INFRATRANS
TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING

TRAFFIC IMPACT ASSESSMENT

KOPPIE CANYON COAL MINE

To be located on portions of the farms Koppie 228-IS and Uitgedacht 229-IS near Bethal, Mpumalanga Province

December 2020

Reference: MP30/5/1/2/2/10273 MR

REPORT INFORMATION SHEET

Title:	TRAFFIC IMPACT ASSESSMENT KOPPIE CANYON COAL MINE To be located on portions of the farms Koppie 228-IS and Uitgedacht 229-IS near Bethal, Mpumalanga Province
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TABLE OF CONTENTS

TABLE OF CONTENTS

FIGURES

DRAWINGS

APPENDICES

1. INTRODUCTION AND STUDY SCOPE

Infratrans (Pty) Ltd was appointed to undertake a Traffic Impact Assessment (TIA) for a proposed coal mine to be located on Portion 4 of the farm Koppie 228-IS and Portions 2, 3, 6, 9, 10, 11, 21, 27, 30, 31 and 32 of the farm Uitgedacht 229-IS near Bethal, Msukaligwa Local Municipality, Mpumalanga Province.

The scope of this TIA includes:

- Conducting a traffic survey to determine current traffic conditions on the surrounding road network (within a defined study area);
- Quantify the impact the proposed development 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 an impact.

This report will form part of the environmental authorisation associated with the application for mining rights required for the proposed mine.

2. PROPOSED DEVELOPMENT

2.1 Location

The location of the study site is shown in **Figure 1** (all figures, appendices and drawings are attached at the end of this report).

2.2 Property details

The proposed Koppie Canyon Coal Mine will be situated on an area of approximately 1955.450 ha on the following farm portions located in Mpumalanga Province:

- Portion 4 of the farm Koppie 228-IS, and
- Portions 2, 3, 6, 9, 10, 11, 21, 27, 30, 31 and 32 of the farm Uitgedacht 229-IS.

The farm portions are located within the Msukaligwa Local Municipality which forms part of the greater Gert Sibande District Municipality.

2.3 Development details

The mine is expected to produce both low– (Eskom) or high-grade (export) coal which may include the following activities:

- Removal of topsoil and soft overburden;
- Underground mining (including coal cutting and delivery to surface);
- Coal handling, screening and crushing, and
- Product logistics.

The proposed draft layout of the mine is shown in **Figure 2**.

3. OVERVIEW OF THE METHOD USED FOR ASSESSMENT

3.1 General overview

The assessment method used can generally be defined by the following steps:

- Determining the traffic characteristics of the proposed development;
- Defining the affected area (study area);
- Collecting data to define the baseline operating conditions within the study area;
- Determining the impact the proposed development will have on the baseline operating conditions; and
- 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 development. 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 5.5**.

3.3 Study area

The study area is defined based on the extent and type of activity and the characteristics of the traffic expected to be generated as a result of the proposed project. 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 area can be recorded and a better understanding of the study area can be acquired.

A site visit was conducted on Monday 19 October 2020. 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 development (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 D1476: This gravel road can be classified as a Class 4 road (collector road) and falls under the jurisdiction of Mpumalanga Province's Department of Public Works, Roads and Transport. The proposed new access road for the preferred mine layout (referred to as Alternative 2) will link up with this road to provide access to the mine (as shown in **Figure 2**);

- Road R35: This road can be classified as a Class 2 road (major arterial road) and falls under the jurisdiction of the South African National Roads Authority Limited (SANRAL);
- Road R544: This road can also be classified as a Class 2 road (major arterial road) and falls under the jurisdiction of Mpumalanga Province's Department of Public Works, Roads and Transport and is referred to as Road P120/1, and
- Road R38: This road can also be classified as a Class 2 road (major arterial road) and falls under the jurisdiction of SANRAL. The proposed new access road for an alternative mine layout (referred to as Alternative 1) will link up with this road to provide access to the mine.

The classification of these roads is based on the *TRH 26, South African Road Classification and Access Management Manual*[2]. The location of the above roads in relation to the subject site is also shown in **Figure 1**.

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 (in this case Road R35 or Road R38) 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 were deemed relevant for investigation:

- Road D1476 / future site access road for preferred mine layout (Alternative 2)
- Road D1476 / Road R35;
- Road R35 / Road R544, and
- Road R38 / possible future site access road for alternative mine layout (Alternative 1)

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 around the study area the relevant road network has been designed to cater for heavy vehicles.

3.4 Data collection

To determine the existing traffic demand on the nearby road network traffic surveys were conducted on Monday 19 October 2020 at the study intersections previously discussed. A more detailed discussion follows in **Section 4.2**.

3.5 Impact and mitigation

By using the data collected, traffic operating conditions were determined by means of traffic engineering software, namely SIDRA INTERSECTION 8. Operating conditions at the study intersections identified in **Section 3.3.3** were determined and compared for the following three scenarios:

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

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

The intersection between Road D1476 and the future site access for the preferred mine layout (Alternative 2) was, however, not included as part of the operational analysis as traffic volumes along Road D1476 are extremely low.

4. EXISTING TRAFFIC STATE (ENVIRONMENTAL BASELINE)

4.1 Site access

Access to the mine is proposed via a new access road which will form an intersection with Road D1476, as shown in **Figure 2**. The proposed layout and traffic flow control of the intersection are shown in **Drawing D001**. It is also recommended that the section of Road D1476 between the access road and Road R35 be surfaced.

It can be confirmed that this access location is in line with the *TRH 26, South African Road Classification and Access Management Manual*[2] and is therefore supported from a traffic engineering and transport planning viewpoint.

For the alternative layout of the mine (Alternative 1), which is not the preferred mine layout, access will be provided via a new access road to the east of the site which will form an intersection with Road R38, as shown in **Figure 4** and **Figure 5**. The exact location of this access has not yet been determined, but this access should be located further than 1.6 km to the southwest of the existing access between Road R38 and gravel road D638. The proposed layout and traffic flow control of this possible access intersection is shown in **Drawing D001**.

4.2 Existing traffic flows

To determine the existing traffic demand on the surrounding road network weekday traffic surveys were conducted on Monday 19 October 2020 at the key intersections previously discussed in **Section 3.3.3**.

From this survey it was determined that the common peak traffic hours occurred between 06h00-07h00 for the AM peak hour and between 15h00-16h00 for the PM peak hour. These existing 2020 peak hour traffic volumes are shown in **Figure 3**.

4.3 Baseline operating conditions

The baseline operating conditions for the key intersections are summarized in **Table 4.3** overleaf with the detailed SIDRA outputs attached as **Appendix A**. These operating conditions are based on the existing 2020 peak hour traffic volumes (as per **Figure 3**) as well as the 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" acceptable for right-turn traffic movements if adequate lengths of storage lanes are provided.

Table 4.3 – Baseline operating conditions

Intersection & approach definitions	Peak hour	Analysis parameter	Intersection capacity analysis results								
			Approach 1			Approach 2			Approach 3		
			L	T	R	L	T	R	L	T	R
D1476 / R35 Approach 1: R35 S Approach 2: D1476 E Approach 3: R35 N	**Week AM**	**V/C**	-	0.03	0.03	0.01	-	0.01	0.01	0.06	-
		Delay (s)	-	0	6	9	-	11	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
	Week PM	**V/C**	-	0.03	0.03	0.01	-	0.01	0.01	0.05	-
		Delay (s)	-	0	6	9	-	10	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
R35 / R544 Approach 1: R35 S Approach 2: R35 N Approach 3: R544 W	**Week AM**	**V/C**	0.04	0.05	-	-	0.06	0.01	0.05	-	0.05
		Delay (s)	6	0	-	-	0	6	6	-	8
		LOS	A	A	-	-	A	A	A	-	A
	Week PM	**V/C**	0.02	0.05	-	-	0.05	0.01	0.06	-	0.06
		Delay (s)	6	0	-	-	0	6	6	-	8
		LOS	A	A	-	-	A	A	A	-	A
R38 / Future Alternative Access Approach 1: R38 NE Approach 2: Access NW Approach 3: R38 SW	**Week AM**	**V/C**	Future Intersection								
		Delay (s)									
		LOS									
	Week PM	**V/C**									
		Delay (s)									
		LOS									

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 4.3** 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 which were observed operating along the R35, R544 and the R38.

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 for staff 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 Nature of impact

The impact of the project activities (discussed in **Section 2.3**) is investigated for the following project phases:

- Construction phase; and
- Operational phase.

Each development phase will have the following traffic characteristics:

- Construction phase:
  - Construction workers will commute to and from the site on a daily basis by either making use of public transport, transport provided by the contractor or private vehicles; and
  - Construction and delivery vehicles will travel to and from the site on a daily basis as required.
- Operational phase:
  - Employees will commute to and from the mine on a daily basis by either making use of public transport, transport provided by the mine or private vehicles;
  - Coal hauling vehicles will travel to and from the mine on a daily basis; and
  - General delivery vehicles will travel to and from the mine on a daily basis.

Based on the traffic characteristics above and considering **Table 5.1** below the nature of the impact during both the project phases can be described as "negative".

Table 5.1 – Listing of the descriptors for the nature 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 the 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 5.2** overleaf the extent of the impact can be described as "local" for both the project phases and a rating of 3 can be adopted.

Table 5.2 – 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. The life of mine (LOM) is expected to be 21 years.

According to **Table 5.3** below a duration rating of 3 can thus be adopted for the construction phase and 4 for the operational phase.

Table 5.3 – 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 5.4** below a frequency rating of 5 can thus be adopted for both the construction phase and operational phase.

Table 5.4 – 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 5.5.1.1** below.

Table 5.5.1.1 – Expected traffic to be generated during the construction phase

Peak hour	Vehicle trips generated (veh/h)		
	In	Out	Total
AM	44	12	56
PM	12	44	56

Figure 4 presents the expected peak hour traffic volumes at the key study intersections during the construction phase. These volumes also include an expected 2% annual growth in background traffic (i.e. existing traffic) over a period of 3 years.

The operating conditions for the key intersections during the construction phase are summarized in **Table 5.5.1.2** overleaf with the detailed SIDRA outputs attached as **Appendix A**. 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**.

The SIDRA analysis results indicate that good traffic operating conditions are expected during the construction phase at the key study intersections.

Table 5.5.1.2 – Construction phase operating conditions

Intersection & approach definitions	Peak hour	Analysis parameter	Intersection capacity analysis results								
			Approach 1			Approach 2			Approach 3		
			L	T	R	L	T	R	L	T	R
D1476 / R35 Approach 1: R35 S Approach 2: D1476 E Approach 3: R35 N	**Week AM**	**V/C**	-	0.05	0.05	0.02	-	0.02	0.01	0.06	-
		Delay (s)	-	0	6	10	-	11	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
	Week PM	**V/C**	-	0.04	0.04	0.06	-	0.06	0.01	0.05	-
		Delay (s)	-	0	6	9	-	11	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
R35 / R544 Approach 1: R35 S Approach 2: R35 N Approach 3: R544 W	**Week AM**	**V/C**	0.04	0.07	-	-	0.07	0.01	0.06	-	0.06
		Delay (s)	6	0	-	-	0	6	6	-	8
		LOS	A	A	-	-	A	A	A	-	A
	Week PM	**V/C**	0.02	0.06	-	-	0.06	0.01	0.07	-	0.07
		Delay (s)	6	0	-	-	0	6	6	-	8
		LOS	A	A	-	-	A	A	A	-	A
R38 / Future Alternative Access Approach 1: R38 NE Approach 2: Access NW Approach 3: R38 SW	**Week AM**	**V/C**	-	0.08	0.02	0.02	-	0.02	0.02	0.07	-
		Delay (s)	-	0	7	10	-	12	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
	Week PM	**V/C**	-	0.06	0.01	0.06	-	0.06	0.01	0.06	-
		Delay (s)	-	0	6	10	-	11	6	0	-
		LOS	-	A	A	A	-	B	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 South African Trip Data Manual[3] mining activities generate 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 future operational characteristics of the mine was obtained and the following assumptions are made:

- 150 000 t of coal will be produced per month;
- All coal produced will be transported by road;
- Haul trucks with a 30-tonne capacity will be used;
- 6 hauling days per week;
- 12 hauling hours per day;
- 300 employees will be employed on site during the operational phase;
- 80% of the employees will make use of transport provided by the employer (busses or shuttles);
- 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;

- 80% of the workers will commute to and from the site during the AM and PM peak traffic hours;
- A peak hour factor of 0.7 is applicable to the critical 15-minute traffic peak, 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 preceding assumptions the future operational phase is expected to generate peak hour traffic volumes as per **Table 5.5.2.1** below.

Table 5.5.2.1 – Expected traffic to be generated during the operational phase

Peak hour	Vehicle trips generated (veh/h)		
	In	Out	Total
AM	46	12	58
PM	12	46	58

Figure 5 presents the expected peak hour traffic volumes at the key study intersections during the future operational phase. These volumes also include an expected 2% annual growth in background traffic (i.e. existing traffic) over a period of 5 years. Although the LOM is expected to be 21 years, national guidelines require a 5-year future traffic horizon to be investigated based on the extent of the subject project.

The operating conditions for the key intersections during the future operational phase are summarized in **Table 5.5.2.2** overleaf with the detailed SIDRA outputs attached as **Appendix A**. These operating conditions are based on the expected peak hour traffic volumes during future operations (as per **Figure 5**) as well as the intersection layouts and traffic control as per **Drawing D001**.

The SIDRA analysis results indicate that good traffic operating conditions are expected during the operational phase at the key study intersections.

