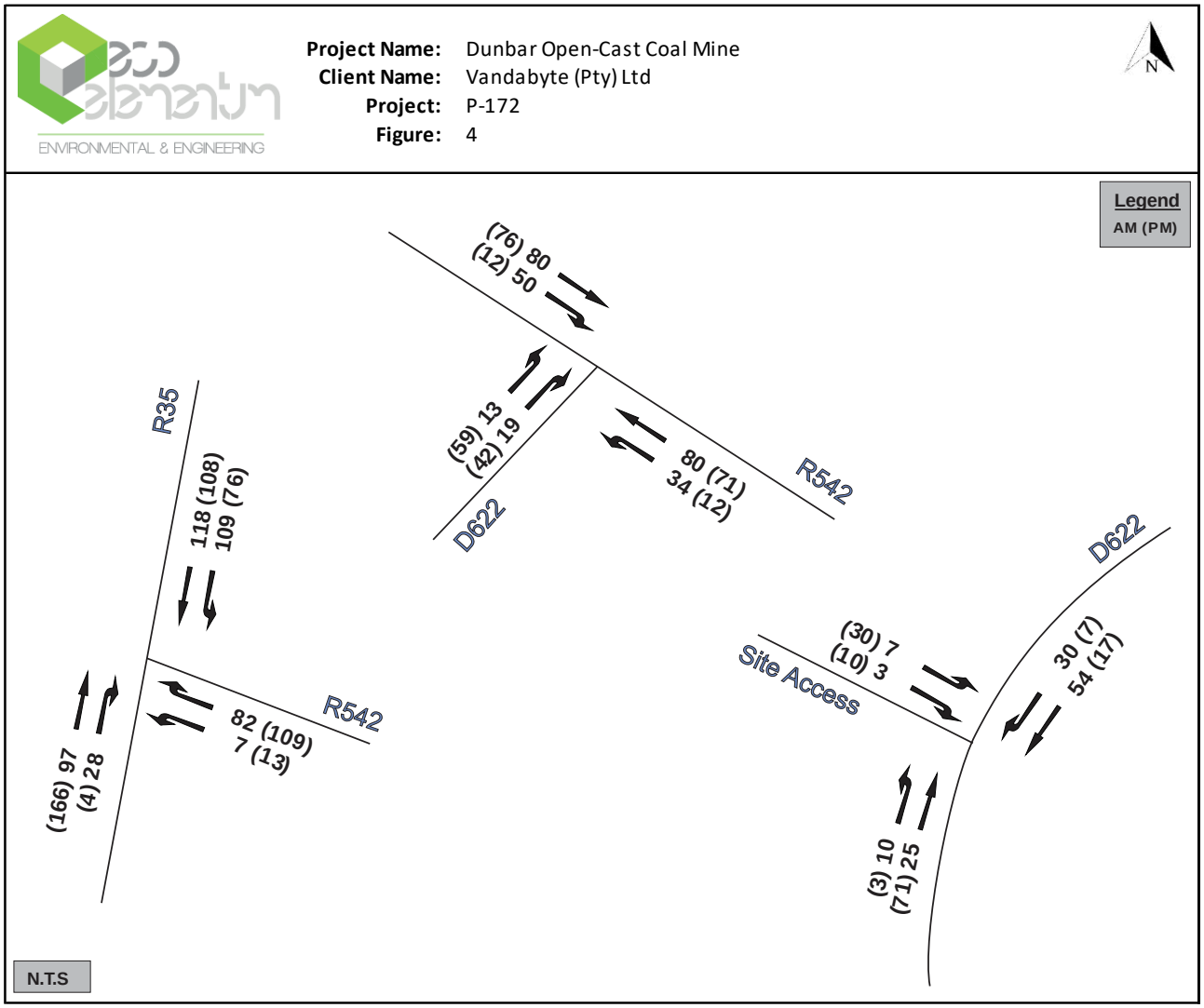


Figure 4: Expected peak hour traffic volumes at the key intersections during the construction phase

The operating conditions for the key intersections during the construction phase are summarized in **Table 10** overleaf with the detailed SIDRA outputs attached as **Appendix B**. These operating conditions are based on the expected peak hour traffic volumes during construction (as per **Figure 4**) as well as the intersection layouts and traffic control (as per **Drawing D001**).

Table 10: Construction phase operating conditions

Intersection & approach definitions	Peak hour	Analysis parameters	Intersection capacity analysis results								
			Approach 1			Approach 2			Approach 3		
			L	T	R	L	T	R	L	T	R
Site Access / Road D622 App 1: Road D622 NE App 2: Site Access NW App 3: Road D622 SW	**Week AM**	**V/C**	-	0.06	0.06	0.01	-	0.01	0.02	0.02	-
		Delay (s)	-	1	6	10	-	10	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
	Week PM	**V/C**	-	0.02	0.02	0.04	-	0.04	0.05	0.05	-
		Delay (s)	-	1	6	10	-	9	6	0	-
		LOS	-	A	A	B	-	A	A	A	-
R542 / Road D622 App 1: R542 SE App 2: R542 NW App 3: Road D622 SW	**Week AM**	**V/C**	0.03	0.06	-	-	0.08	0.08	0.06	-	0.06
		Delay (s)	6	0	-	-	1	7	7	-	10
		LOS	A	A	-	-	A	A	A	-	A
	Week PM	**V/C**	0.01	0.06	-	-	0.05	0.05	0.16	-	0.16
		Delay (s)	6	0	-	-	1	7	7	-	9
		LOS	A	A	-	-	A	A	A	-	A
R35 / R542 App 1: R35 S App 2: R542 E App 3: R35 N	**Week AM**	**V/C**	-	0.08	0.08	0.23	-	0.23	0.09	0.09	-
		Delay (s)	-	1	8	11	-	16	6	0	-
		LOS	-	A	A	B	-	C	A	A	-
	Week PM	**V/C**	-	0.09	0.09	0.33	-	0.33	0.06	0.08	-
		Delay (s)	-	1	8	12	-	18	6	0	-
		LOS	-	A	A	B	-	C	A	A	-

Notes: L=left, T=through, R=right, V/C=volume/capacity, LOS=Level of Service, red text indicates unacceptable performance

5.5.2 Impact during Operational Phase

According to the *TMH 17 Volume 1, South African Trip Data Manual South African Trip Data Manual*[3] mining activities generates an insignificant number of vehicle trips on the external (i.e. public) road network (a maximum of 1 trip per 100 employees during peak traffic hours). To determine more site-specific trip generation data information regarding the operational characteristics of the mine was obtained from the Applicant.

To determine the traffic impact during future operations the following assumptions are made:

- 150 employees will be employed on site during the operational phase;
- 50% of the employees will make use of transport provided by the employer (busses or shuttles);
- The remaining 50% will make use of private transport which is assumed to have a vehicle occupancy of 1.2 occupants per vehicle during the peak traffic hours;
- 80% of the workers will commute to and from the site during the AM and PM peak traffic hours;
- An in:out traffic split of 80%:20% and 20%:80% is assumed for the AM and PM peak traffic hours respectively;
- 5 000 t of coal will be transported by road from the mine per day with a peaking factor of 0.15; and
- Coal will primarily be transported to Komati.

Based on the preceding assumptions the future operational phase is expected to generate peak hour traffic volumes as per **Table 11** below.

Table 11: Expected traffic to be generated during the operational phase

Peak Hour	Vehicle Trips Generated (Vehicles / hour)		
	In	Out	Total
AM	54	14	68
PM	14	54	68

Figure 5 below presents the expected peak hour traffic volumes at the key study intersections during the future operational phase.

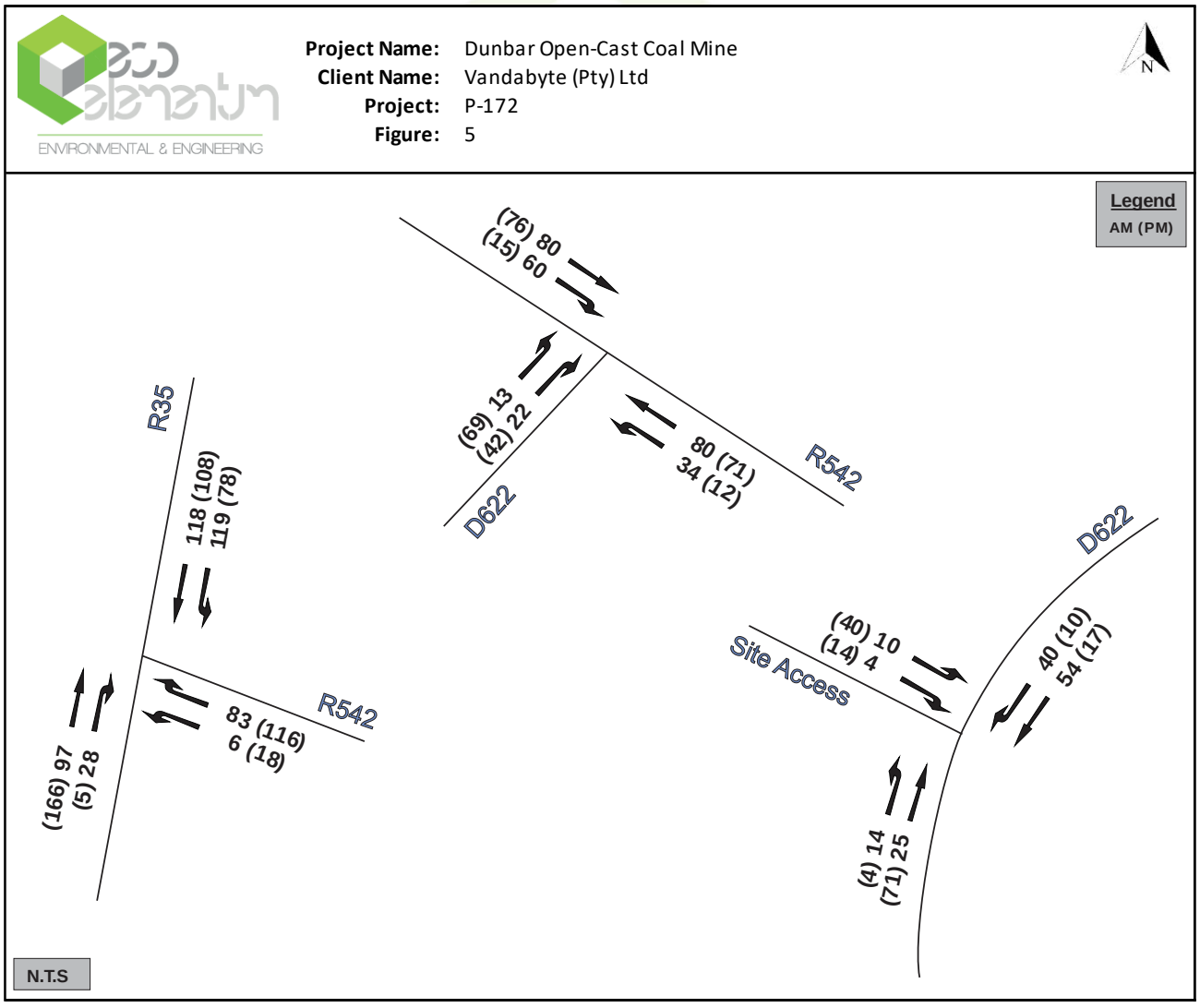


Figure 5: Expected peak hour traffic volumes at the key intersections during the future operational phase

The operating conditions for the key intersections during the future operational phase are summarized in **Table 12** below with the detailed SIDRA outputs attached as **Appendix B**. These operating conditions are based on the expected peak hour traffic volumes during future operations (as per **Figure 5**) as well as the existing intersection layouts and traffic control (as per **Drawing D001**).