Table 5.5.2.2 – Operational phase operating conditions

Intersection & approach definitions	Peak hour	Analysis parameter	Intersection capacity analysis results								
			Approach 1			Approach 2			Approach 3		
			L	T	R	L	T	R	L	T	R
D1476 / R35 Approach 1: R35 S Approach 2: D1476 E Approach 3: R35 N	**Week AM**	**V/C**	-	0.06	0.06	0.02	-	0.02	0.01	0.06	-
		Delay (s)	-	0	6	10	-	11	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
	Week PM	**V/C**	-	0.04	0.04	0.06	-	0.06	0.01	0.05	-
		Delay (s)	-	0	6	9	-	11	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
R35 / R544 Approach 1: R35 S Approach 2: R35 N Approach 3: R544 W	**Week AM**	**V/C**	0.04	0.07	-	-	0.07	0.01	0.06	-	0.06
		Delay (s)	6	0	-	-	0	6	6	-	9
		LOS	A	A	-	-	A	A	A	-	A
	Week PM	**V/C**	0.03	0.06	-	-	0.07	0.01	0.07	-	0.07
		Delay (s)	6	0	-	-	0	6	6	-	8
		LOS	A	A	-	-	A	A	A	-	A
R38 / Future Alternative Access Approach 1: R38 NE Approach 2: Access NW Approach 3: R38 SW	**Week AM**	**V/C**	-	0.08	0.02	0.02	-	0.02	0.02	0.08	-
		Delay (s)	-	0	7	10	-	12	6	0	-
		LOS	-	A	A	A	-	B	A	A	-
	Week PM	**V/C**	-	0.06	0.01	0.07	-	0.07	0.01	0.07	-
		Delay (s)	-	0	6	10	-	11	6	0	-
		LOS	-	A	A	A	-	B	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 on the external road network is expected for both these project phases.

Based on the above and considering **Table 5.5.3** below 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 5.5.3 – Listing of the descriptors for the severity of the impact

Severity 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 5.6** below a rating of 4 can be allocated to the probability of the traffic impact during both the construction and operational phases.

Table 5.6 – 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 6.1** below.

Table 6.1 – 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
1	2	4	6	8	10	12	14	16	08	20	22	24	26	28	30
2	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
3	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
4	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
5	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
6	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
7	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
8	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
9	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 6.2** below.

Table 6.2 – Impact assessment for the project phases considered

Project phase	Mitigation	Nature	Impact rating criteria					Significance
			Spatial Extent	Duration	Frequency	Severity	Probability	
Construction	No	+	3	3	5	1	4	63
Operations	No	-	3	4	5	1	4	72

Based on the nature of the impact and the significant scores in **Table 6.2** the recommenced impact management or mitigation can be determined as per **Table 6.3** overleaf.

Table 6.3 – 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 6.2** without the need to implement any mitigation measures.

As discussed in **Section 4.1** it is, however, recommended that the section of Road D1476 between the mine access road and Road R35 be surfaced.

7. LEGAL REQUIREMENTS AND OTHER CONSIDERATIONS

The following comments can be made with regard to legal requirements and other considerations during the project phases:

- 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 coal mine to be located on Portion 4 of the farm Koppie 228-IS and Portions 2, 3, 6, 9, 10, 11, 21, 27, 30, 31 and 32 of the farm Uitgedacht 229-IS near Bethal, Msukaligwa Local Municipality, Mpumalanga Province:

- This report will form part of the environmental authorisation associated with the application for mining rights required for the proposed mine;
- 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);
- Two layouts of the mine are proposed; a preferred mine layout (referred to as Alternative 2) and an alternative mine layout (referred to as Alternative 1). These alternatives will have separate access arrangements which both have been covered by this study;
- 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 D1476 / future site access road for preferred mine layout (Alternative 2);
  - Road D1476 / Road R35;
  - Road R35 / Road R544, and
  - Road R38 / possible future site access road for alternative mine layout (Alternative 1)
- No vulnerabilities or sensitivities currently exists in the defined study area;
- To determine the existing traffic demand on the nearby road network weekday traffic surveys were conducted on Monday 19 October 2020 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. It is, however, recommended that the section of Road D1476 between the mine access road and Road R35 be surfaced, 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.

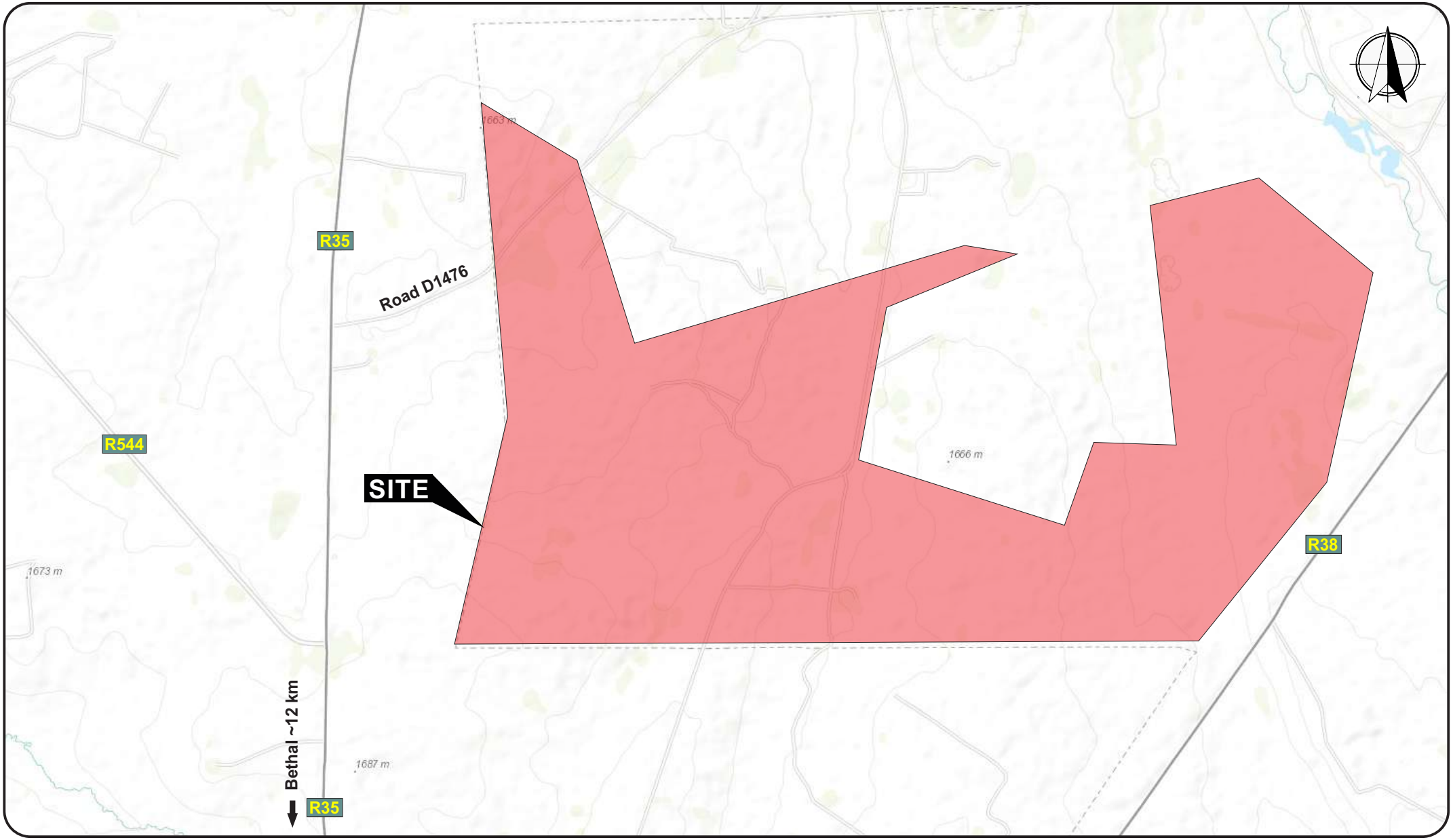
9. REFERENCES

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. Version 1.0, September 2012.

FIGURES



INFRATRANS
TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING

PROJECT:
Traffic Impact Assessment:
Koppie Canyon Coal Mine

FIGURE NAME:
Locality Map

PROJECT NO.
P-390

FIGURE NO.
1

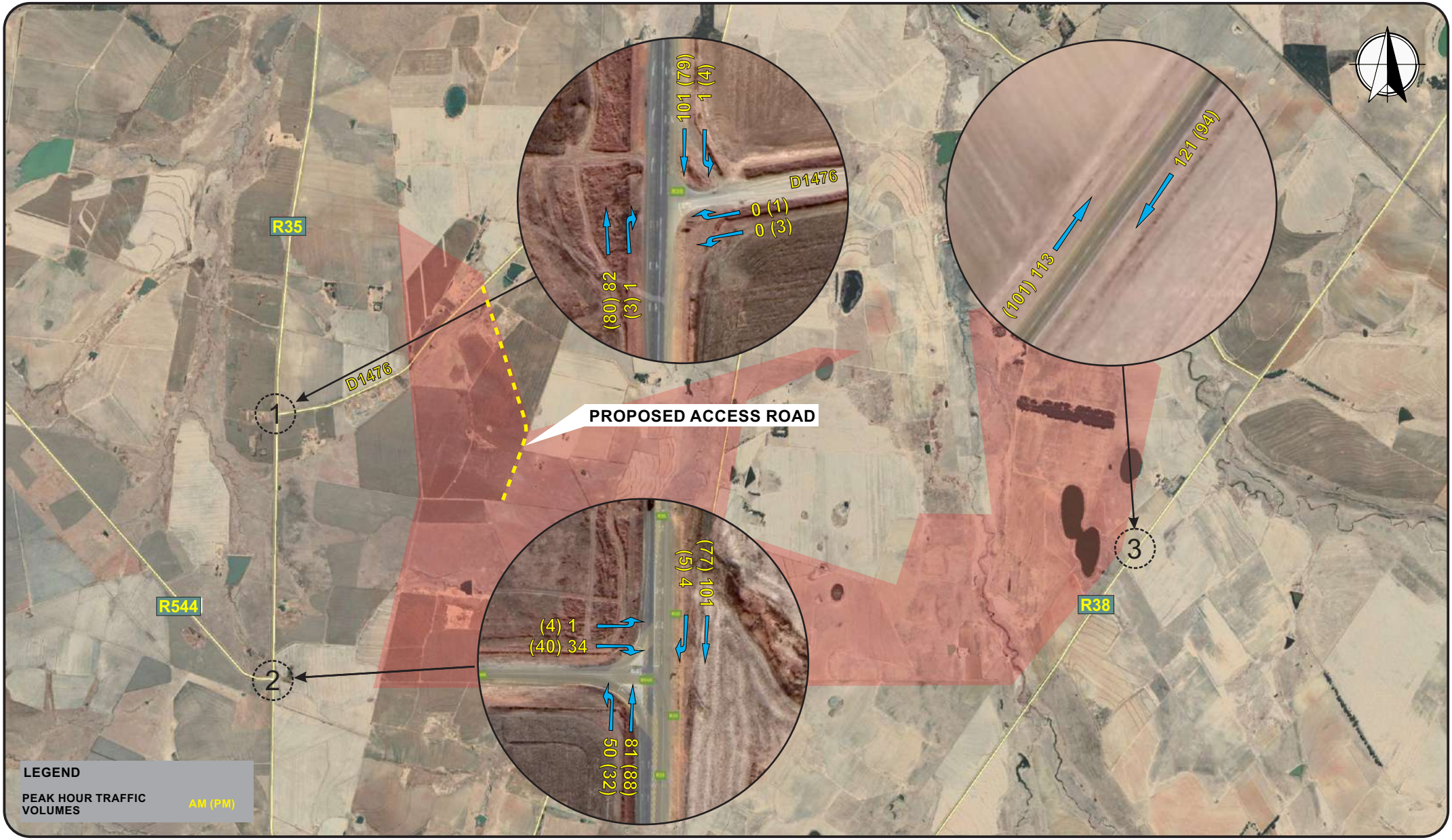
INFRATRANS
TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING

PROJECT:
Traffic Impact Assessment:
Koppie Canyon Coal Mine

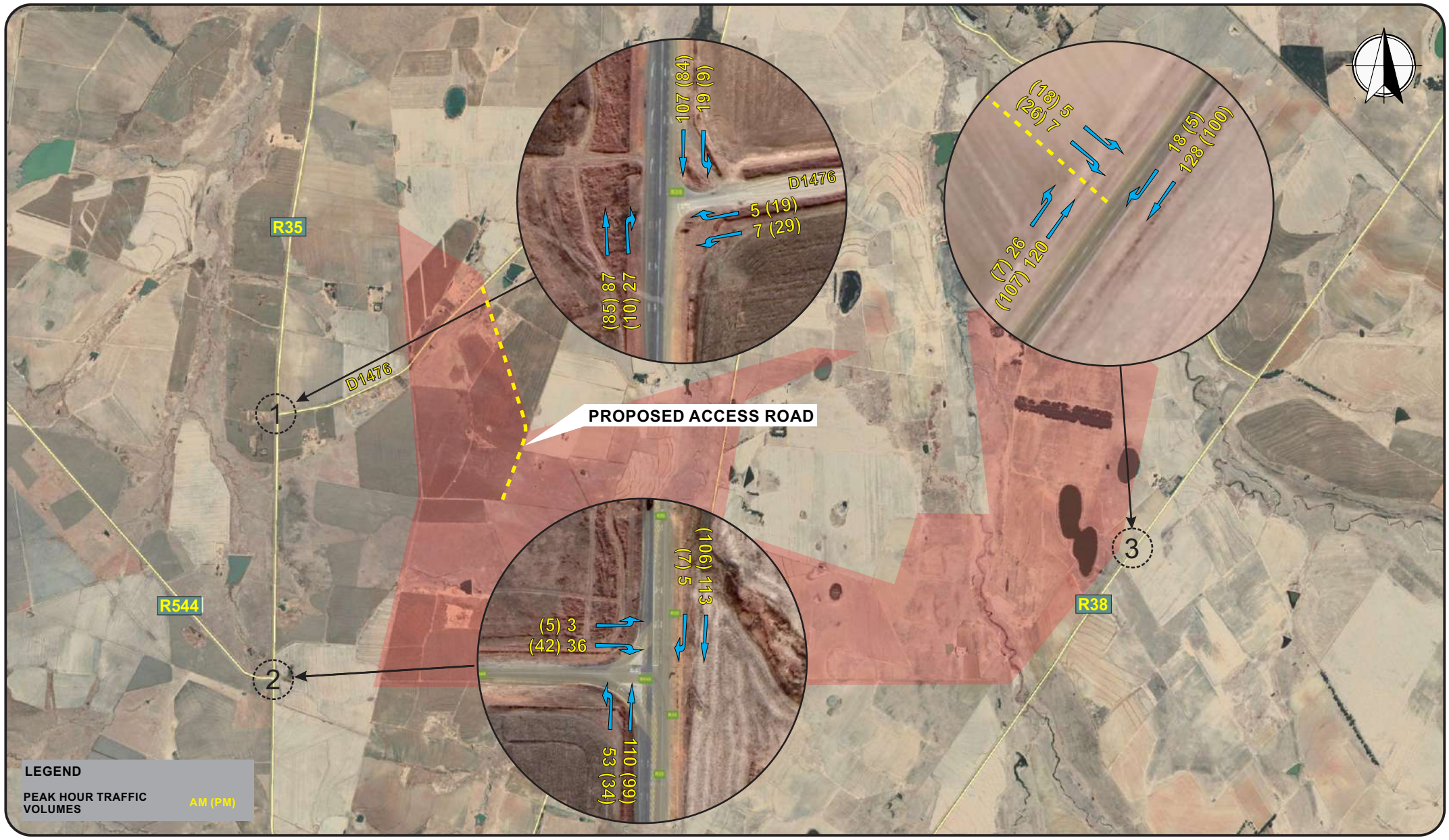
FIGURE NAME:
Proposed Layout of Mine

PROJECT NO.
P-390

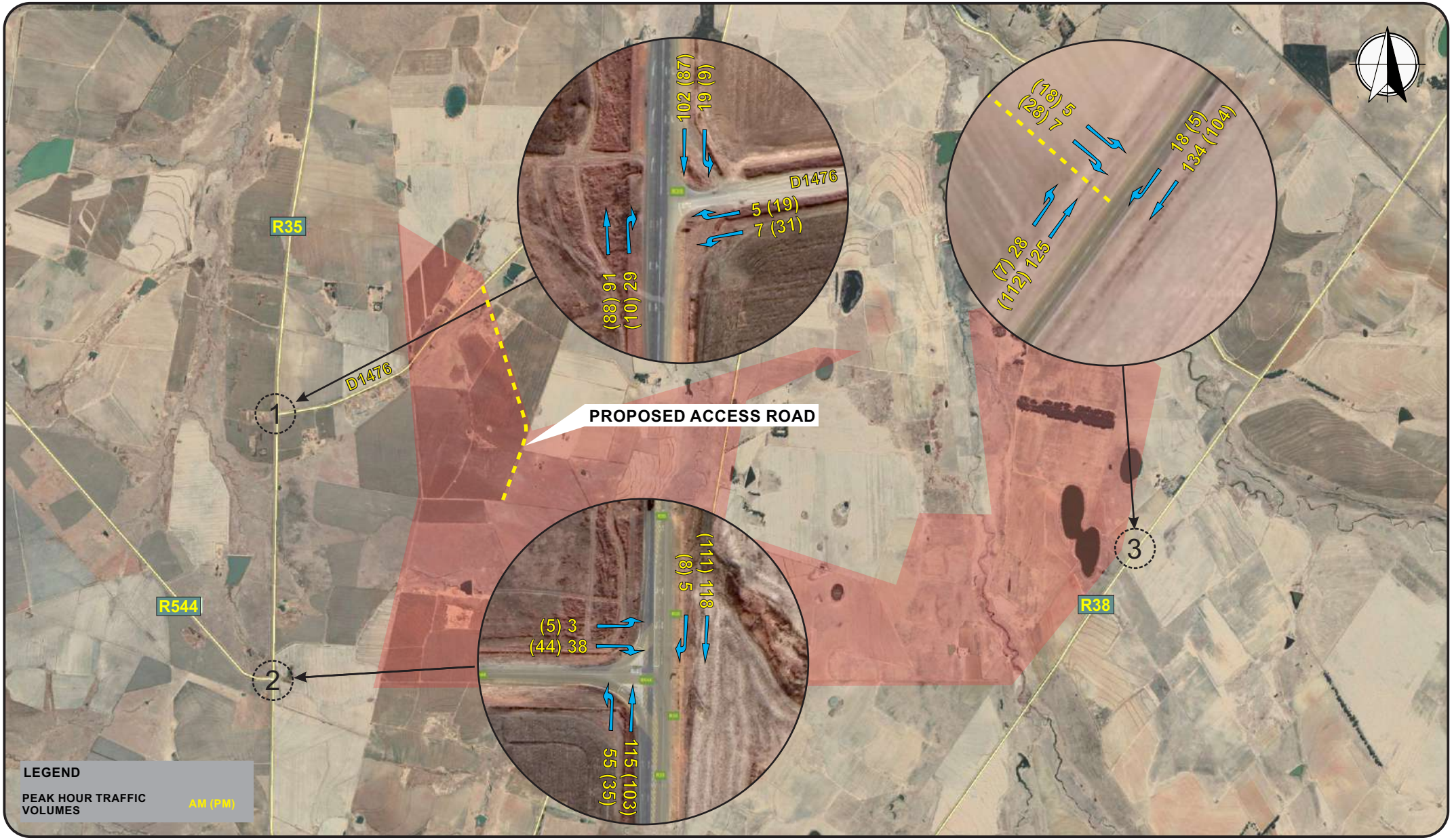
FIGURE NO.
2



INFRATRANS TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING	PROJECT: Traffic Impact Assessment: Koppie Canyon Coal Mine	FIGURE NAME: Existing 2020 Peak Hour Traffic Volumes	PROJECT NO. P-390 FIGURE NO. 3



INFRATRANS TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING	PROJECT: Traffic Impact Assessment: Koppie Canyon Coal Mine	FIGURE NAME: Expected Peak Hour Traffic Volumes During Construction Phase	PROJECT NO. P-390 FIGURE NO. 4



INFRATRANS
TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING

PROJECT:
Traffic Impact Assessment:
Koppie Canyon Coal Mine

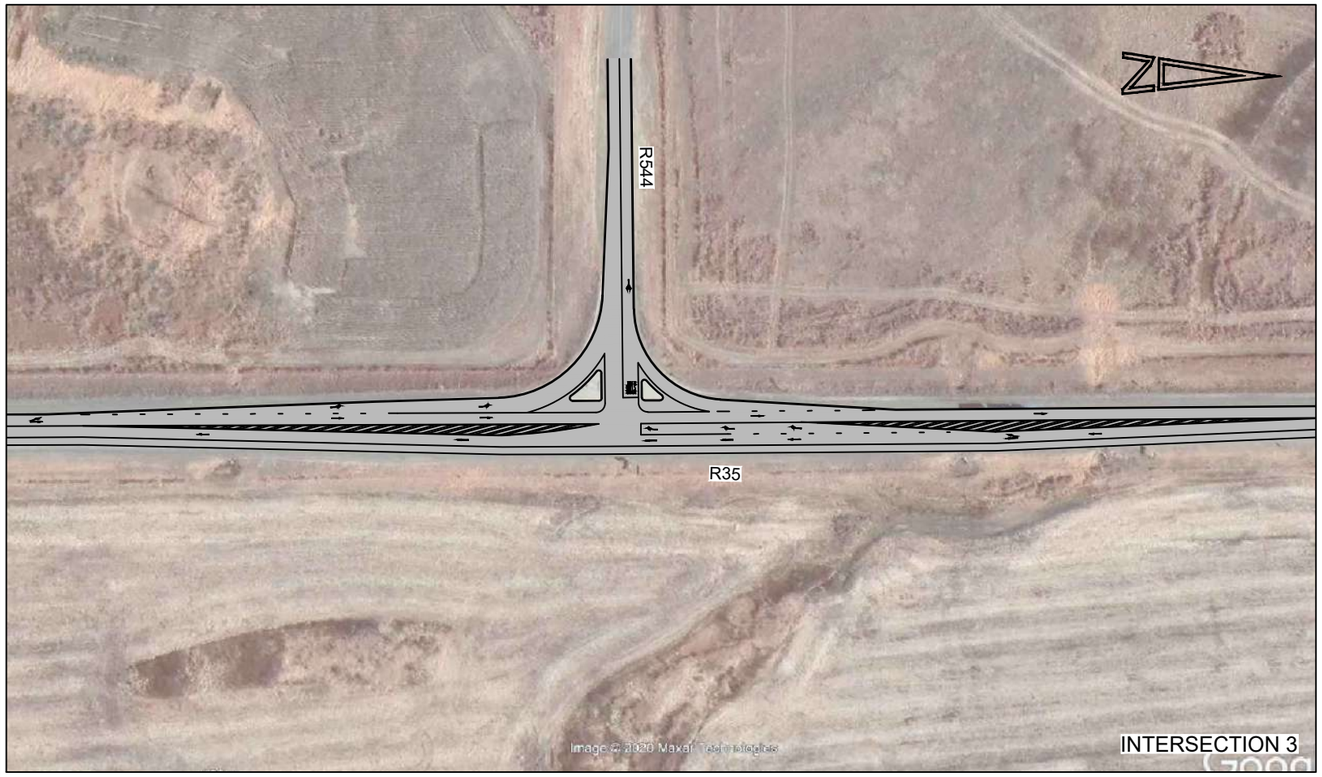
FIGURE NAME:
Expected Peak Hour Traffic Volumes During Operational Phase

PROJECT NO.
P-390

FIGURE NO.
5

DRAWINGS

Drawing D001 Intersection Layouts and Controls



REV	DATE	BY	DESCRIPTION	CHK	APD

ARCHITECT: -

CLIENT:

DRAWING STATUS: CONCEPTUAL

INFRATRANS
TRAFFIC AND TRANSPORTATION ENGINEERING CONSULTING

PROJECT: TRAFFIC IMPACT ASSESSMENT: KOPPIE CANYON COAL MINE

TITLE: INTERSECTION LAYOUTS AND CONTROLS

SCALE @ A3:	CHECKED:	APPROVED:
1:1000	PJ	PJ
DESIGN: PJ	DRAWN: PJ	DATE: 19/11/2020

PROJECT No:	DRAWING No:	REV:
P-390	D001	A

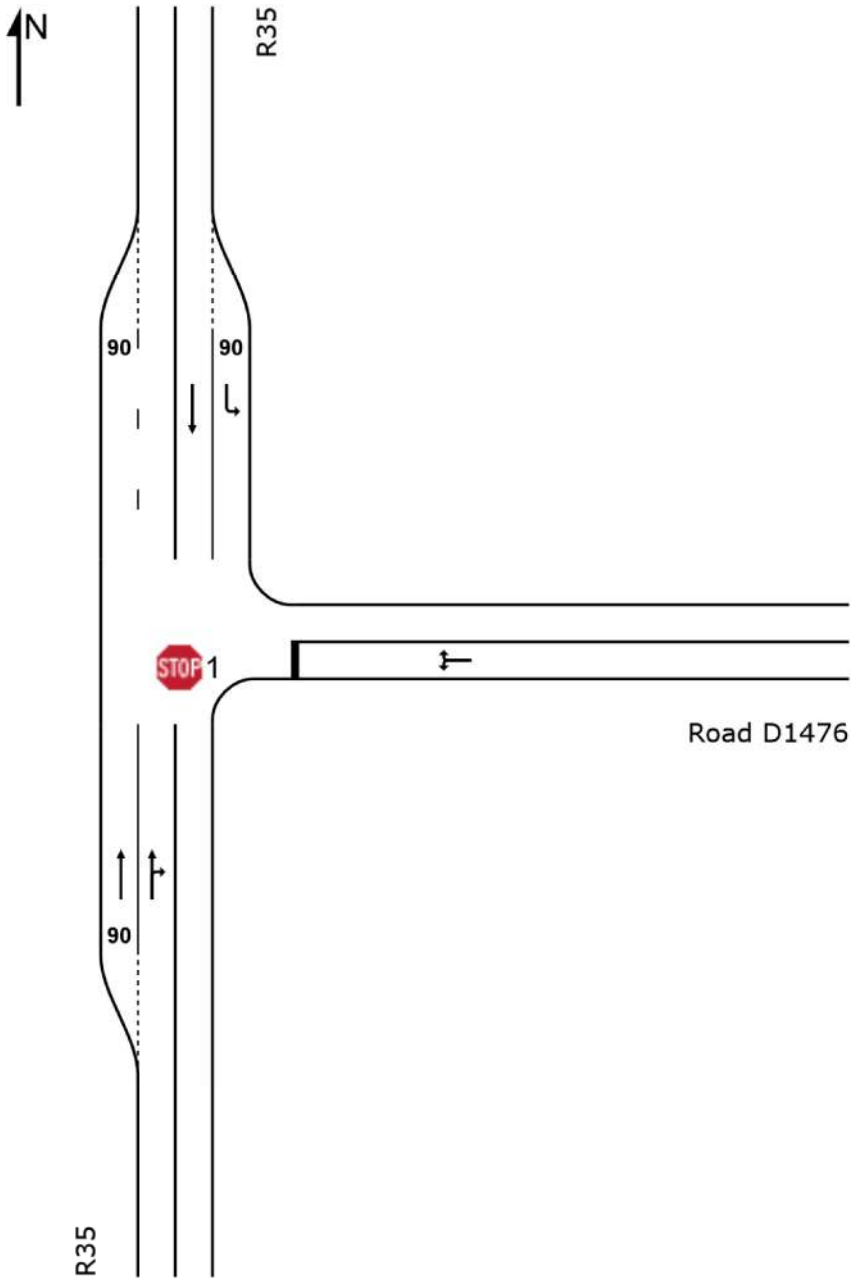
APPENDIX A

Output of SIDRA intersection capacity analyses

SITE LAYOUT

Site: 1 [2020 AM]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [2020 AM]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)

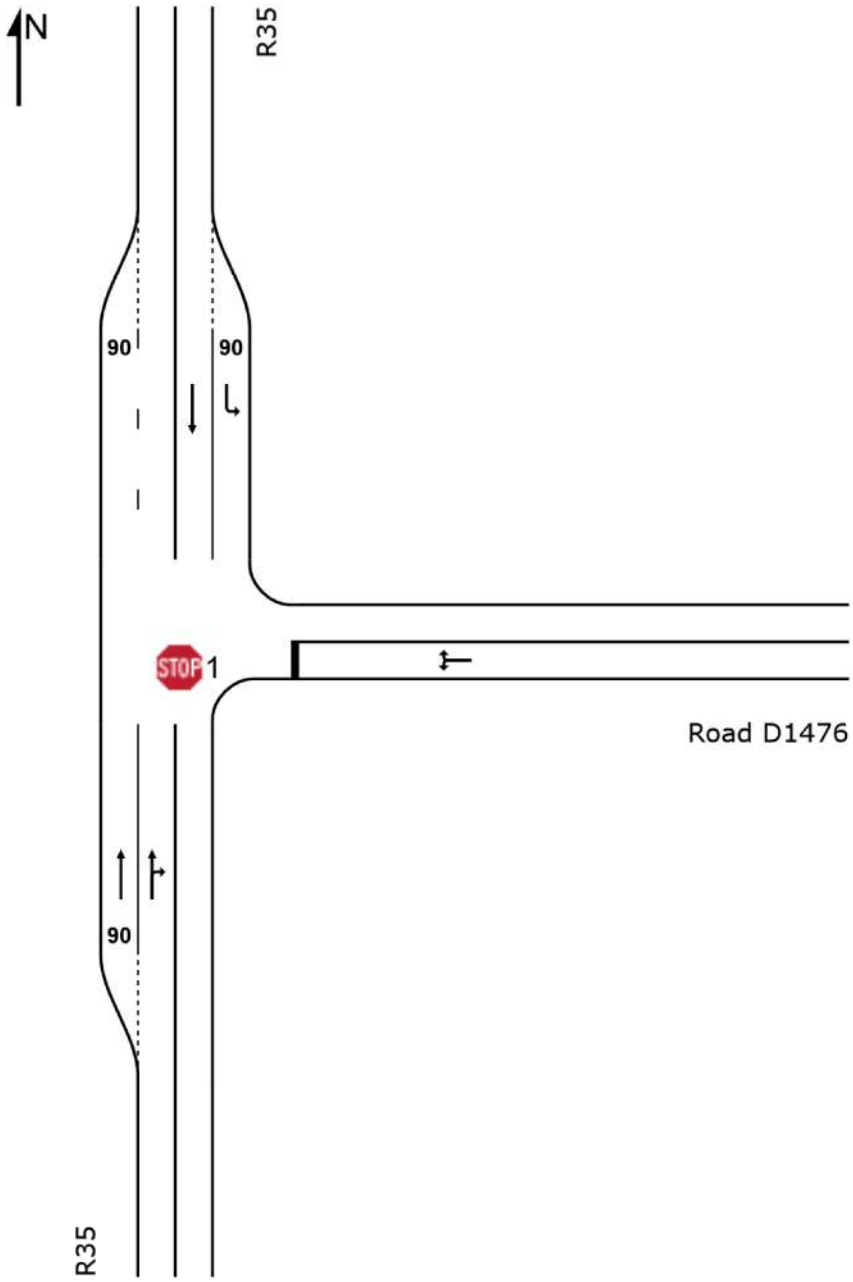
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	86	20.0	0.034	0.0	LOS A	0.0	0.1	0.01	0.01	0.01	59.9
3	R2	1	20.0	0.034	6.2	LOS A	0.0	0.1	0.01	0.01	0.01	56.7
Approach		87	20.0	0.034	0.1	NA	0.0	0.1	0.01	0.01	0.01	59.9
East: Road D1476												
4	L2	1	20.0	0.003	9.4	LOS A	0.0	0.1	0.28	0.86	0.28	50.5
6	R2	1	20.0	0.003	10.6	LOS B	0.0	0.1	0.28	0.86	0.28	50.5
Approach		2	20.0	0.003	10.0	LOS B	0.0	0.1	0.28	0.86	0.28	50.5
North: R35												
7	L2	1	20.0	0.001	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
8	T1	106	20.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		107	20.0	0.060	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.9
All Vehicles		197	20.0	0.060	0.2	NA	0.0	0.1	0.01	0.02	0.01	59.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
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 [2020 PM]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [2020 PM]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)

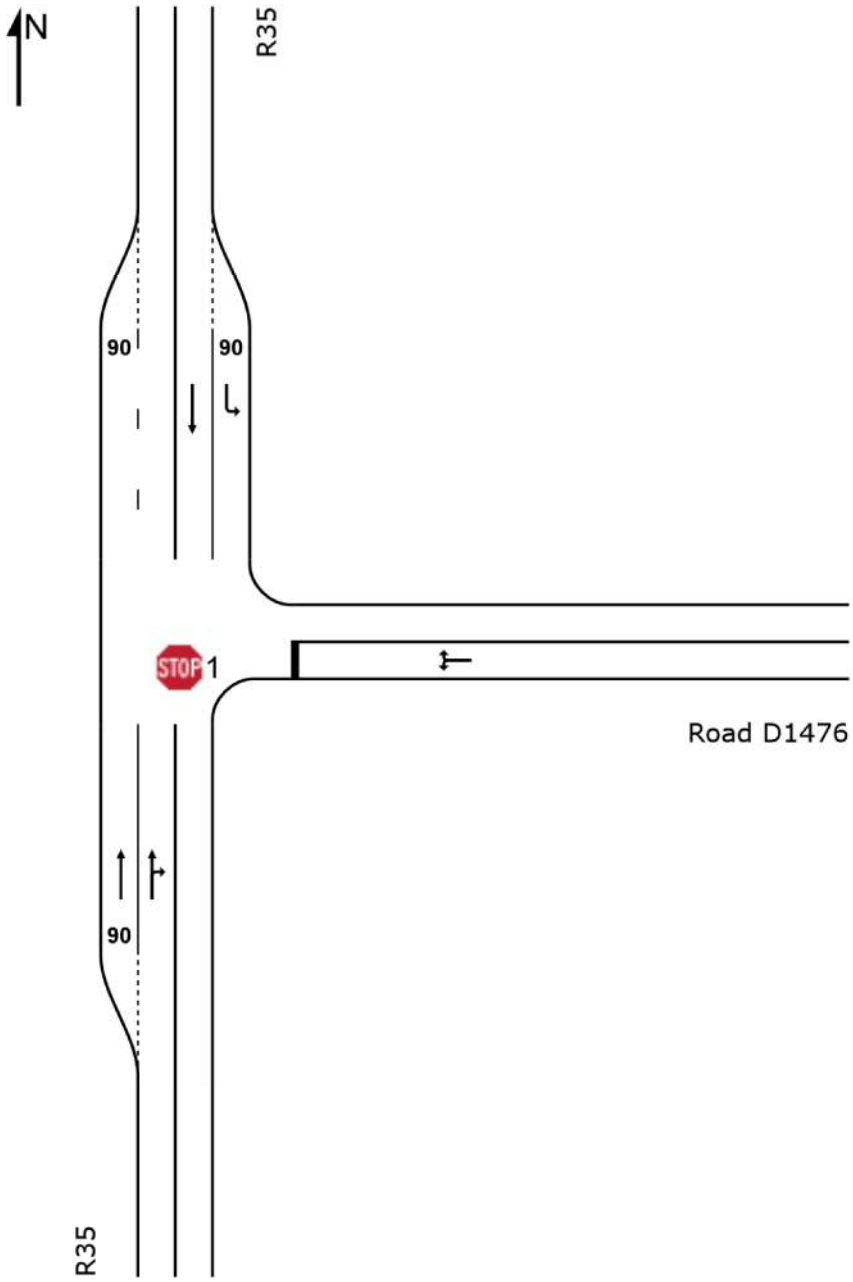
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	84	20.0	0.034	0.0	LOS A	0.0	0.2	0.02	0.02	0.02	59.7
3	R2	3	20.0	0.034	6.1	LOS A	0.0	0.2	0.03	0.03	0.03	56.5
Approach		87	20.0	0.034	0.2	NA	0.0	0.2	0.02	0.02	0.02	59.6
East: Road D1476												
4	L2	3	20.0	0.005	9.3	LOS A	0.0	0.1	0.22	0.89	0.22	50.8
6	R2	1	20.0	0.005	10.4	LOS B	0.0	0.1	0.22	0.89	0.22	50.7
Approach		4	20.0	0.005	9.6	LOS A	0.0	0.1	0.22	0.89	0.22	50.7
North: R35												
7	L2	4	20.0	0.003	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
8	T1	83	20.0	0.047	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		87	20.0	0.047	0.3	NA	0.0	0.0	0.00	0.03	0.00	59.6
All Vehicles		179	20.0	0.047	0.5	NA	0.0	0.2	0.01	0.05	0.01	59.4

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: 1 [2023 AM + Construction Phase]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [2023 AM + Construction Phase]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)

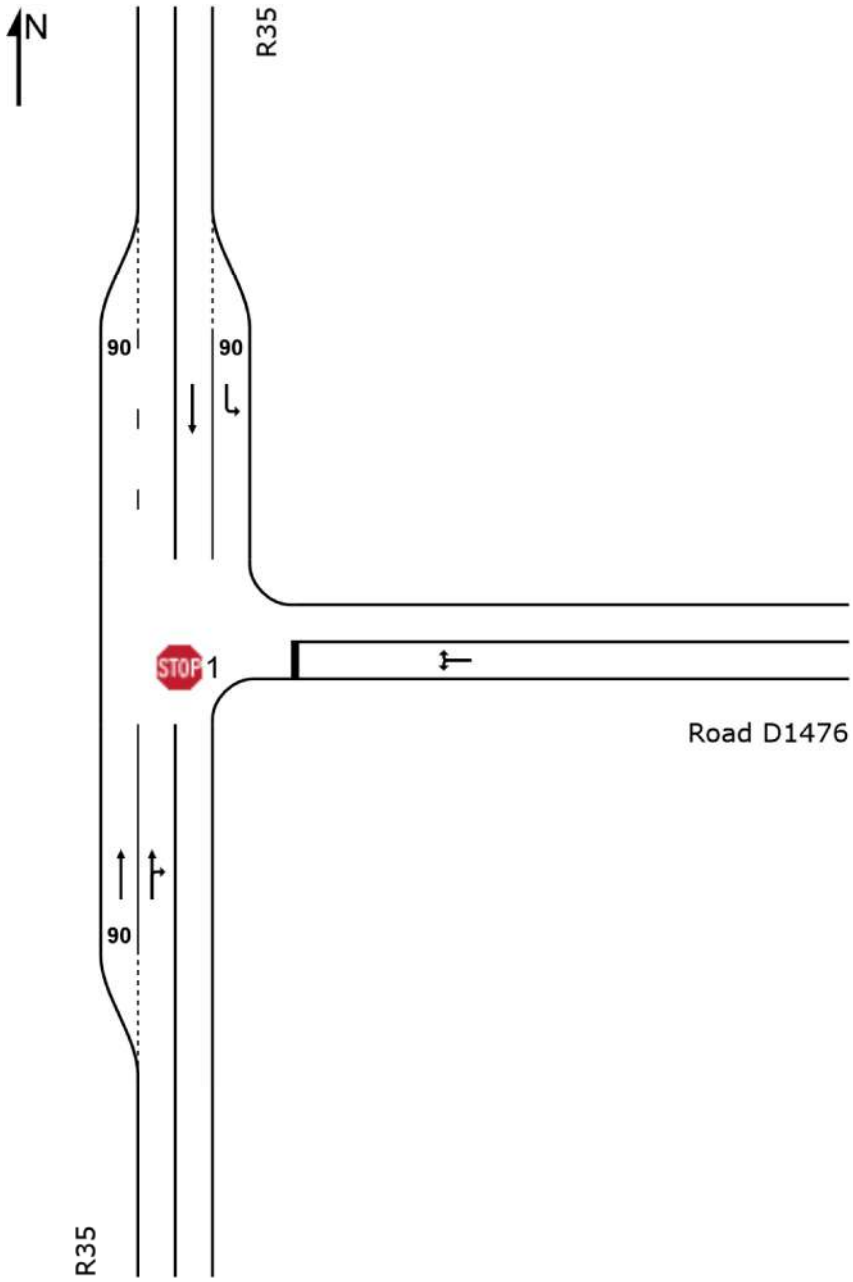
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	92	20.0	0.052	0.2	LOS A	0.2	1.7	0.10	0.11	0.10	58.6
3	R2	28	20.0	0.052	6.4	LOS A	0.2	1.7	0.20	0.22	0.20	54.4
Approach		120	20.0	0.052	1.7	NA	0.2	1.7	0.13	0.14	0.13	57.5
East: Road D1476												
4	L2	7	20.0	0.016	9.5	LOS A	0.1	0.5	0.29	0.89	0.29	50.4
6	R2	5	20.0	0.016	11.3	LOS B	0.1	0.5	0.29	0.89	0.29	50.3
Approach		13	20.0	0.016	10.3	LOS B	0.1	0.5	0.29	0.89	0.29	50.4
North: R35												
7	L2	20	20.0	0.012	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
8	T1	113	20.0	0.064	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		133	20.0	0.064	0.9	NA	0.0	0.0	0.00	0.09	0.00	58.8
All Vehicles		265	20.0	0.064	1.7	NA	0.2	1.7	0.07	0.15	0.07	57.7