Table 12: Future operational phase operating conditions

Intersection & approach definitions	Peak hour	Analysis parameters	Intersection capacity analysis results								
			Approach 1			Approach 2			Approach 3		
			L	T	R	L	T	R	L	T	R
Site Access / Road D622 App 1: Road D622 NE App 2: Site Access NW App 3: Road D622 SW	**Week AM**	**V/C**	-	0.07	0.07	0.01	-	0.01	0.03	0.03	-
		Delay (s)	-	1	6	10	-	10	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
	Week PM	**V/C**	-	0.02	0.02	0.06	-	0.06	0.05	0.05	-
		Delay (s)	-	1	6	10	-	10	6	0	-
		LOS	-	A	A	B	-	A	A	A	-
R542 / Road D622 App 1: R542 SE App 2: R542 NW App 3: Road D622 SW	**Week AM**	**V/C**	0.03	0.06	-	-	0.09	0.09	0.07	-	0.07
		Delay (s)	6	0	-	-	1	7	7	-	10
		LOS	A	A	-	-	A	A	A	-	B
	Week PM	**V/C**	0.01	0.06	-	-	0.06	0.06	0.18	-	0.18
		Delay (s)	6	0	-	-	1	7	7	-	9
		LOS	A	A	-	-	A	A	A	-	A
R35 / R542 App 1: R35 S App 2: R542 E App 3: R35 N	**Week AM**	**V/C**	-	0.08	0.08	0.24	-	0.24	0.09	0.09	-
		Delay (s)	-	1	8	11	-	16	6	0	-
		LOS	-	A	A	B	-	C	A	A	-
	Week PM	**V/C**	-	0.09	0.09	0.36	-	0.36	0.06	0.08	-
		Delay (s)	-	1	8	12	-	18	6	0	-
		LOS	-	A	A	B	-	C	A	A	-

Notes: L=left, T=through, R=right, V/C=volume/capacity, LOS=Level of Service, red text indicates unacceptable performance

5.5.3 Comparing Operating Conditions with the Baseline

By comparing the expected operating conditions during the project's construction and operational phases with the baseline it can be stated that an insignificant traffic impact is expected for both these project phases.

Based on the above and considering **Table 13** overleaf the severity of the traffic impact can be described as "very low" for both the project phases and a rating of 1 can thus be adopted.

Table 13: Listing of the descriptors for the severity of the impact

Intensity descriptors	Definitions	Rating
None	Negligible – zero or very low impact	1
Minor	Site specific and short-term impacts	2
Low	Local scale and / or short-term impacts	3
Moderate	Regional and / or long-term impacts	4
High	Global scale and / or permanent environmental change	5

5.6 Probability of Impact Occurring

Considering **Table 14** below a rating of 4 can be allocated to the probability of the traffic impact during both the construction and operational phases.

Table 14: Listing of the descriptors for the probability of the impact

Probability descriptors	Definitions	Rating
Highly Improbable	Likelihood of the impact arising is estimated to be negligible; <5%	1
Improbable	Likelihood of the impact arising is estimated to be 5-35%	2
Possible	Likelihood of the impact arising is estimated to be 35-65%	3
Probable	Likelihood of the impact arising is estimated to be 65-95%	4
Highly Probable	Likelihood of the impact arising is estimated to be > 95%	5

6. MITIGATION MEASURES

A significance rating can be allocated to the expected traffic impact based on the significance assessment matrix provided in **Table 15** below.

Table 15: Significance assessment matrix

Likelihood (Frequency + Probability)	Consequence (Severity + Spatial Extent + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	08	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

The significant ratings for the project phases are presented in **Table 16** below.

Table 16: Impact assessment for the project phases considered

Project phase	Mitigation	Nature	Impact rating criteria					Significance (as per Table 15)
			Spatial Extent	Duration	Frequency	Severity	Probability	
Construction	No	Negative	3	3	5	1	4	63
Operations	No	Negative	3	4	5	1	4	72

Based on the nature of the impact and the significant scores in **Table 16** the recommenced impact management or mitigation can be determined as per **Table 17** overleaf.

Table 17: Positive and negative impact mitigation ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Improve Current Management	Maintain Current Management
	High	101-125	Improve Current Management	Maintain Current Management
	Medium-High	76-100	Improve Current Management	Maintain Current Management
	Low-Medium	51-75	Maintain Current Management	Improve Current Management
	Low	26-50	Maintain Current Management	Improve Current Management
	Very Low	1-25	Maintain Current Management	Improve Current Management

Based on the impact mitigation ratings above the project can be authorised in terms of the criteria as per **Table 17** without the need to implement any mitigation measures.

7. LEGAL REQUIREMENTS AND OTHER CONSIDERATIONS

The following comments can be made regarding legal requirements and other considerations during the proposed project:

- All legal authorisations and permits must be obtained for the transportation of abnormal loads and hazardous materials on public roads;
- Measures should be taken to ensure that all health and safety requirements regarding transportation activities are complied with. This may include dust covers for hauling vehicles and dust control on all gravel roads;
- It is proposed that flagmen and temporary warning signs be placed at all access points where heavy vehicles will access public roads during construction, and
- Controls should be in place to ensure that vehicles exiting the site are not overloaded.

8. SUMMARY AND CONCLUSIONS

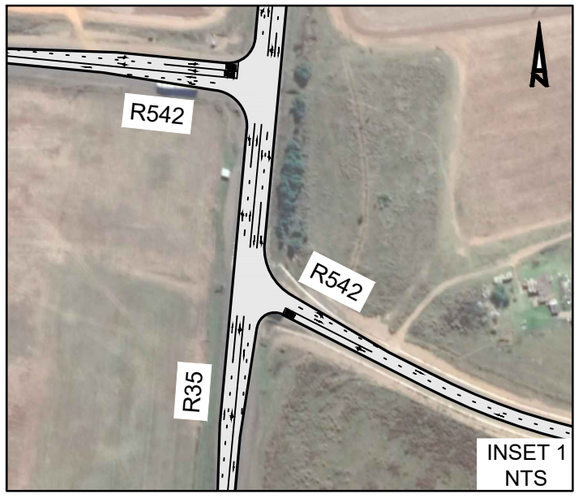
In summary and based on the contents of this document the following key conclusions are made regarding the proposed Dunbar Coal Mine to be situated between Hendrina and Komati in Mpumalanga Province, South Africa:

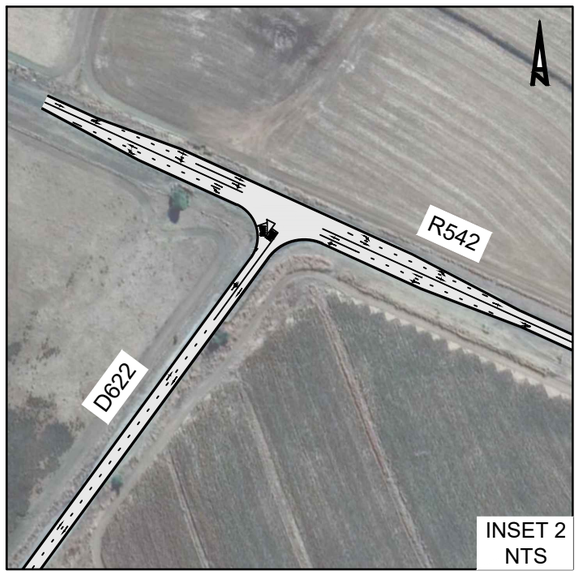
- This report forms part of the environmental authorisation processes required for the proposed project;
- The purpose of this report is to investigate the traffic impact that the proposed project will have on the surrounding road network and propose possible measures to mitigate such impact (if necessary);
- The study area (receiving environment) was defined based on the extent and type of the project activities and the characteristics of the traffic expected to be generated as a result. Based on this the boundaries of the study area are limited to the location of the following key intersections:
  - Road D622 / Proposed Access to Dunbar Coal Mine;
  - Road D622 / Road R542 (P182/1), and
  - Road R542 (P182/1) / R35.
- No vulnerabilities or sensitivities currently exists in the defined study area;
- To determine the existing traffic demand on the nearby road network classified 13-hour manual traffic surveys were conducted on Wednesday 18 September 2019 at the key study intersections;
- By using the data collected and observations made during the site visit traffic operating conditions were determined by means of traffic engineer software, namely SIDRA INERSECTION 8. Operating conditions were determined and compared for the following three scenarios:
  - Baseline;
  - Project construction phase; and
  - Project operational phase
- By comparing the operating conditions for the different scenarios, it is concluded that the proposed project will have an insignificant traffic impact on the surrounding road network;
- Seeing as no traffic problems or congestion are expected as a result of the project activities (providing that the issues discussed in **Section 7** of this report be addressed) no mitigation measures are required; and
- Traffic impact significance scores of 63 and 72 are calculated for the construction and operational phases of the proposed project respectively, which implies that the project can be authorized from a traffic engineering viewpoint.

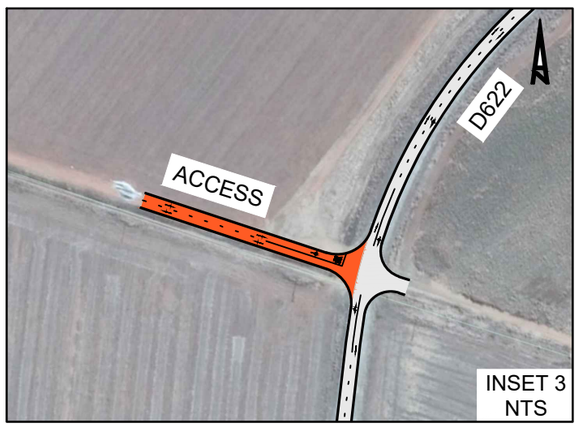
9. REFERENCES

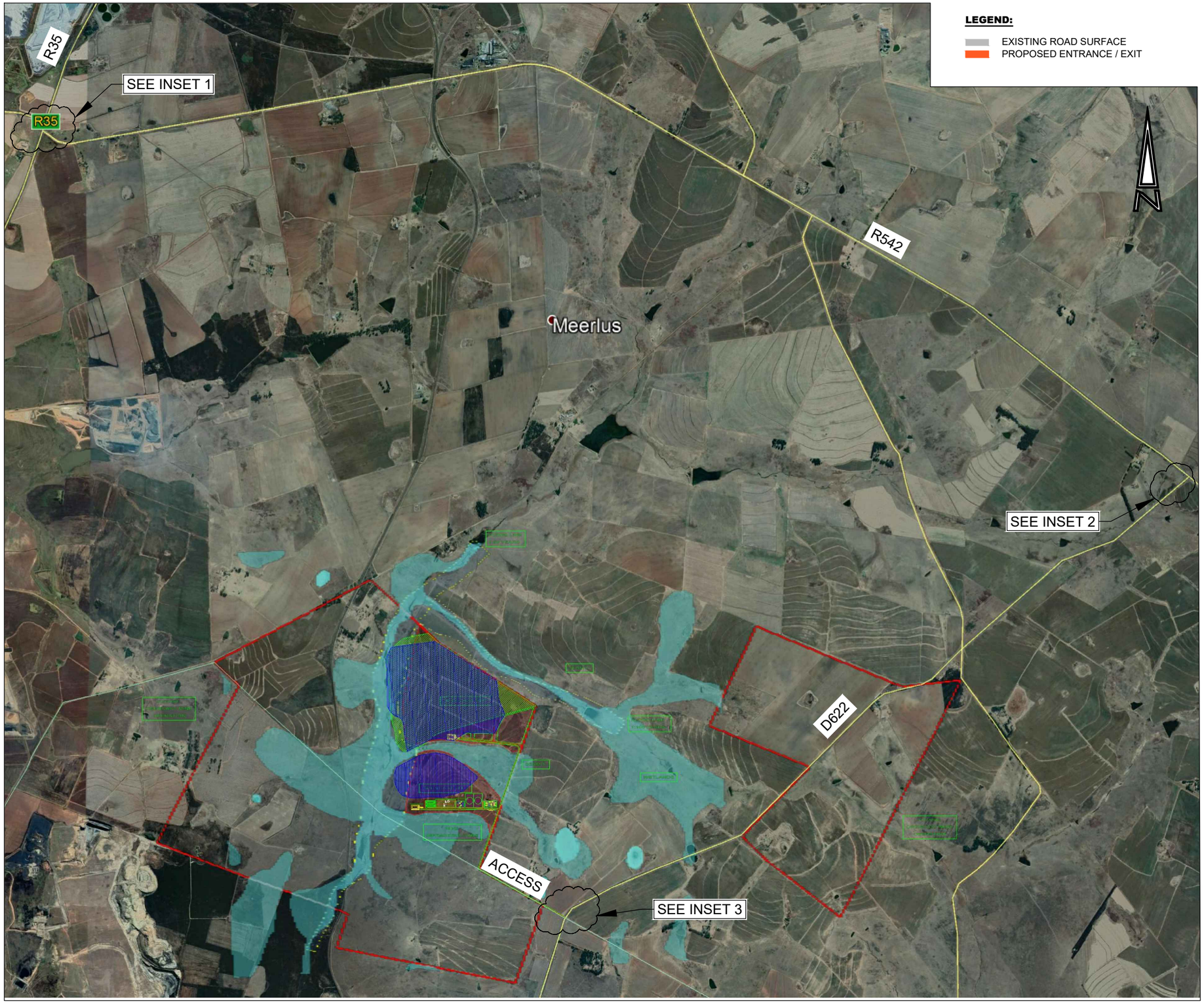
1. Committee of Transport Officials. TMH 16 Volume 2, South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual. Version 1.0, August 2012.
2. Committee of Transport Officials. TRH 26, South African Road Classification and Access Management Manual. Version 1.0, August 2012.
3. Committee of Transport Officials. TMH 17 Volume 1, South African Trip Data Manual. Versio n 1.0, September 2012.