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: 1 [2023 PM + Construction Phase]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [2023 PM + Construction Phase]

R35 / D1476 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
South: R35												
2	T1	89	20.0	0.041	0.1	LOS A	0.1	0.7	0.05	0.06	0.05	59.3
3	R2	11	20.0	0.041	6.2	LOS A	0.1	0.7	0.08	0.09	0.08	55.8
Approach		100	20.0	0.041	0.7	NA	0.1	0.7	0.05	0.06	0.05	58.9
East: Road D1476												
4	L2	31	20.0	0.061	9.4	LOS A	0.2	1.9	0.26	0.91	0.26	50.5
6	R2	20	20.0	0.061	10.8	LOS B	0.2	1.9	0.26	0.91	0.26	50.5
Approach		51	20.0	0.061	10.0	LOS A	0.2	1.9	0.26	0.91	0.26	50.5
North: R35												
7	L2	9	20.0	0.006	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
8	T1	88	20.0	0.050	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		98	20.0	0.050	0.6	NA	0.0	0.0	0.00	0.06	0.00	59.2
All Vehicles		248	20.0	0.061	2.5	NA	0.2	1.9	0.07	0.23	0.07	57.1

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.
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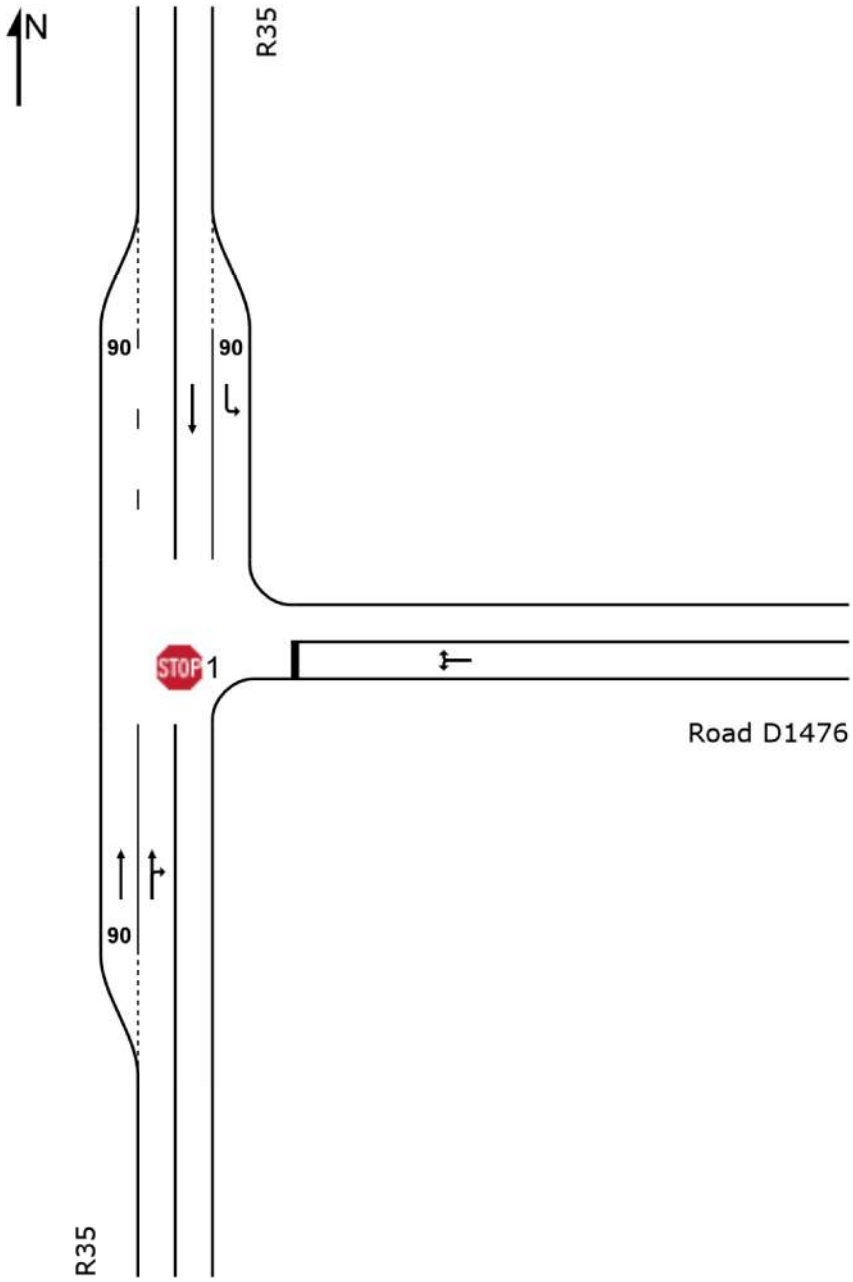
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [2025 AM + Operational Phase]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [2025 AM + Operational Phase]

R35 / D1476 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
South: R35												
2	T1	96	20.0	0.055	0.2	LOS A	0.2	1.8	0.10	0.11	0.10	58.6
3	R2	31	20.0	0.055	6.4	LOS A	0.2	1.8	0.20	0.22	0.20	54.4
Approach		126	20.0	0.055	1.7	NA	0.2	1.8	0.12	0.14	0.12	57.5
East: Road D1476												
4	L2	7	20.0	0.016	9.5	LOS A	0.1	0.5	0.29	0.89	0.29	50.4
6	R2	5	20.0	0.016	11.3	LOS B	0.1	0.5	0.29	0.89	0.29	50.3
Approach		13	20.0	0.016	10.3	LOS B	0.1	0.5	0.29	0.89	0.29	50.4
North: R35												
7	L2	20	20.0	0.012	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
8	T1	107	20.0	0.061	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		127	20.0	0.061	0.9	NA	0.0	0.0	0.00	0.09	0.00	58.7
All Vehicles		266	20.0	0.061	1.7	NA	0.2	1.8	0.07	0.15	0.07	57.7

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.
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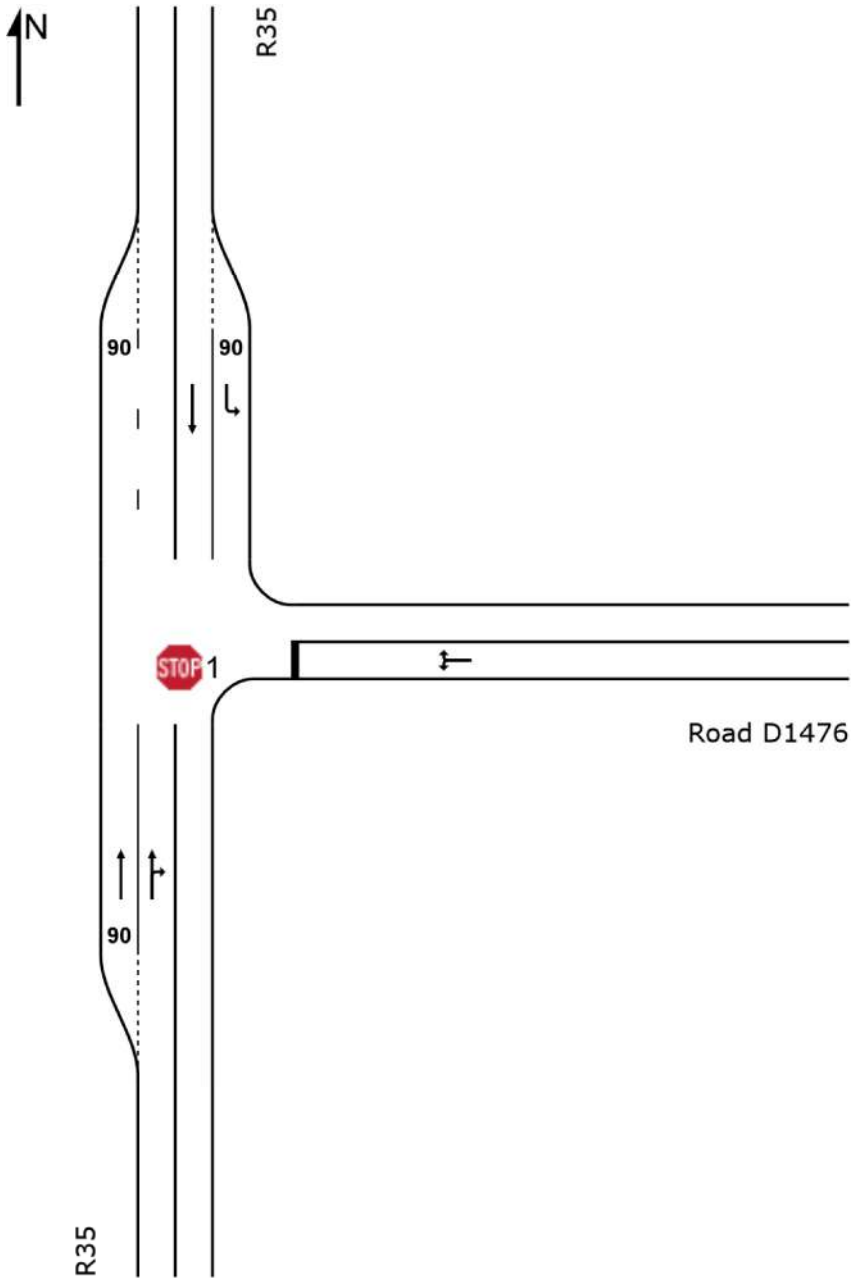
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [2025 PM + Operational Phase]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [2025 PM + Operational Phase]

R35 / D1476 Intersection
Site Category: -
Stop (Two-Way)

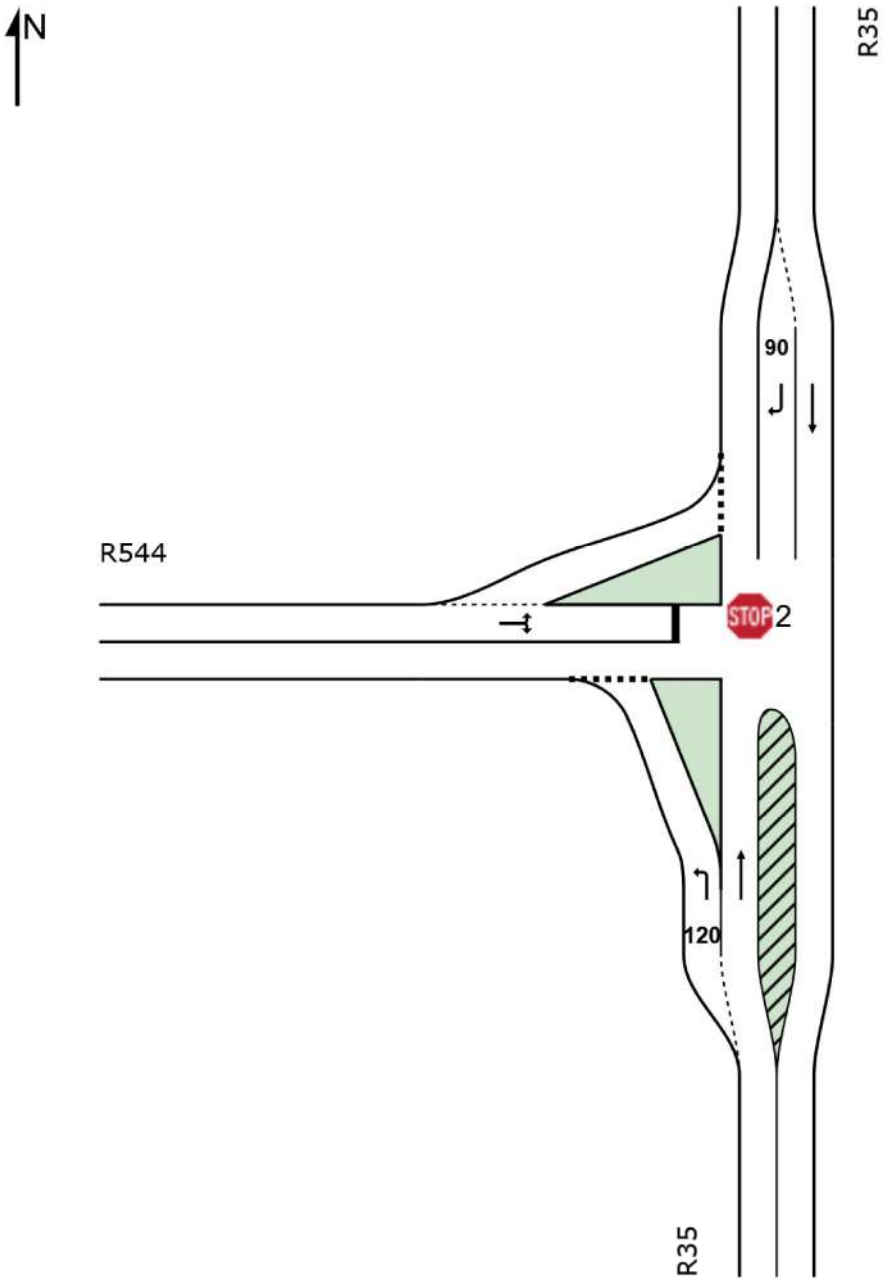
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
2	T1	93	20.0	0.042	0.1	LOS A	0.1	0.7	0.05	0.06	0.05	59.3
3	R2	11	20.0	0.042	6.2	LOS A	0.1	0.7	0.08	0.09	0.08	55.8
Approach		103	20.0	0.042	0.7	NA	0.1	0.7	0.05	0.06	0.05	58.9
East: Road D1476												
4	L2	33	20.0	0.064	9.4	LOS A	0.2	2.0	0.26	0.91	0.26	50.5
6	R2	20	20.0	0.064	10.9	LOS B	0.2	2.0	0.26	0.91	0.26	50.5
Approach		53	20.0	0.064	10.0	LOS A	0.2	2.0	0.26	0.91	0.26	50.5
North: R35												
7	L2	9	20.0	0.006	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
8	T1	92	20.0	0.052	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		101	20.0	0.052	0.5	NA	0.0	0.0	0.00	0.05	0.00	59.2
All Vehicles		257	20.0	0.064	2.5	NA	0.2	2.0	0.07	0.23	0.07	57.1

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.