Appendix A
Drawing D001– Existing Roads and Intersection Layouts









REV	DATE	BY	DESCRIPTION	CHK	APD
A	2019-10-02	PJ	FOR APPROVAL	PJ	RvW

ARCHITECT: -

CLIENT:

DRAWING STATUS: PRELIMINARY

INFRATRANS
TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING

PROJECT: DUNBAR OPEN-CAST COAL MINE

TITLE: EXISTING ROADS AND INTERSECTION LAYOUTS

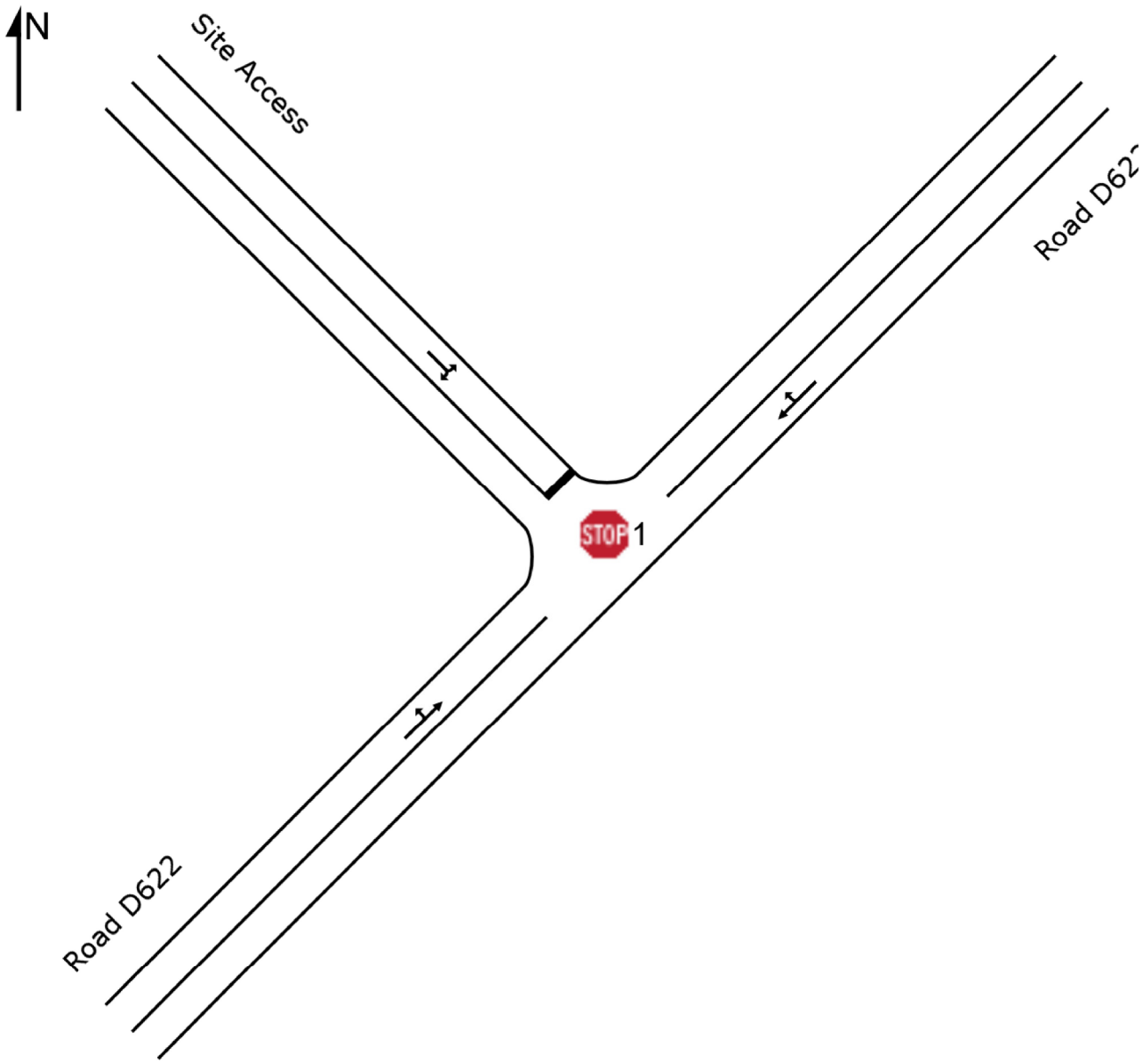
SCALE @ A3:	CHECKED:	APPROVED:
NTS	PJ	RvW
DESIGN:	DRAWN:	DATE:
PJ	PJ	02/10/2019
PROJECT No:	DRAWING No:	REV:
P-172	D001	A

Appendix B
SIDRA outputs

SITE LAYOUT

Site: 1 [2019 AM + Construction (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)



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Project: C:\Users\piete\Dropbox\PROJECTS\P-172 Dunbar Mining Rights Application TIA\7 Analyses & Calculations\1_Site Access_D622.sip8

MOVEMENT SUMMARY

Site: 1 [2019 AM + Construction (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)

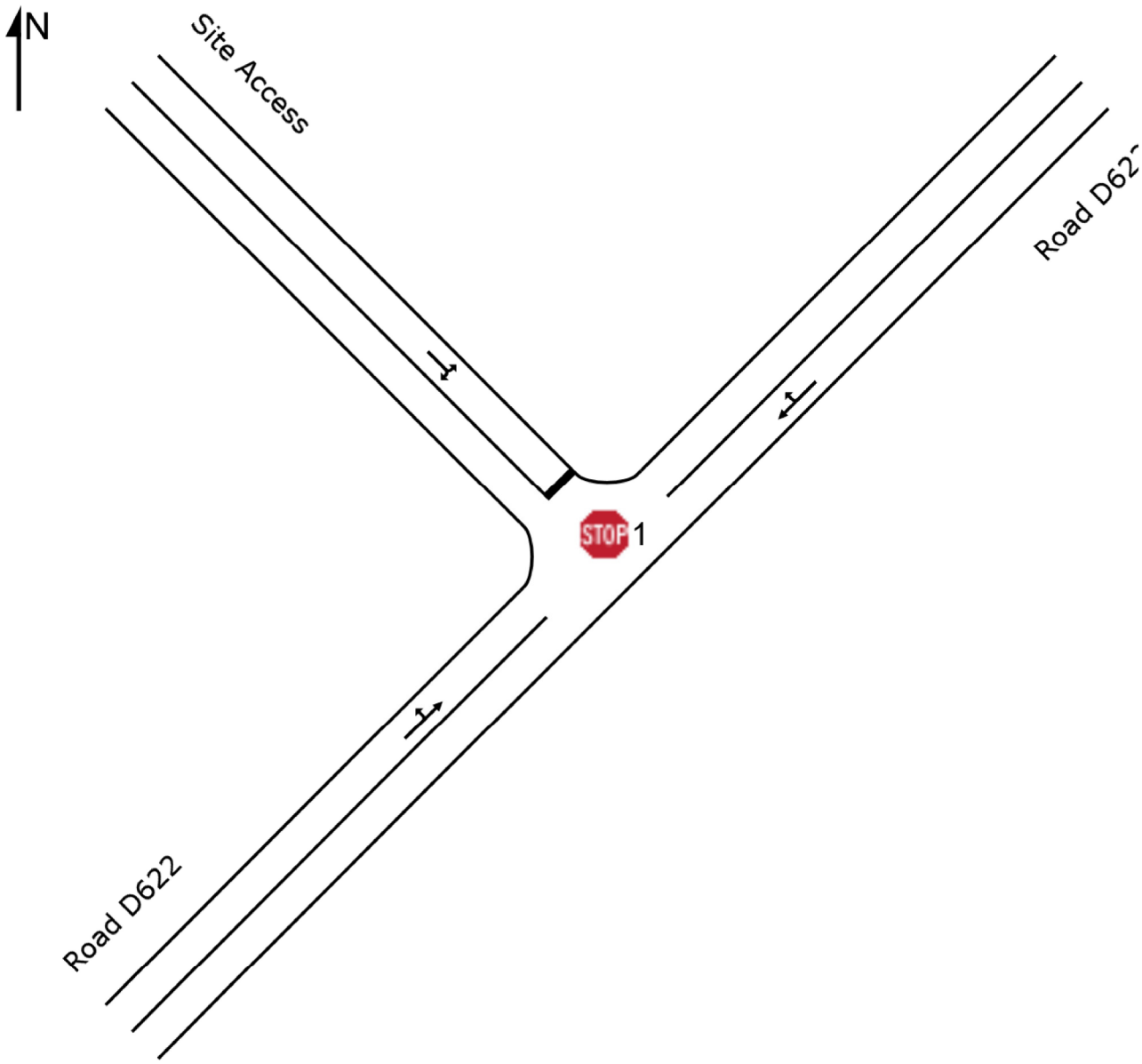
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
NorthEast: Road D622												
8	T1	57	40.0	0.059	0.1	LOS A	0.2	1.9	0.10	0.21	0.10	57.8
9	R2	32	40.0	0.059	6.1	LOS A	0.2	1.9	0.10	0.21	0.10	53.8
Approach		88	40.0	0.059	2.2	NA	0.2	1.9	0.10	0.21	0.10	56.3
NorthWest: Site Access												
10	L2	7	40.0	0.010	9.9	LOS A	0.0	0.3	0.11	0.99	0.11	50.2
12	R2	3	40.0	0.010	10.0	LOS B	0.0	0.3	0.11	0.99	0.11	49.7
Approach		11	40.0	0.010	9.9	LOS A	0.0	0.3	0.11	0.99	0.11	50.0
SouthWest: Road D622												
1	L2	11	40.0	0.024	6.0	LOS A	0.0	0.0	0.00	0.17	0.00	55.0
2	T1	26	40.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.17	0.00	58.5
Approach		37	40.0	0.024	1.7	NA	0.0	0.0	0.00	0.17	0.00	57.4
All Vehicles		136	40.0	0.059	2.7	NA	0.2	1.9	0.07	0.26	0.07	56.0

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [2019 PM + Construction (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)



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Project: C:\Users\piete\Dropbox\PROJECTS\P-172 Dunbar Mining Rights Application TIA\7 Analyses & Calculations\1_Site Access_D622.sip8

MOVEMENT SUMMARY

Site: 1 [2019 PM + Construction (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)

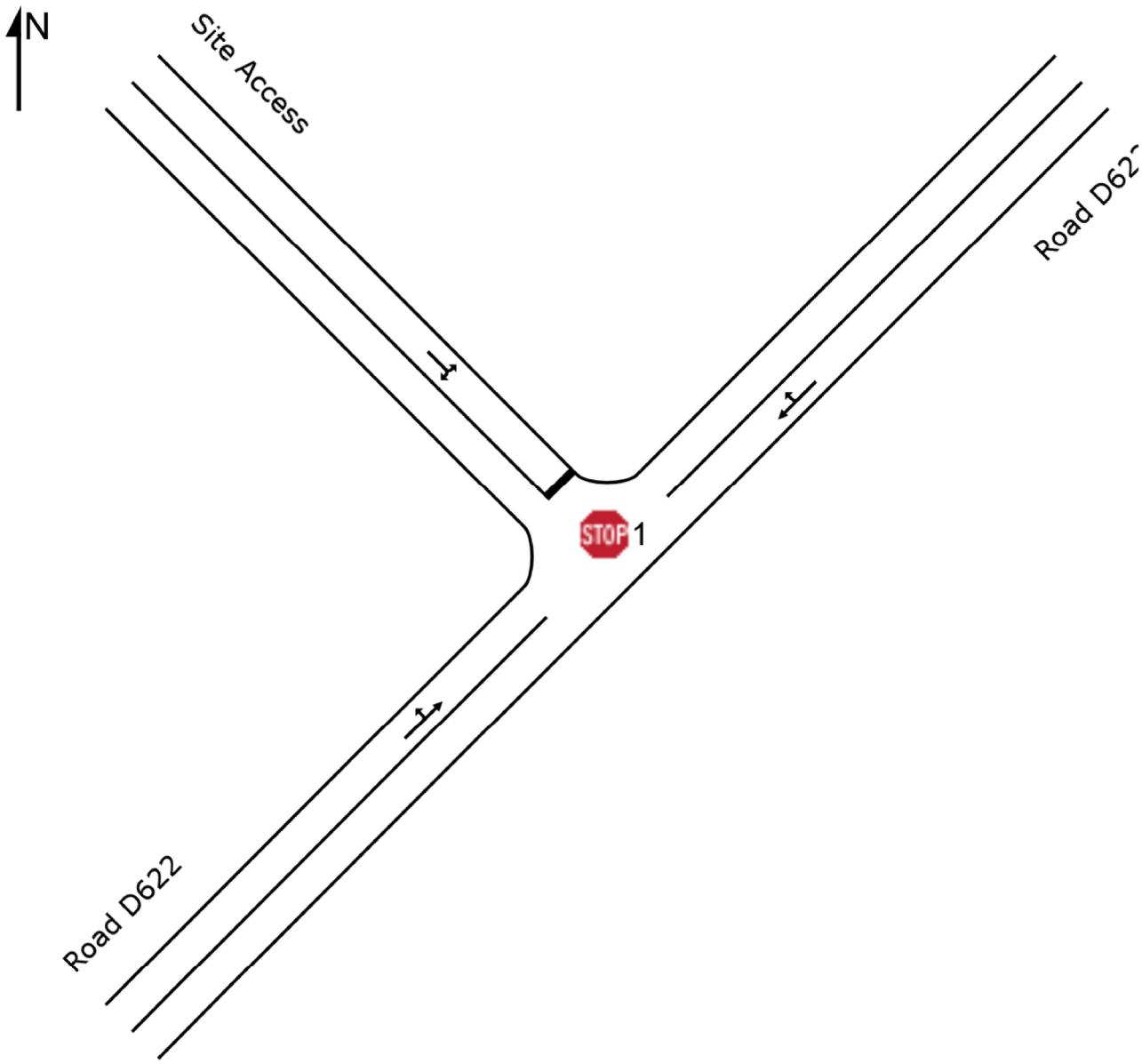
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
NorthEast: Road D622												
8	T1	18	40.0	0.017	0.2	LOS A	0.0	0.5	0.13	0.17	0.13	58.0
9	R2	7	40.0	0.017	6.3	LOS A	0.0	0.5	0.13	0.17	0.13	54.0
Approach		25	40.0	0.017	2.0	NA	0.0	0.5	0.13	0.17	0.13	56.7
NorthWest: Site Access												
10	L2	32	40.0	0.042	10.2	LOS B	0.2	1.5	0.21	0.93	0.21	50.2
12	R2	11	40.0	0.042	9.9	LOS A	0.2	1.5	0.21	0.93	0.21	49.7
Approach		42	40.0	0.042	10.1	LOS B	0.2	1.5	0.21	0.93	0.21	50.1
SouthWest: Road D622												
1	L2	3	40.0	0.050	6.0	LOS A	0.0	0.0	0.00	0.02	0.00	56.2
2	T1	75	40.0	0.050	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.8
Approach		78	40.0	0.050	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.6
All Vehicles		145	40.0	0.050	3.4	NA	0.2	1.5	0.08	0.31	0.08	56.0

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [2019 AM + Operation (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [2019 AM + Operation (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)

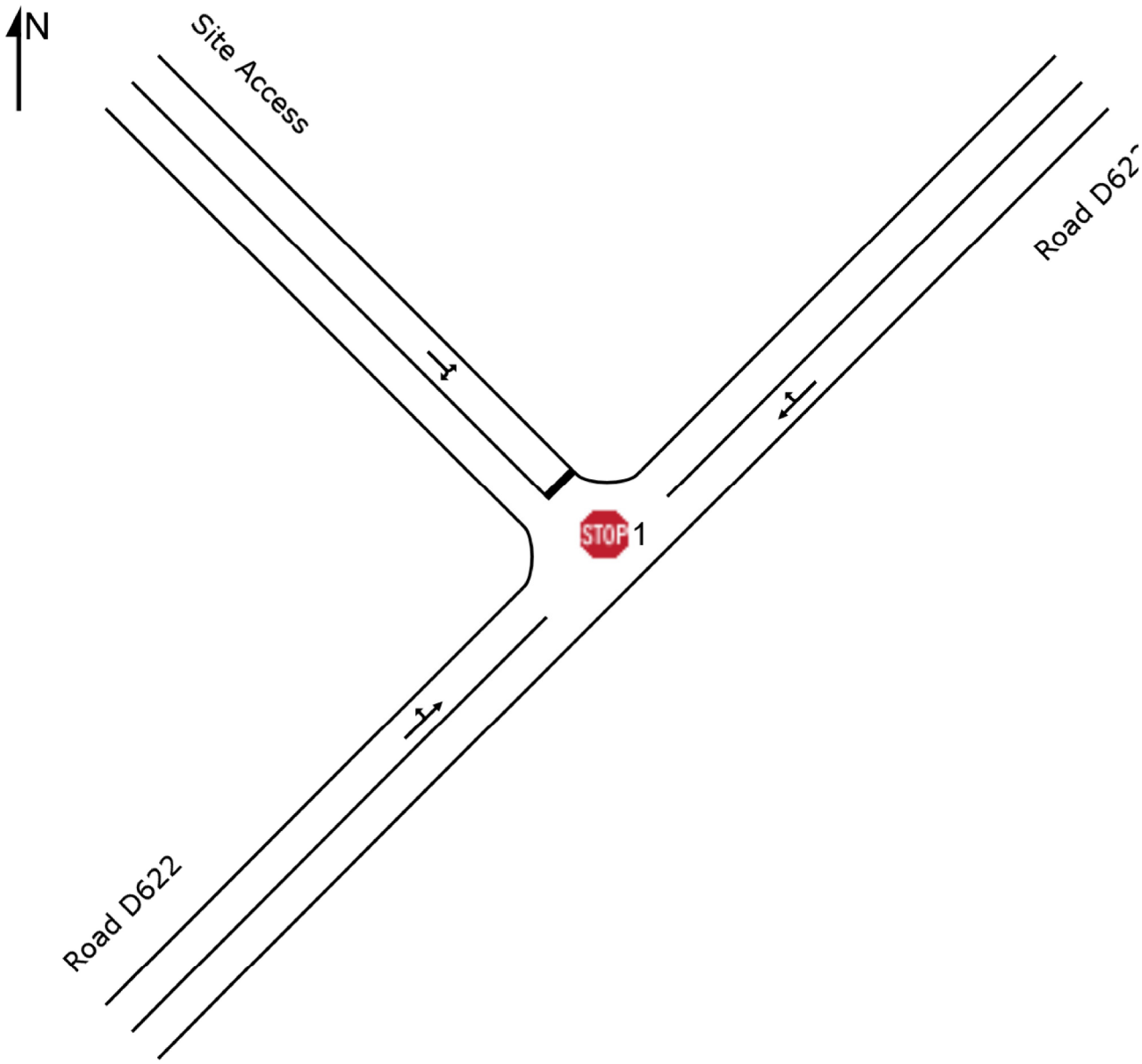
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
NorthEast: Road D622												
8	T1	57	40.0	0.067	0.1	LOS A	0.3	2.4	0.12	0.24	0.12	57.3
9	R2	42	40.0	0.067	6.1	LOS A	0.3	2.4	0.12	0.24	0.12	53.4
Approach		99	40.0	0.067	2.7	NA	0.3	2.4	0.12	0.24	0.12	55.6
NorthWest: Site Access												
10	L2	11	40.0	0.014	9.9	LOS A	0.1	0.5	0.10	0.99	0.10	50.2
12	R2	4	40.0	0.014	10.1	LOS B	0.1	0.5	0.10	0.99	0.10	49.7
Approach		15	40.0	0.014	9.9	LOS A	0.1	0.5	0.10	0.99	0.10	50.0
SouthWest: Road D622												
1	L2	15	40.0	0.027	6.0	LOS A	0.0	0.0	0.00	0.21	0.00	54.7
2	T1	26	40.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.21	0.00	58.1
Approach		41	40.0	0.027	2.2	NA	0.0	0.0	0.00	0.21	0.00	56.8
All Vehicles		155	40.0	0.067	3.2	NA	0.3	2.4	0.09	0.31	0.09	55.3

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [2019 PM + Operation (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)



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Project: C:\Users\piete\Dropbox\PROJECTS\P-172 Dunbar Mining Rights Application TIA\7 Analyses & Calculations\1_Site Access_D622.sip8

MOVEMENT SUMMARY

Site: 1 [2019 PM + Operation (proposed layout)]

Road D622 / Proposed Site Access Road Intersection
Site Category: (None)
Stop (Two-Way)

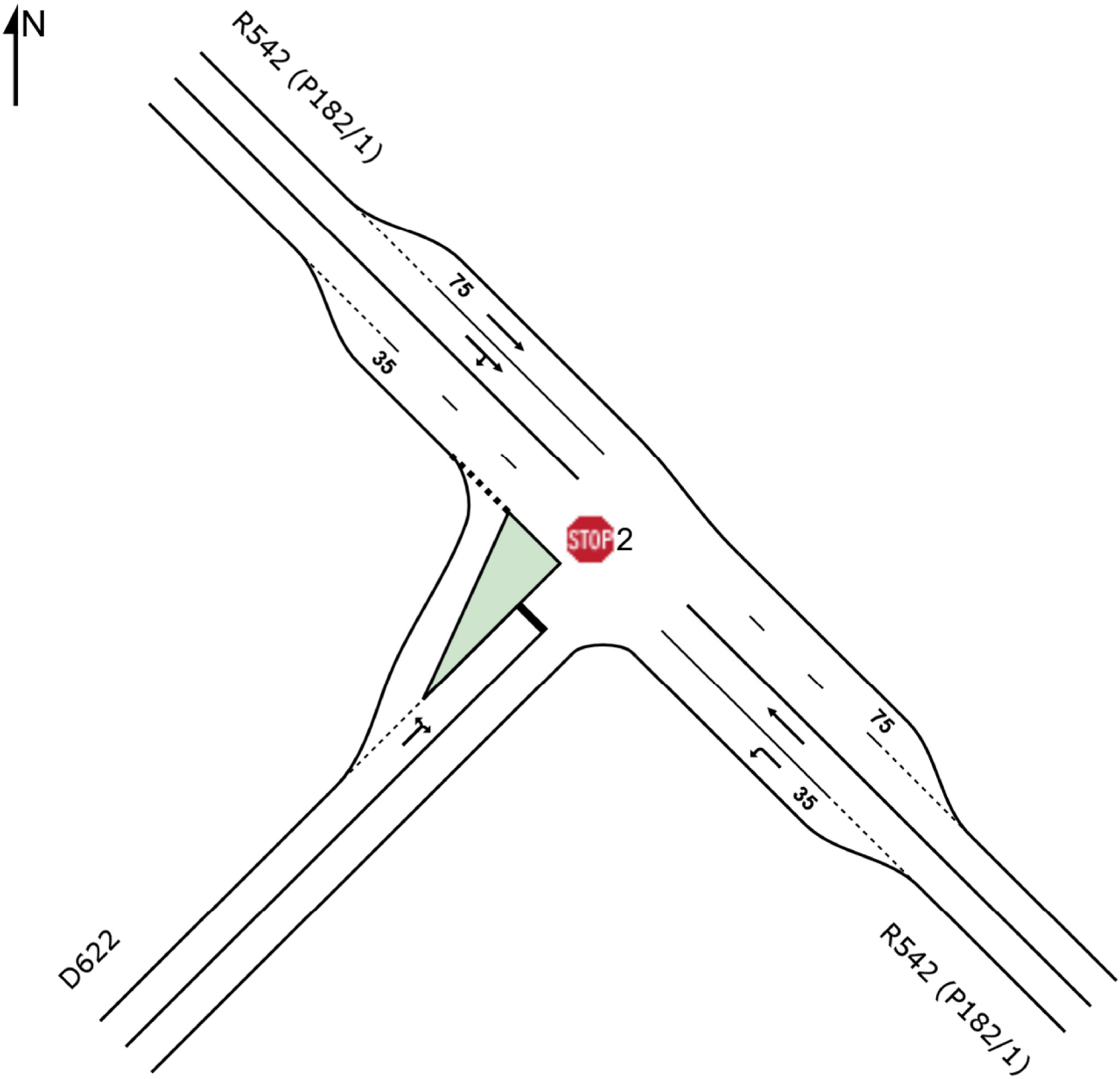
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
NorthEast: Road D622												
8	T1	18	40.0	0.019	0.2	LOS A	0.1	0.6	0.15	0.21	0.15	57.5
9	R2	11	40.0	0.019	6.3	LOS A	0.1	0.6	0.15	0.21	0.15	53.6
Approach		28	40.0	0.019	2.5	NA	0.1	0.6	0.15	0.21	0.15	56.0
NorthWest: Site Access												
10	L2	42	40.0	0.056	10.2	LOS B	0.2	2.0	0.22	0.94	0.22	50.2
12	R2	15	40.0	0.056	10.0	LOS A	0.2	2.0	0.22	0.94	0.22	49.7
Approach		57	40.0	0.056	10.1	LOS B	0.2	2.0	0.22	0.94	0.22	50.1
SouthWest: Road D622												
1	L2	4	40.0	0.051	6.0	LOS A	0.0	0.0	0.00	0.03	0.00	56.1
2	T1	75	40.0	0.051	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	59.7
Approach		79	40.0	0.051	0.3	NA	0.0	0.0	0.00	0.03	0.00	59.5
All Vehicles		164	40.0	0.056	4.1	NA	0.2	2.0	0.10	0.38	0.10	55.3