SITE LAYOUT

Site: 2 [2020 AM]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2020 AM]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)

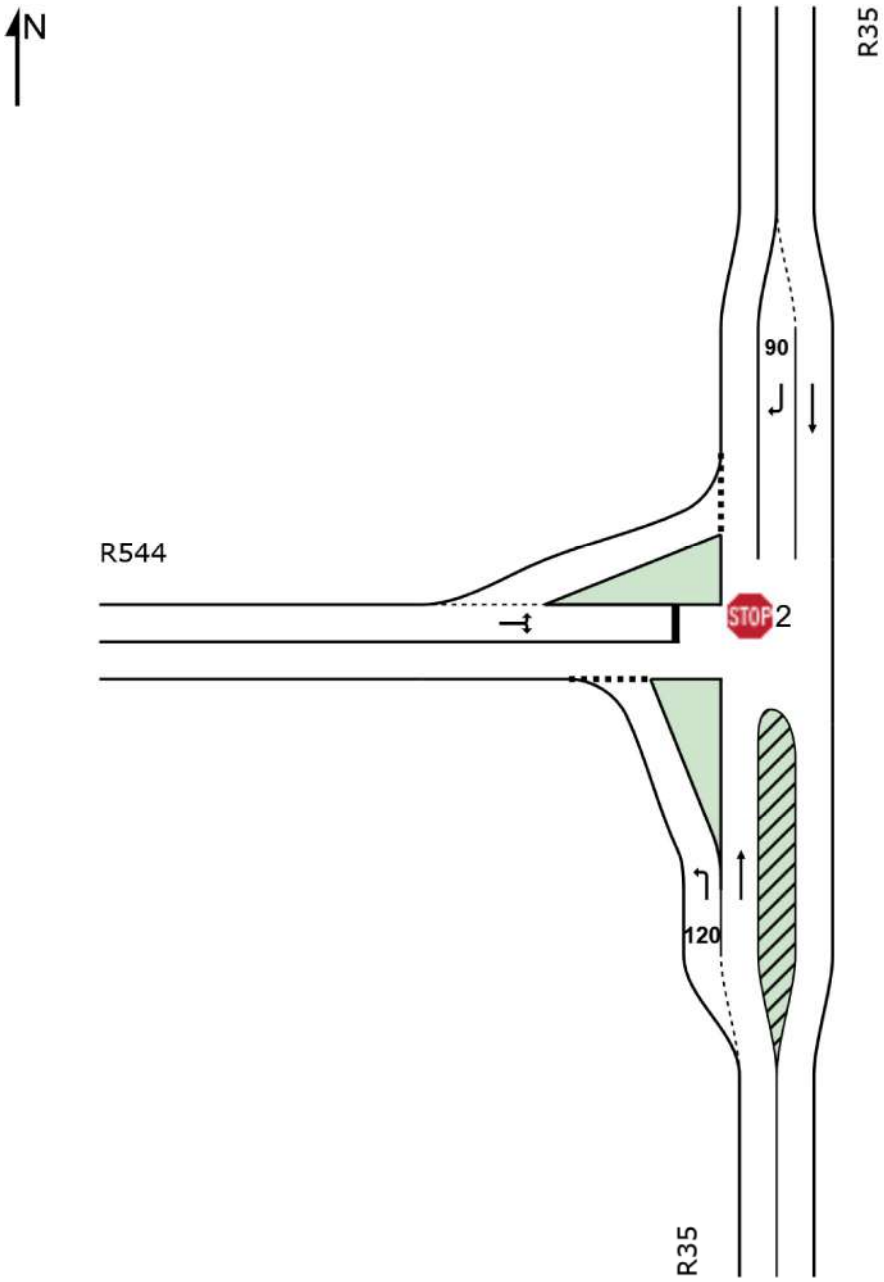
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
1	L2	53	20.0	0.036	5.8	LOS A	0.1	1.2	0.03	0.53	0.03	53.4
2	T1	85	20.0	0.048	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		138	20.0	0.048	2.2	LOS A	0.1	1.2	0.01	0.20	0.01	57.3
North: R35												
8	T1	106	20.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	4	20.0	0.003	6.0	LOS A	0.0	0.1	0.20	0.53	0.20	51.8
Approach		111	20.0	0.060	0.2	NA	0.0	0.1	0.01	0.02	0.01	59.6
West: R544												
10	L2	1	20.0	0.051	6.1	LOS A	0.2	1.6	0.38	0.61	0.38	52.0
12	R2	36	20.0	0.051	7.8	LOS A	0.2	1.6	0.38	0.61	0.38	51.2
Approach		37	20.0	0.051	7.7	LOS A	0.2	1.6	0.38	0.61	0.38	51.3
All Vehicles		285	20.0	0.060	2.2	NA	0.2	1.6	0.06	0.18	0.06	57.3

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 [2020 PM]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2020 PM]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)

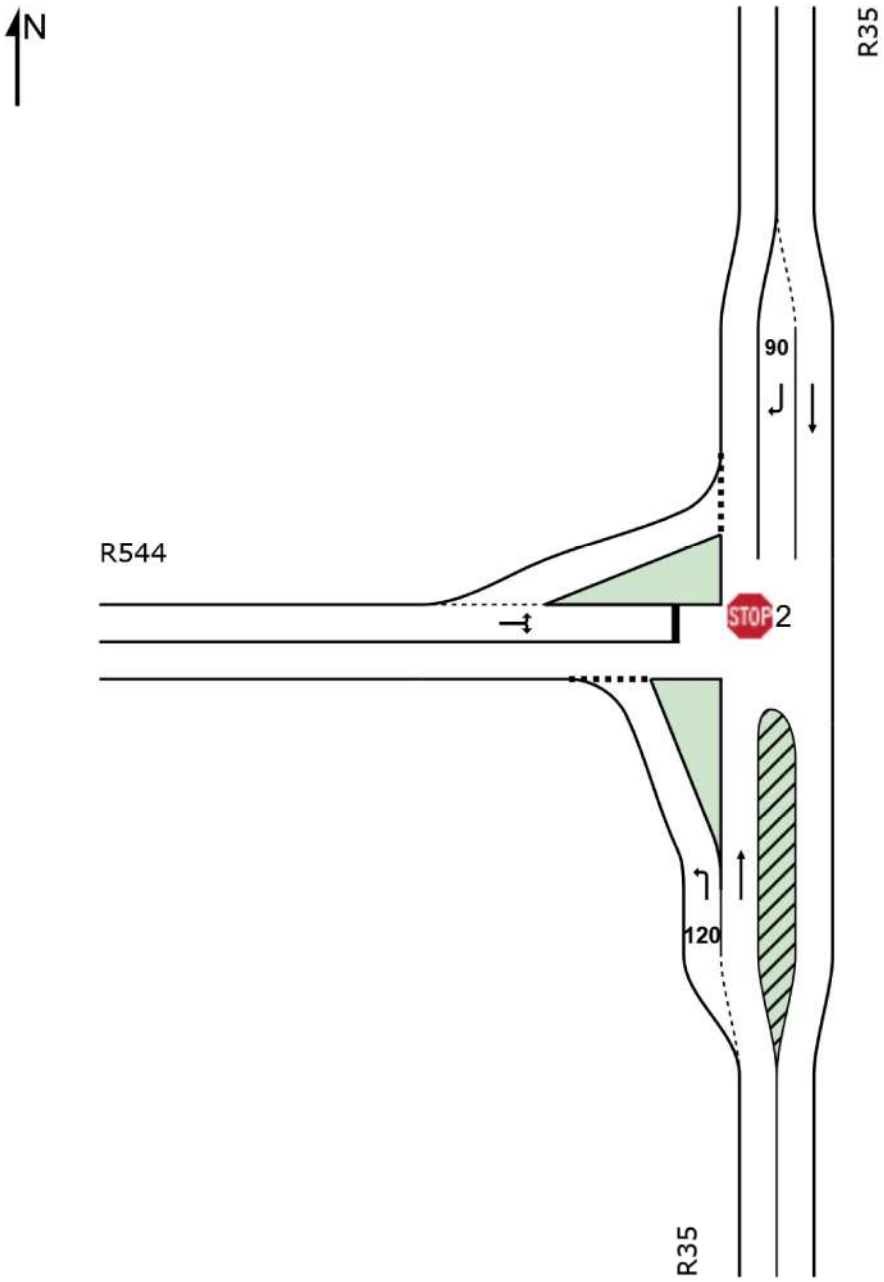
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
1	L2	34	20.0	0.023	5.8	LOS A	0.1	0.7	0.04	0.53	0.04	53.4
2	T1	93	20.0	0.053	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		126	20.0	0.053	1.6	LOS A	0.1	0.7	0.01	0.14	0.01	58.1
North: R35												
8	T1	81	20.0	0.046	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	5	20.0	0.004	6.0	LOS A	0.0	0.1	0.21	0.54	0.21	51.8
Approach		86	20.0	0.046	0.4	NA	0.0	0.1	0.01	0.03	0.01	59.4
West: R544												
10	L2	4	20.0	0.060	6.2	LOS A	0.2	1.9	0.35	0.60	0.35	52.3
12	R2	42	20.0	0.060	7.5	LOS A	0.2	1.9	0.35	0.60	0.35	51.5
Approach		46	20.0	0.060	7.4	LOS A	0.2	1.9	0.35	0.60	0.35	51.6
All Vehicles		259	20.0	0.060	2.2	NA	0.2	1.9	0.07	0.19	0.07	57.2

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: 2 [2023 AM + Construction Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2023 AM + Construction Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)

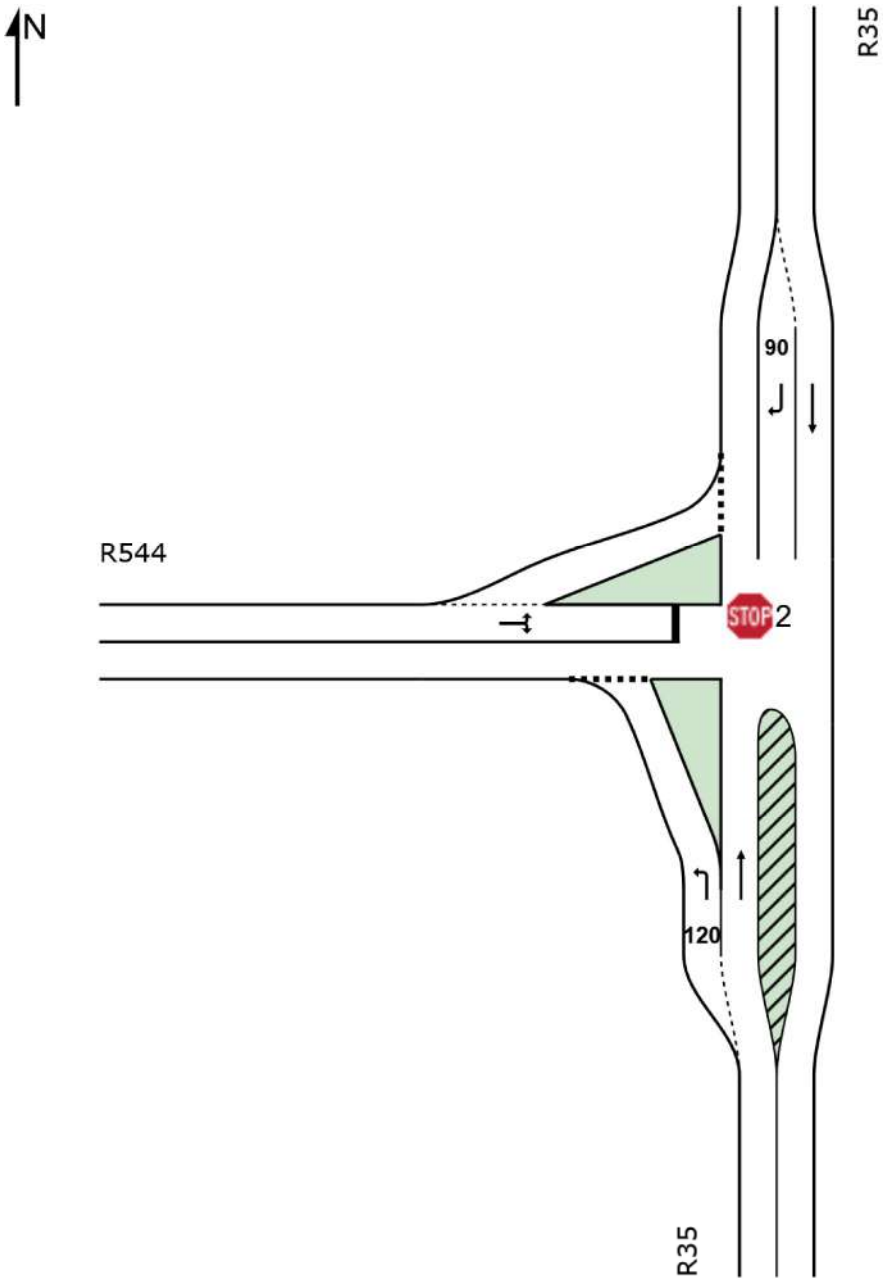
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
1	L2	56	20.0	0.038	5.8	LOS A	0.2	1.3	0.04	0.53	0.04	53.4
2	T1	116	20.0	0.066	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		172	20.0	0.066	1.9	LOS A	0.2	1.3	0.01	0.17	0.01	57.6
North: R35												
8	T1	119	20.0	0.068	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	5	20.0	0.004	6.1	LOS A	0.0	0.1	0.24	0.53	0.24	51.7
Approach		124	20.0	0.068	0.3	NA	0.0	0.1	0.01	0.02	0.01	59.6
West: R544												
10	L2	3	20.0	0.059	6.3	LOS A	0.2	1.9	0.41	0.63	0.41	51.7
12	R2	38	20.0	0.059	8.3	LOS A	0.2	1.9	0.41	0.63	0.41	50.9
Approach		41	20.0	0.059	8.1	LOS A	0.2	1.9	0.41	0.63	0.41	51.0
All Vehicles		337	20.0	0.068	2.1	NA	0.2	1.9	0.06	0.17	0.06	57.4