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 2 [2019 AM (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2019 AM (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)

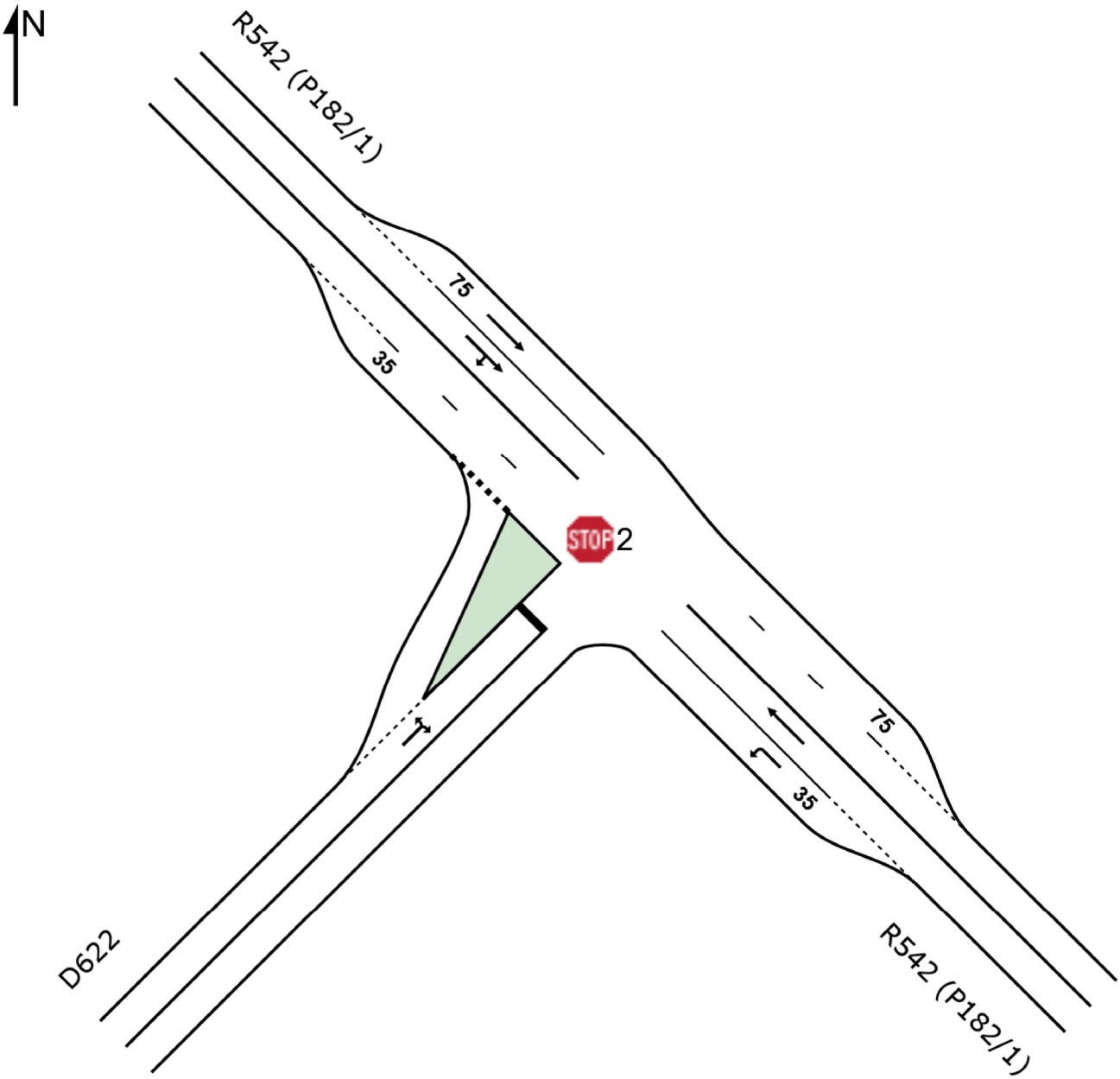
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: R542 (P182/1)												
4	L2	28	40.0	0.019	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.0
5	T1	92	40.0	0.059	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		120	40.0	0.059	1.4	NA	0.0	0.0	0.00	0.13	0.00	57.9
NorthWest: R542 (P182/1)												
11	T1	92	40.0	0.066	0.3	LOS A	0.3	2.5	0.12	0.13	0.12	58.3
12	R2	34	40.0	0.066	6.8	LOS A	0.3	2.5	0.22	0.24	0.22	53.5
Approach		126	40.0	0.066	2.1	NA	0.3	2.5	0.15	0.16	0.15	56.9
SouthWest: D622												
1	L2	11	40.0	0.044	6.6	LOS A	0.2	1.5	0.33	0.59	0.33	51.1
3	R2	17	40.0	0.044	9.4	LOS A	0.2	1.5	0.33	0.59	0.33	50.2
Approach		29	40.0	0.044	8.3	LOS A	0.2	1.5	0.33	0.59	0.33	50.5
All Vehicles		275	40.0	0.066	2.4	NA	0.3	2.5	0.10	0.19	0.10	56.6

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 2 [2019 PM (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)



Organisation: INFRATRANS CIVIL AND TRAFFIC ENGINEERING | Created: Wednesday, 02 October 2019 12:06:03
Project: C:\Users\piete\Dropbox\PROJECTS\P-172 Dunbar Mining Rights Application TIA\7 Analyses & Calculations\2_R542_D622.sip8

MOVEMENT SUMMARY

Site: 2 [2019 PM (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)

Movement Performance - Vehicles

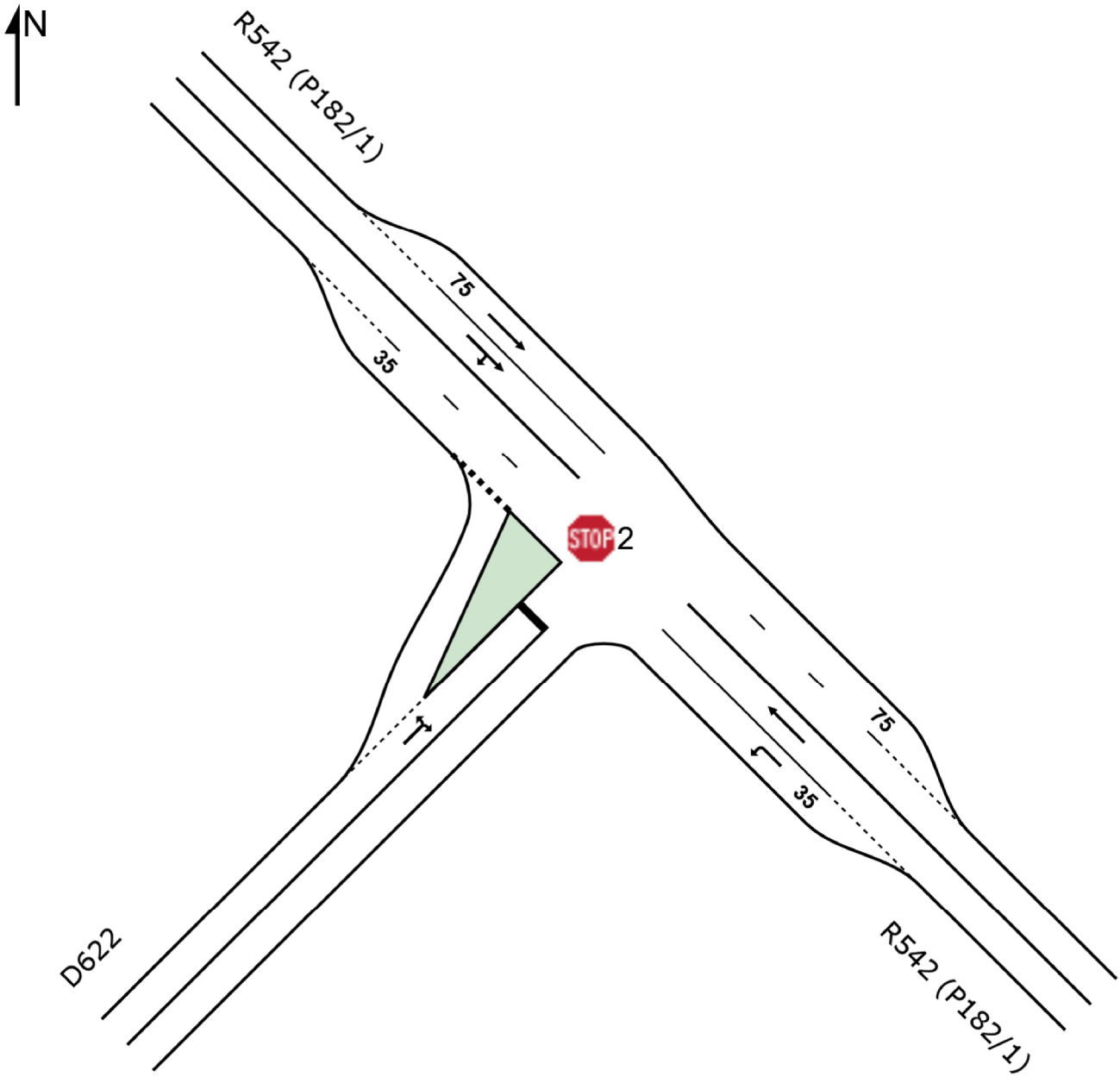
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: R542 (P182/1)												
4	L2	11	40.0	0.008	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.0
5	T1	87	40.0	0.055	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		98	40.0	0.055	0.7	NA	0.0	0.0	0.00	0.06	0.00	59.0
NorthWest: R542 (P182/1)												
11	T1	93	40.0	0.049	0.1	LOS A	0.1	0.8	0.05	0.05	0.05	59.3
12	R2	10	40.0	0.049	6.6	LOS A	0.1	0.8	0.08	0.08	0.08	55.2
Approach		102	40.0	0.049	0.7	NA	0.1	0.8	0.05	0.06	0.05	58.9
SouthWest: D622												
1	L2	48	40.0	0.116	6.6	LOS A	0.5	4.2	0.30	0.58	0.30	51.5
3	R2	39	40.0	0.116	9.0	LOS A	0.5	4.2	0.30	0.58	0.30	50.6
Approach		87	40.0	0.116	7.7	LOS A	0.5	4.2	0.30	0.58	0.30	51.1
All Vehicles		287	40.0	0.116	2.8	NA	0.5	4.2	0.11	0.22	0.11	56.3

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 2 [2019 AM + Construction (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2019 AM + Construction (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)

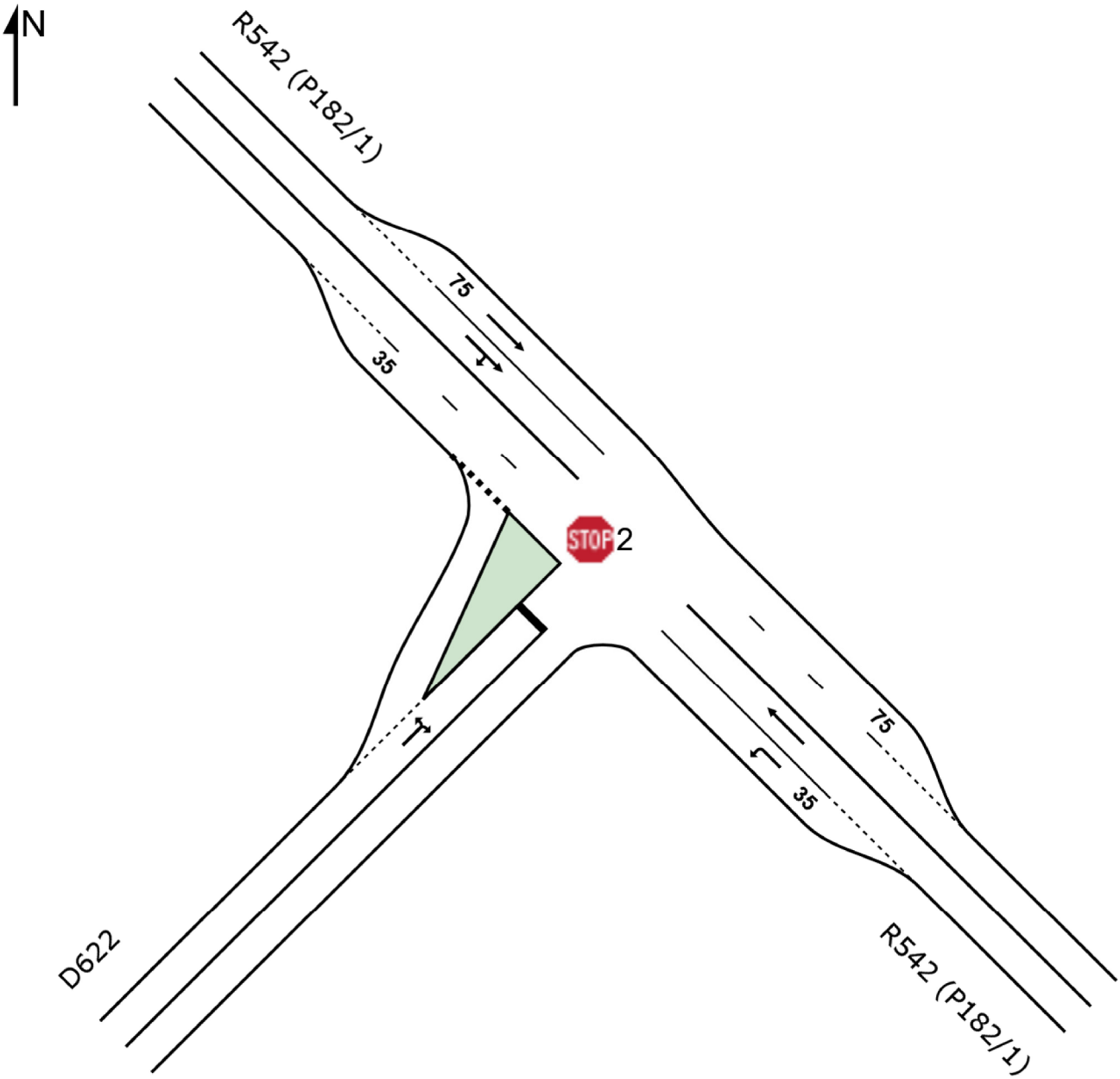
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: R542 (P182/1)												
4	L2	39	40.0	0.027	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.0
5	T1	92	40.0	0.059	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		131	40.0	0.059	1.8	NA	0.0	0.0	0.00	0.17	0.00	57.3
NorthWest: R542 (P182/1)												
11	T1	92	40.0	0.083	0.3	LOS A	0.4	3.5	0.12	0.15	0.12	58.2
12	R2	57	40.0	0.083	6.9	LOS A	0.4	3.5	0.28	0.34	0.28	52.6
Approach		149	40.0	0.083	2.9	NA	0.4	3.5	0.18	0.22	0.18	55.9
SouthWest: D622												
1	L2	15	40.0	0.059	6.6	LOS A	0.2	2.0	0.34	0.60	0.34	50.9
3	R2	22	40.0	0.059	10.0	LOS A	0.2	2.0	0.34	0.60	0.34	49.9
Approach		37	40.0	0.059	8.6	LOS A	0.2	2.0	0.34	0.60	0.34	50.3
All Vehicles		317	40.0	0.083	3.1	NA	0.4	3.5	0.13	0.24	0.13	55.7

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 2 [2019 PM + Construction (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)



Organisation: INFRATRANS CIVIL AND TRAFFIC ENGINEERING | Created: Wednesday, 02 October 2019 12:06:08
Project: C:\Users\piete\Dropbox\PROJECTS\P-172 Dunbar Mining Rights Application TIA\7 Analyses & Calculations\2_R542_D622.sip8

MOVEMENT SUMMARY

Site: 2 [2019 PM + Construction (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)

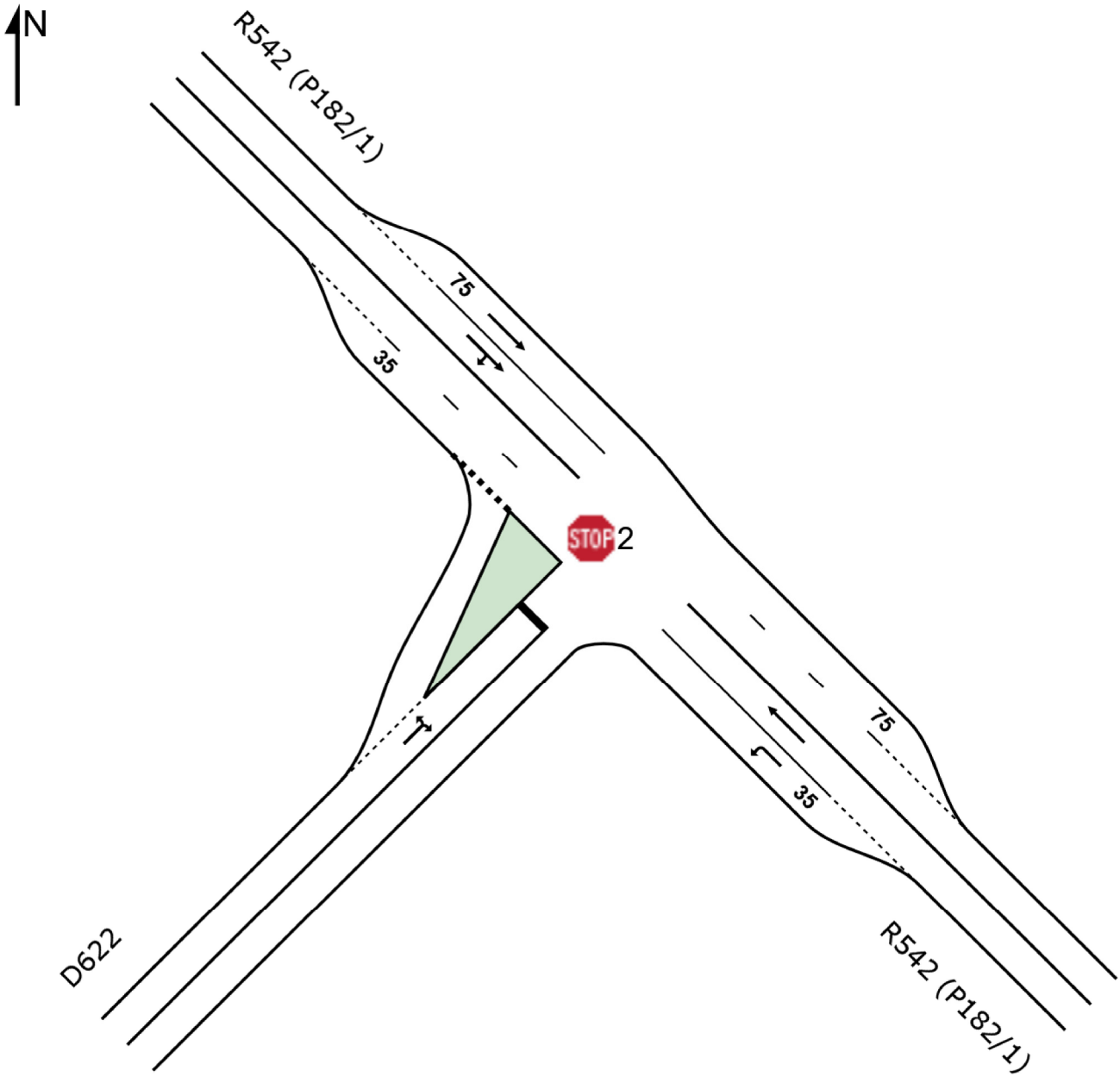
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: R542 (P182/1)												
4	L2	15	40.0	0.010	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.0
5	T1	87	40.0	0.055	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		101	40.0	0.055	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.7
NorthWest: R542 (P182/1)												
11	T1	93	40.0	0.052	0.1	LOS A	0.1	1.2	0.07	0.07	0.07	59.0
12	R2	15	40.0	0.052	6.6	LOS A	0.1	1.2	0.11	0.11	0.11	54.8
Approach		107	40.0	0.052	1.0	NA	0.1	1.2	0.08	0.08	0.08	58.4
SouthWest: D622												
1	L2	72	40.0	0.163	6.7	LOS A	0.7	6.2	0.30	0.58	0.30	51.5
3	R2	51	40.0	0.163	9.3	LOS A	0.7	6.2	0.30	0.58	0.30	50.5
Approach		123	40.0	0.163	7.7	LOS A	0.7	6.2	0.30	0.58	0.30	51.1
All Vehicles		332	40.0	0.163	3.5	NA	0.7	6.2	0.14	0.27	0.14	55.5

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 2 [2019 AM + Operation (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)



Organisation: INFRATRANS CIVIL AND TRAFFIC ENGINEERING | Created: Wednesday, 02 October 2019 12:06:12
Project: C:\Users\piete\Dropbox\PROJECTS\P-172 Dunbar Mining Rights Application TIA\7 Analyses & Calculations\2_R542_D622.sip8

MOVEMENT SUMMARY

Site: 2 [2019 AM + Operation (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	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	Aver. No. Cycles	Average Speed km/h
SouthEast: R542 (P182/1)												
4	L2	39	40.0	0.027	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.0
5	T1	92	40.0	0.059	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		131	40.0	0.059	1.8	NA	0.0	0.0	0.00	0.17	0.00	57.3
NorthWest: R542 (P182/1)												
11	T1	92	40.0	0.091	0.3	LOS A	0.4	3.9	0.11	0.14	0.11	58.3
12	R2	69	40.0	0.091	6.9	LOS A	0.4	3.9	0.29	0.39	0.29	52.3
Approach		161	40.0	0.091	3.1	NA	0.4	3.9	0.19	0.25	0.19	55.5
SouthWest: D622												
1	L2	15	40.0	0.067	6.6	LOS A	0.2	2.3	0.36	0.61	0.36	50.7
3	R2	25	40.0	0.067	10.2	LOS B	0.2	2.3	0.36	0.61	0.36	49.7
Approach		40	40.0	0.067	8.9	LOS A	0.2	2.3	0.36	0.61	0.36	50.1
All Vehicles		332	40.0	0.091	3.3	NA	0.4	3.9	0.13	0.26	0.13	55.5

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [2019 PM + Operation (existing layout and control)]

R542 (P182/1) / Road D622 Intersection
Site Category: -
Stop (Two-Way)