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: 2 [2023 PM + Construction Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2023 PM + Construction Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)

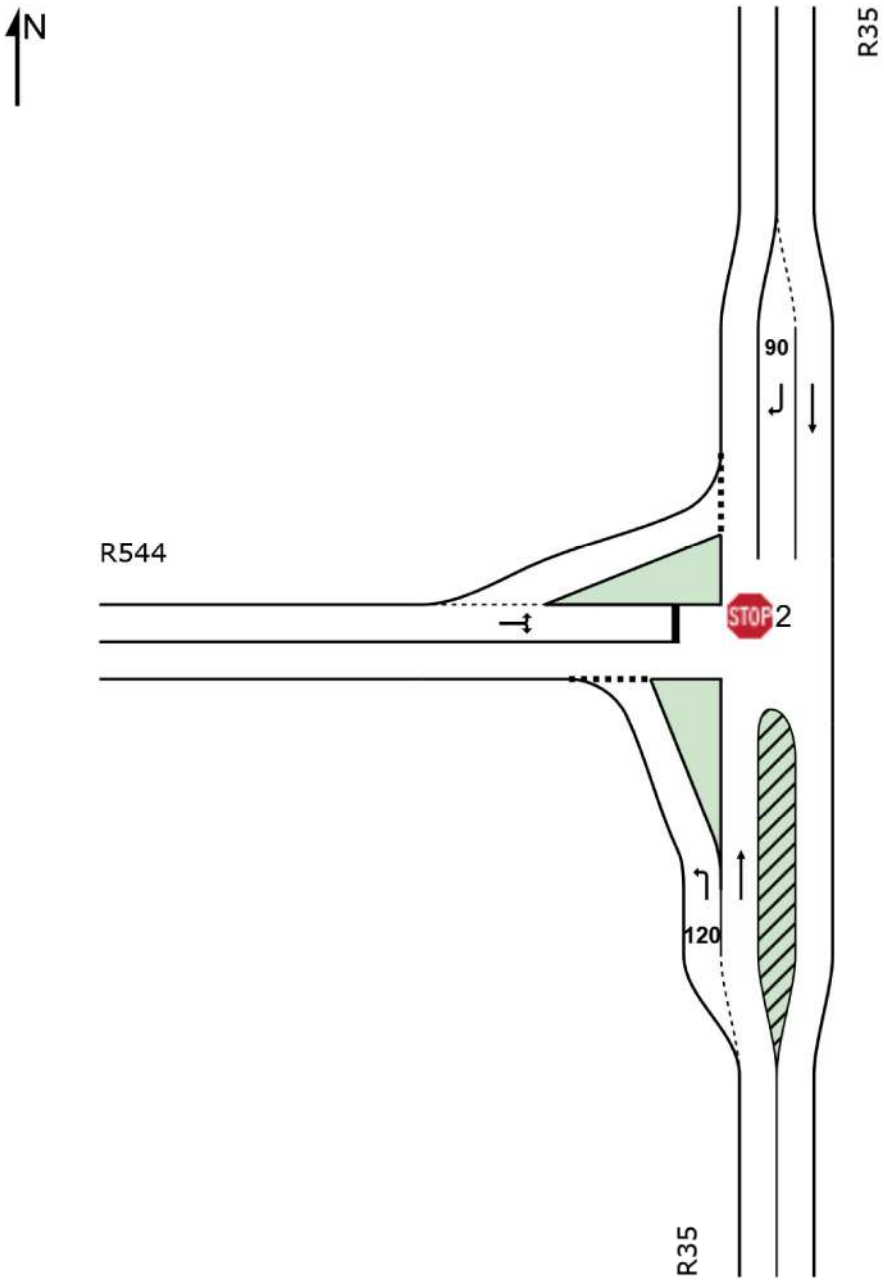
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
1	L2	36	20.0	0.024	5.8	LOS A	0.1	0.8	0.04	0.52	0.04	53.4
2	T1	104	20.0	0.059	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		140	20.0	0.059	1.5	LOS A	0.1	0.8	0.01	0.13	0.01	58.1
North: R35												
8	T1	112	20.0	0.063	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	7	20.0	0.005	6.1	LOS A	0.0	0.2	0.23	0.54	0.23	51.7
Approach		119	20.0	0.063	0.4	NA	0.0	0.2	0.01	0.03	0.01	59.4
West: R544												
10	L2	5	20.0	0.068	6.2	LOS A	0.3	2.1	0.38	0.62	0.38	52.0
12	R2	44	20.0	0.068	8.0	LOS A	0.3	2.1	0.38	0.62	0.38	51.2
Approach		49	20.0	0.068	7.8	LOS A	0.3	2.1	0.38	0.62	0.38	51.3
All Vehicles		308	20.0	0.068	2.1	NA	0.3	2.1	0.07	0.17	0.07	57.4

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: 2 [2025 AM + Operational Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2025 AM + Operational Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)

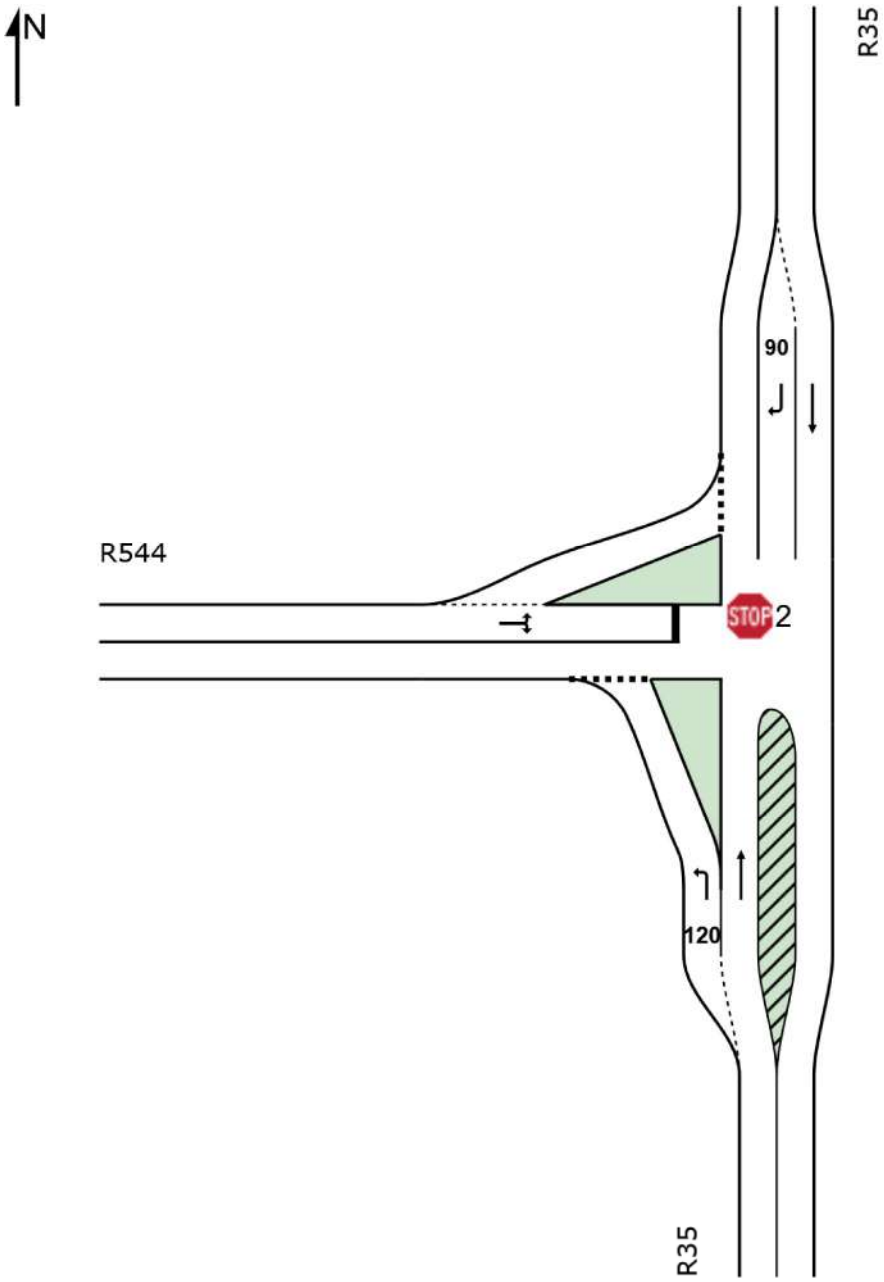
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
1	L2	58	20.0	0.039	5.8	LOS A	0.2	1.3	0.04	0.53	0.04	53.4
2	T1	121	20.0	0.069	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		179	20.0	0.069	1.9	LOS A	0.2	1.3	0.01	0.17	0.01	57.7
North: R35												
8	T1	124	20.0	0.071	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	5	20.0	0.004	6.1	LOS A	0.0	0.1	0.25	0.53	0.25	51.7
Approach		129	20.0	0.071	0.3	NA	0.0	0.1	0.01	0.02	0.01	59.6
West: R544												
10	L2	3	20.0	0.064	6.3	LOS A	0.2	2.0	0.42	0.64	0.42	51.6
12	R2	40	20.0	0.064	8.5	LOS A	0.2	2.0	0.42	0.64	0.42	50.8
Approach		43	20.0	0.064	8.3	LOS A	0.2	2.0	0.42	0.64	0.42	50.9
All Vehicles		352	20.0	0.071	2.1	NA	0.2	2.0	0.06	0.17	0.06	57.4

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: 2 [2025 PM + Operational Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 2 [2025 PM + Operational Phase]

R35 / R544 Intersection
Site Category: -
Stop (Two-Way)