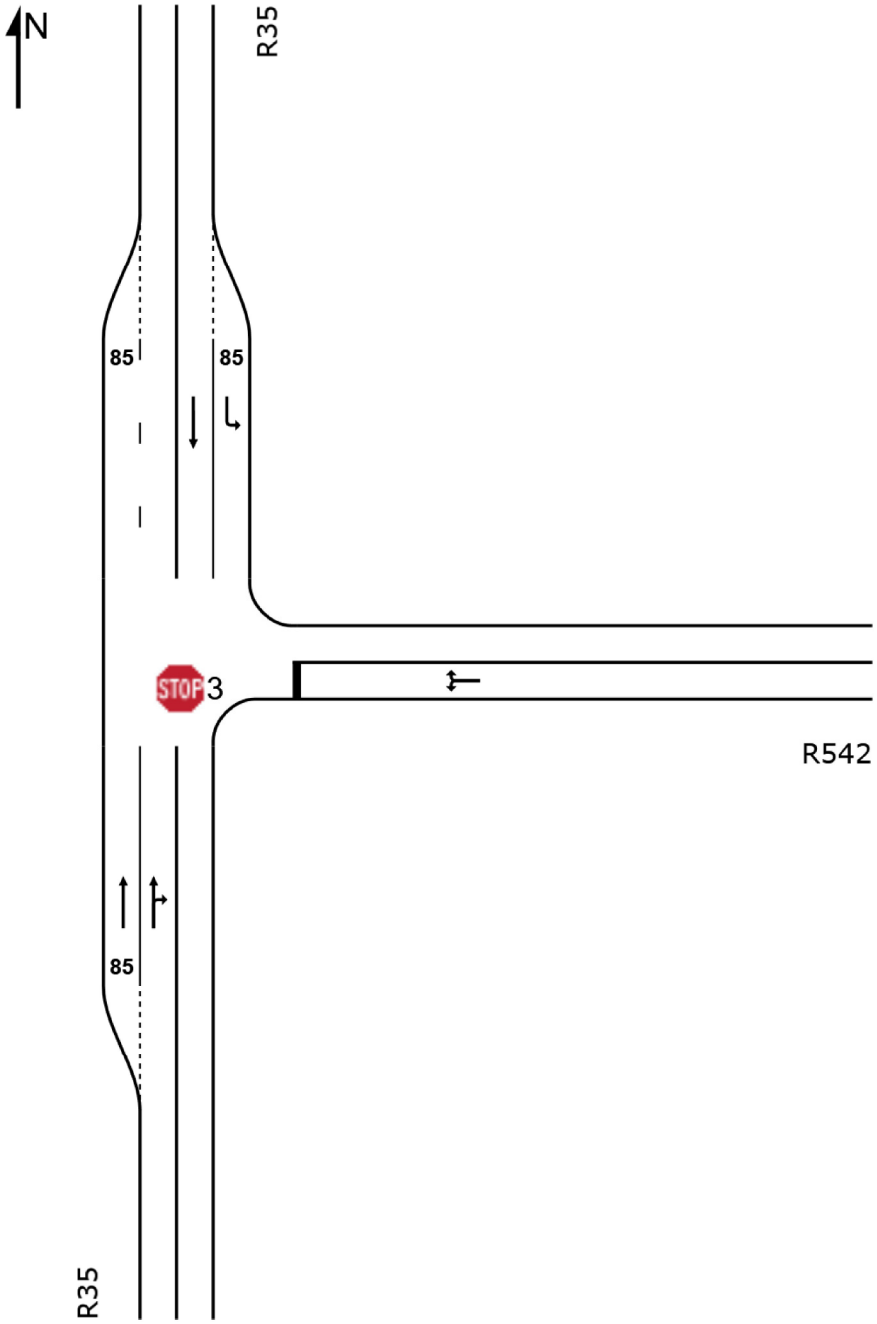
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: R542 (P182/1)												
4	L2	15	40.0	0.010	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.0
5	T1	87	40.0	0.055	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		101	40.0	0.055	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.7
NorthWest: R542 (P182/1)												
11	T1	93	40.0	0.055	0.2	LOS A	0.2	1.4	0.08	0.09	0.08	58.9
12	R2	18	40.0	0.055	6.7	LOS A	0.2	1.4	0.13	0.14	0.13	54.6
Approach		111	40.0	0.055	1.2	NA	0.2	1.4	0.09	0.09	0.09	58.1
SouthWest: D622												
1	L2	84	40.0	0.176	6.7	LOS A	0.7	6.7	0.30	0.58	0.30	51.5
3	R2	51	40.0	0.176	9.4	LOS A	0.7	6.7	0.30	0.58	0.30	50.6
Approach		135	40.0	0.176	7.7	LOS A	0.7	6.7	0.30	0.58	0.30	51.2
All Vehicles		348	40.0	0.176	3.6	NA	0.7	6.7	0.15	0.28	0.15	55.3

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 3 [2019 AM (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 3 [2019 AM (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)

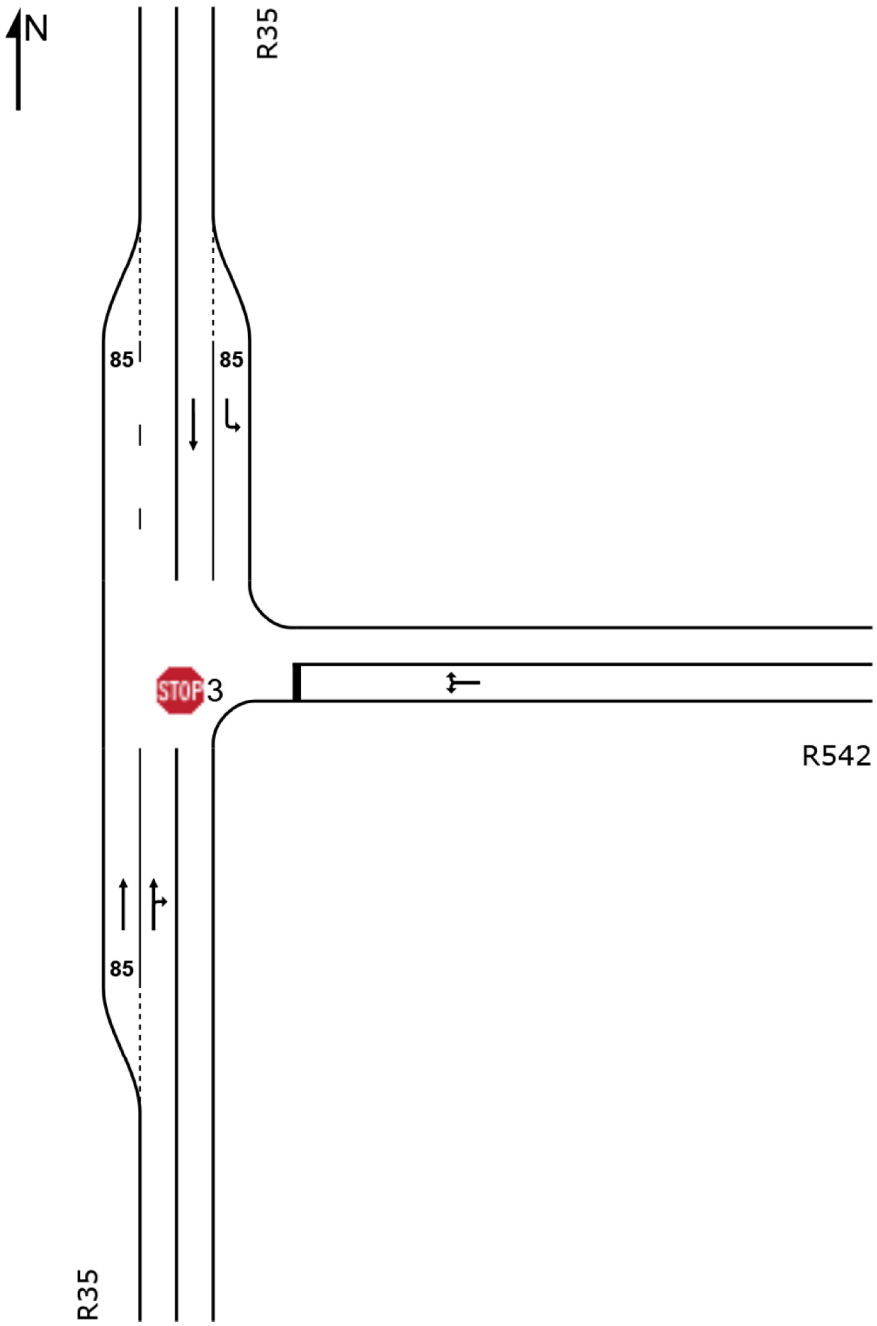
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	113	37.0	0.070	0.5	LOS A	0.3	2.5	0.15	0.10	0.15	58.5
3	R2	27	37.0	0.070	7.7	LOS A	0.3	2.5	0.27	0.19	0.27	53.5
Approach		140	37.0	0.070	1.9	NA	0.3	2.5	0.17	0.12	0.17	57.5
East: R542												
4	L2	7	37.0	0.218	10.8	LOS B	0.9	8.1	0.55	1.00	0.55	47.4
6	R2	93	37.0	0.218	15.4	LOS C	0.9	8.1	0.55	1.00	0.55	47.3
Approach		100	37.0	0.218	15.0	LOS C	0.9	8.1	0.55	1.00	0.55	47.3
North: R35												
7	L2	109	37.0	0.074	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
8	T1	137	37.0	0.086	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		247	37.0	0.086	2.7	NA	0.0	0.0	0.00	0.25	0.00	56.2
All Vehicles		486	37.0	0.218	5.0	NA	0.9	8.1	0.16	0.37	0.16	54.4

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 3 [2019 PM (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 3 [2019 PM (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)

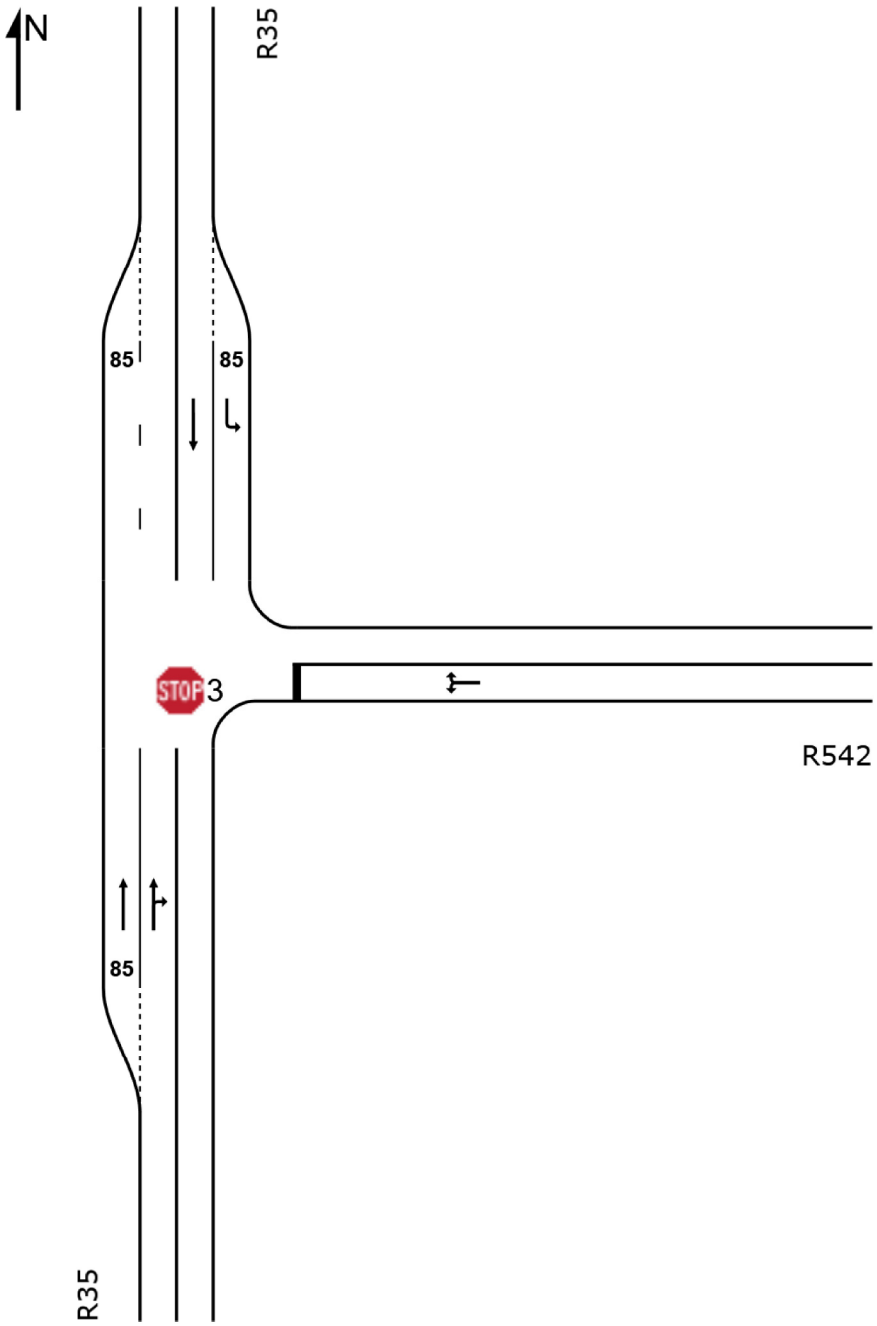
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	195	37.0	0.087	0.0	LOS A	0.0	0.4	0.02	0.01	0.02	59.8
3	R2	4	37.0	0.087	7.5	LOS A	0.0	0.4	0.03	0.02	0.03	55.7
Approach		199	37.0	0.087	0.2	NA	0.0	0.4	0.02	0.01	0.02	59.7
East: R542												
4	L2	9	37.0	0.286	11.2	LOS B	1.3	11.8	0.59	1.04	0.66	46.5
6	R2	113	37.0	0.286	17.0	LOS C	1.3	11.8	0.59	1.04	0.66	46.4
Approach		122	37.0	0.286	16.6	LOS C	1.3	11.8	0.59	1.04	0.66	46.4
North: R35												
7	L2	86	37.0	0.058	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
8	T1	127	37.0	0.080	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		213	37.0	0.080	2.4	NA	0.0	0.0	0.00	0.23	0.00	56.5
All Vehicles		534	37.0	0.286	4.8	NA	1.3	11.8	0.14	0.33	0.16	54.9

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 3 [2019 AM + Construction (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 3 [2019 AM + Construction (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)

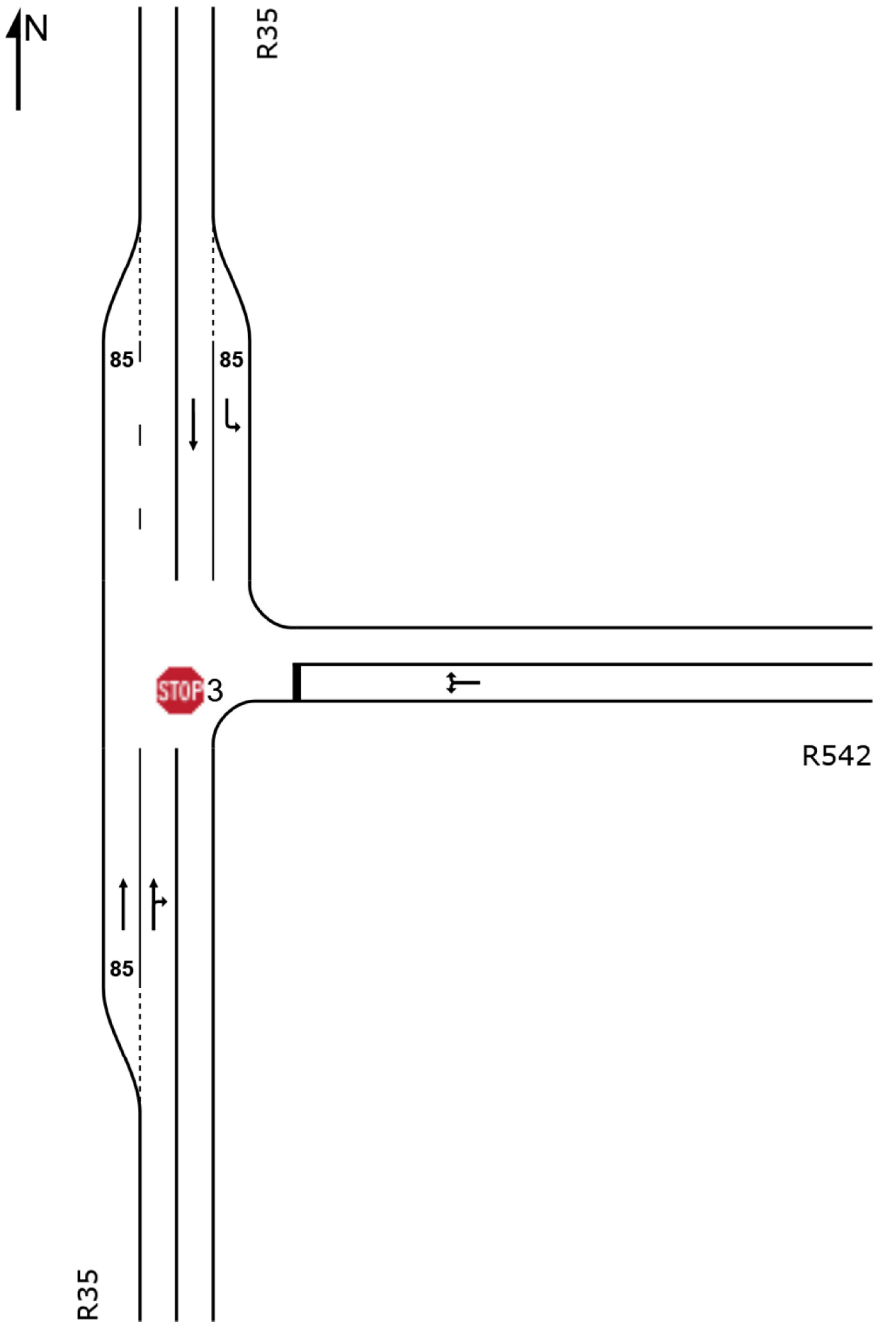
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	113	37.0	0.075	0.6	LOS A	0.3	3.0	0.17	0.12	0.17	58.3
3	R2	33	37.0	0.075	7.9	LOS A	0.3	3.0	0.32	0.23	0.32	53.1
Approach		145	37.0	0.075	2.2	NA	0.3	3.0	0.20	0.14	0.20	57.0
East: R542												
4	L2	8	37.0	0.232	10.8	LOS B	0.9	8.6	0.56	1.01	0.56	47.3
6	R2	95	37.0	0.232	15.8	LOS C	0.9	8.6	0.56	1.01	0.56	47.1
Approach		103	37.0	0.232	15.4	LOS C	0.9	8.6	0.56	1.01	0.56	47.1
North: R35												
7	L2	127	37.0	0.085	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
8	T1	137	37.0	0.086	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		264	37.0	0.086	2.9	NA	0.0	0.0	0.00	0.27	0.00	55.9
All Vehicles		513	37.0	0.232	5.2	NA	0.9	8.6	0.17	0.39	0.17	54.2

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 3 [2019 PM + Construction (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 3 [2019 PM + Construction (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)

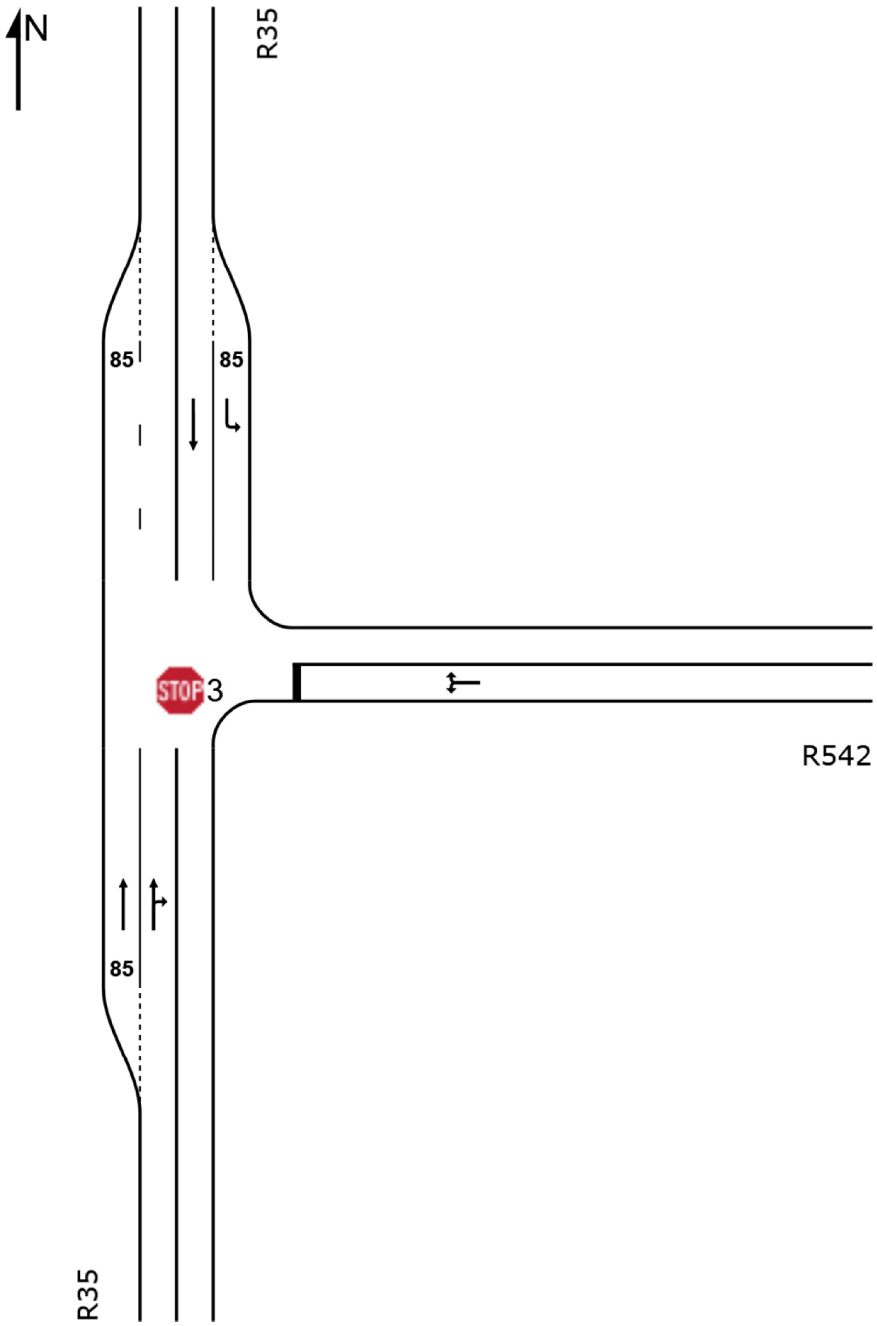
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	195	37.0	0.088	0.1	LOS A	0.1	0.5	0.02	0.01	0.02	59.8
3	R2	5	37.0	0.088	7.5	LOS A	0.1	0.5	0.03	0.02	0.03	55.6
Approach		200	37.0	0.088	0.2	NA	0.1	0.5	0.02	0.01	0.02	59.7
East: R542												
4	L2	15	37.0	0.333	11.7	LOS B	1.6	14.8	0.59	1.05	0.72	46.2
6	R2	128	37.0	0.333	17.8	LOS C	1.6	14.8	0.59	1.05	0.72	46.1
Approach		144	37.0	0.333	17.1	LOS C	1.6	14.8	0.59	1.05	0.72	46.1
North: R35												
7	L2	89	37.0	0.060	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
8	T1	127	37.0	0.080	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		216	37.0	0.080	2.5	NA	0.0	0.0	0.00	0.24	0.00	56.4
All Vehicles		560	37.0	0.333	5.4	NA	1.6	14.8	0.16	0.37	0.19	54.4

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 3 [2019 AM + Operation (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 3 [2019 AM + Operation (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	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	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	113	37.0	0.076	0.7	LOS A	0.3	3.0	0.17	0.12	0.17	58.3
3	R2	33	37.0	0.076	8.0	LOS A	0.3	3.0	0.33	0.23	0.33	53.0
Approach		145	37.0	0.076	2.3	NA	0.3	3.0	0.21	0.15	0.21	57.0
East: R542												
4	L2	7	37.0	0.236	10.9	LOS B	0.9	8.7	0.57	1.02	0.58	47.1
6	R2	97	37.0	0.236	15.9	LOS C	0.9	8.7	0.57	1.02	0.58	47.0
Approach		103	37.0	0.236	15.6	LOS C	0.9	8.7	0.57	1.02	0.58	47.0
North: R35												
7	L2	138	37.0	0.093	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
8	T1	137	37.0	0.086	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		276	37.0	0.093	3.0	NA	0.0	0.0	0.00	0.29	0.00	55.7
All Vehicles		524	37.0	0.236	5.3	NA	0.9	8.7	0.17	0.39	0.17	54.1

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [2019 PM + Operation (existing layout and control)]

R35 / R542 Intersection
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	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	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	195	37.0	0.089	0.1	LOS A	0.1	0.6	0.03	0.02	0.03	59.7
3	R2	6	37.0	0.089	7.5	LOS A	0.1	0.6	0.04	0.03	0.04	55.5
Approach		201	37.0	0.089	0.3	NA	0.1	0.6	0.03	0.02	0.03	59.6
East: R542												
4	L2	21	37.0	0.362	11.9	LOS B	1.8	17.0	0.59	1.06	0.75	46.1
6	R2	136	37.0	0.362	18.2	LOS C	1.8	17.0	0.59	1.06	0.75	45.9
Approach		158	37.0	0.362	17.4	LOS C	1.8	17.0	0.59	1.06	0.75	46.0
North: R35												
7	L2	92	37.0	0.062	6.0	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
8	T1	127	37.0	0.080	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		219	37.0	0.080	2.5	NA	0.0	0.0	0.00	0.24	0.00	56.4
All Vehicles		578	37.0	0.362	5.8	NA	1.8	17.0	0.17	0.39	0.21	54.0

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.