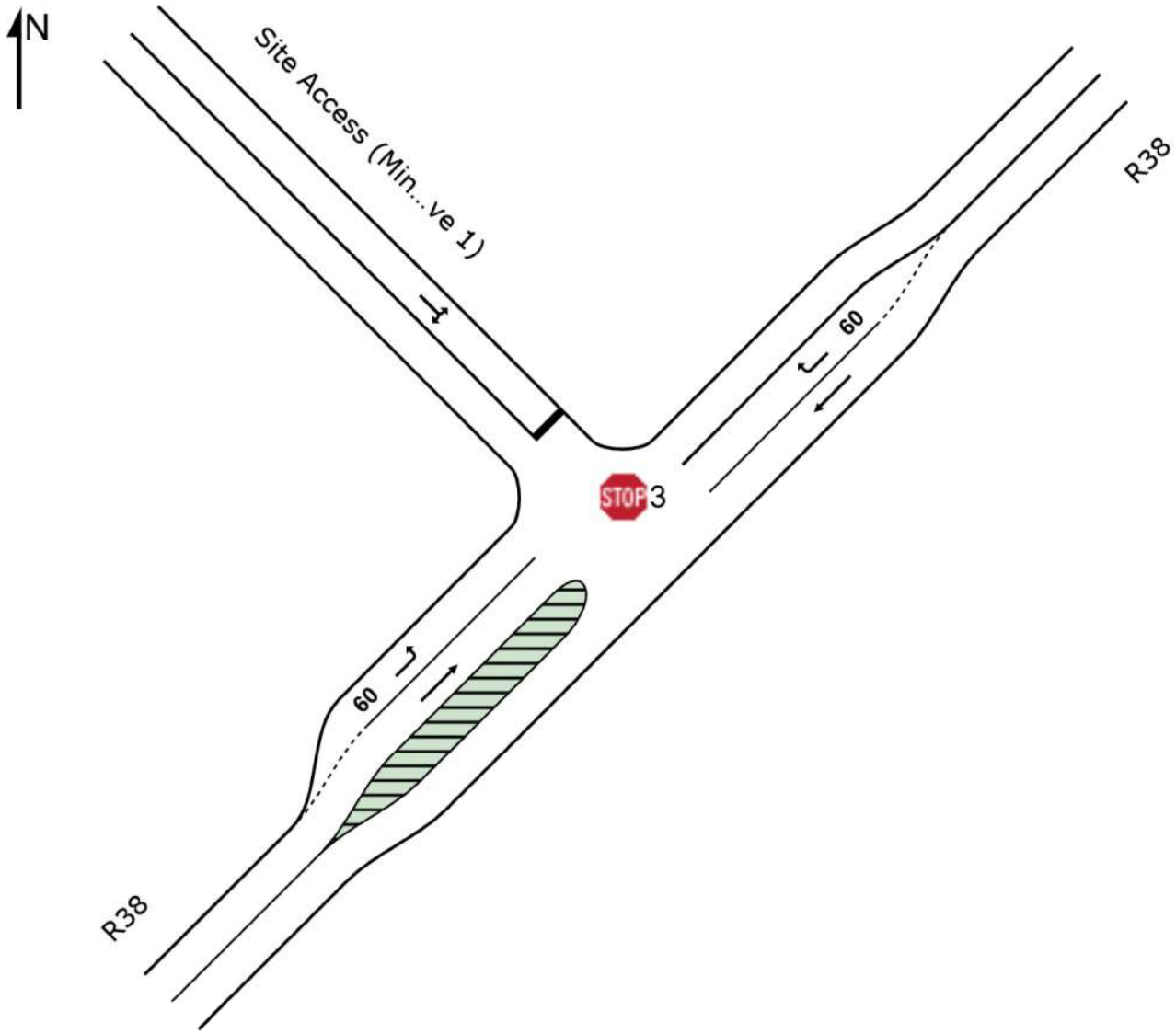
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: R35												
1	L2	37	20.0	0.025	5.9	LOS A	0.1	0.8	0.05	0.52	0.05	53.3
2	T1	108	20.0	0.062	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		145	20.0	0.062	1.5	LOS A	0.1	0.8	0.01	0.13	0.01	58.1
North: R35												
8	T1	117	20.0	0.066	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	8	20.0	0.006	6.1	LOS A	0.0	0.2	0.23	0.54	0.23	51.7
Approach		125	20.0	0.066	0.4	NA	0.0	0.2	0.02	0.04	0.02	59.3
West: R544												
10	L2	5	20.0	0.072	6.2	LOS A	0.3	2.3	0.39	0.63	0.39	51.9
12	R2	46	20.0	0.072	8.2	LOS A	0.3	2.3	0.39	0.63	0.39	51.1
Approach		52	20.0	0.072	8.0	LOS A	0.3	2.3	0.39	0.63	0.39	51.2
All Vehicles		322	20.0	0.072	2.1	NA	0.3	2.3	0.07	0.17	0.07	57.3

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 [2023 AM + Construction Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 3 [2023 AM + Construction Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) Intersection
Site Category: -
Stop (Two-Way)

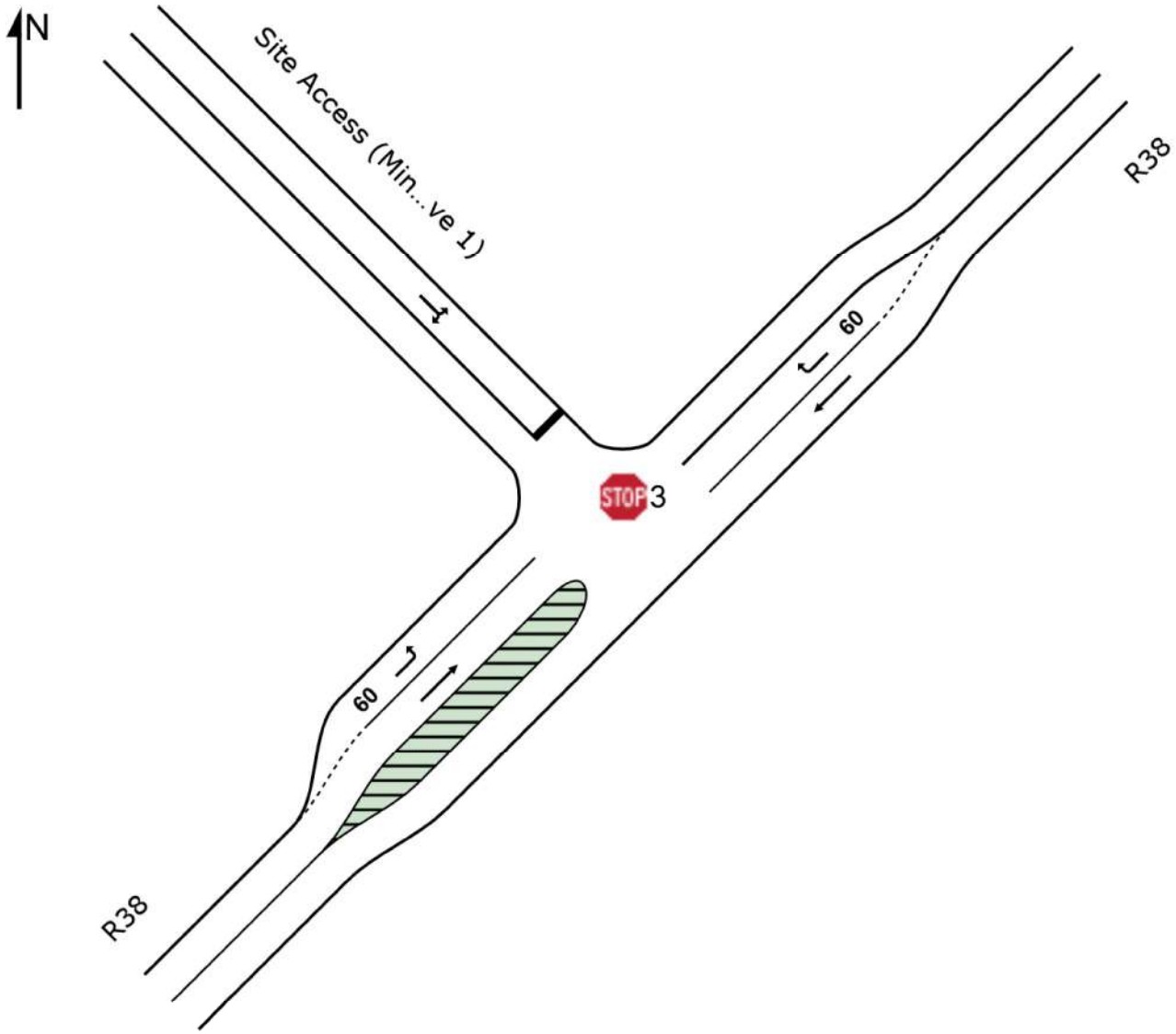
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
NorthEast: R38												
8	T1	135	20.0	0.077	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	19	20.0	0.017	6.5	LOS A	0.1	0.5	0.28	0.56	0.28	51.6
Approach		154	20.0	0.077	0.8	NA	0.1	0.5	0.03	0.07	0.03	58.8
NorthWest: Site Access (Mine Layout Alternative 1)												
10	L2	5	20.0	0.019	9.6	LOS A	0.1	0.6	0.35	0.88	0.35	50.0
12	R2	7	20.0	0.019	12.0	LOS B	0.1	0.6	0.35	0.88	0.35	49.9
Approach		13	20.0	0.019	11.0	LOS B	0.1	0.6	0.35	0.88	0.35	49.9
SouthWest: R38												
1	L2	27	20.0	0.016	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
2	T1	126	20.0	0.072	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		154	20.0	0.072	1.0	NA	0.0	0.0	0.00	0.10	0.00	58.6
All Vehicles		320	20.0	0.077	1.3	NA	0.1	0.6	0.03	0.12	0.03	58.3

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 [2023 PM + Construction Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) Intersection
Site Category: -
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 3 [2023 PM + Construction Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) Intersection
Site Category: -
Stop (Two-Way)

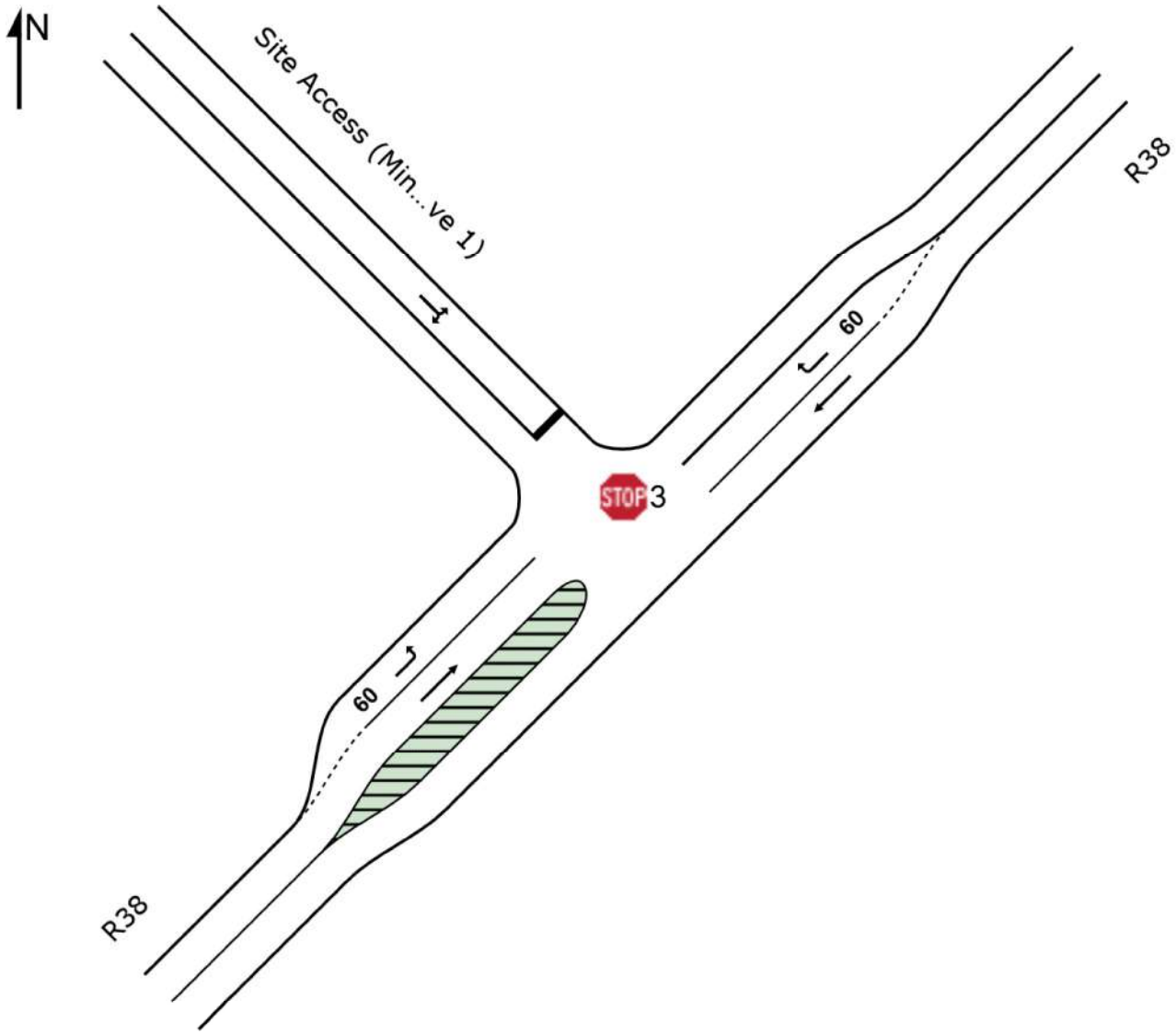
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
NorthEast: R38												
8	T1	105	20.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	5	20.0	0.005	6.3	LOS A	0.0	0.1	0.24	0.54	0.24	51.7
Approach		111	20.0	0.060	0.3	NA	0.0	0.1	0.01	0.03	0.01	59.5
NorthWest: Site Access (Mine Layout Alternative 1)												
10	L2	19	20.0	0.063	9.6	LOS A	0.2	2.0	0.33	0.90	0.33	50.2
12	R2	27	20.0	0.063	11.3	LOS B	0.2	2.0	0.33	0.90	0.33	50.1
Approach		46	20.0	0.063	10.6	LOS B	0.2	2.0	0.33	0.90	0.33	50.2
SouthWest: R38												
1	L2	7	20.0	0.004	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
2	T1	113	20.0	0.064	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		120	20.0	0.064	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.5
All Vehicles		277	20.0	0.064	2.0	NA	0.2	2.0	0.06	0.18	0.06	57.7

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: 3 [2025 AM + Operational Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) Intersection
Site Category: -
Stop (Two-Way)



Organisation: INFRATRANS TRAFFIC AND TRANSPORTATION ENGINEERING | Created: Friday, 20 November 2020 09:40:15
Project: C:\Users\piete\Dropbox\PROJECTS\P-390 Proposed Koppie Coal Mine, Bethal EIA TIA\7 Analyses & Calculations\03_R38_Site Access Alternative 1.sip8

MOVEMENT SUMMARY

Site: 3 [2025 AM + Operational Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) Intersection
Site Category: -
Stop (Two-Way)

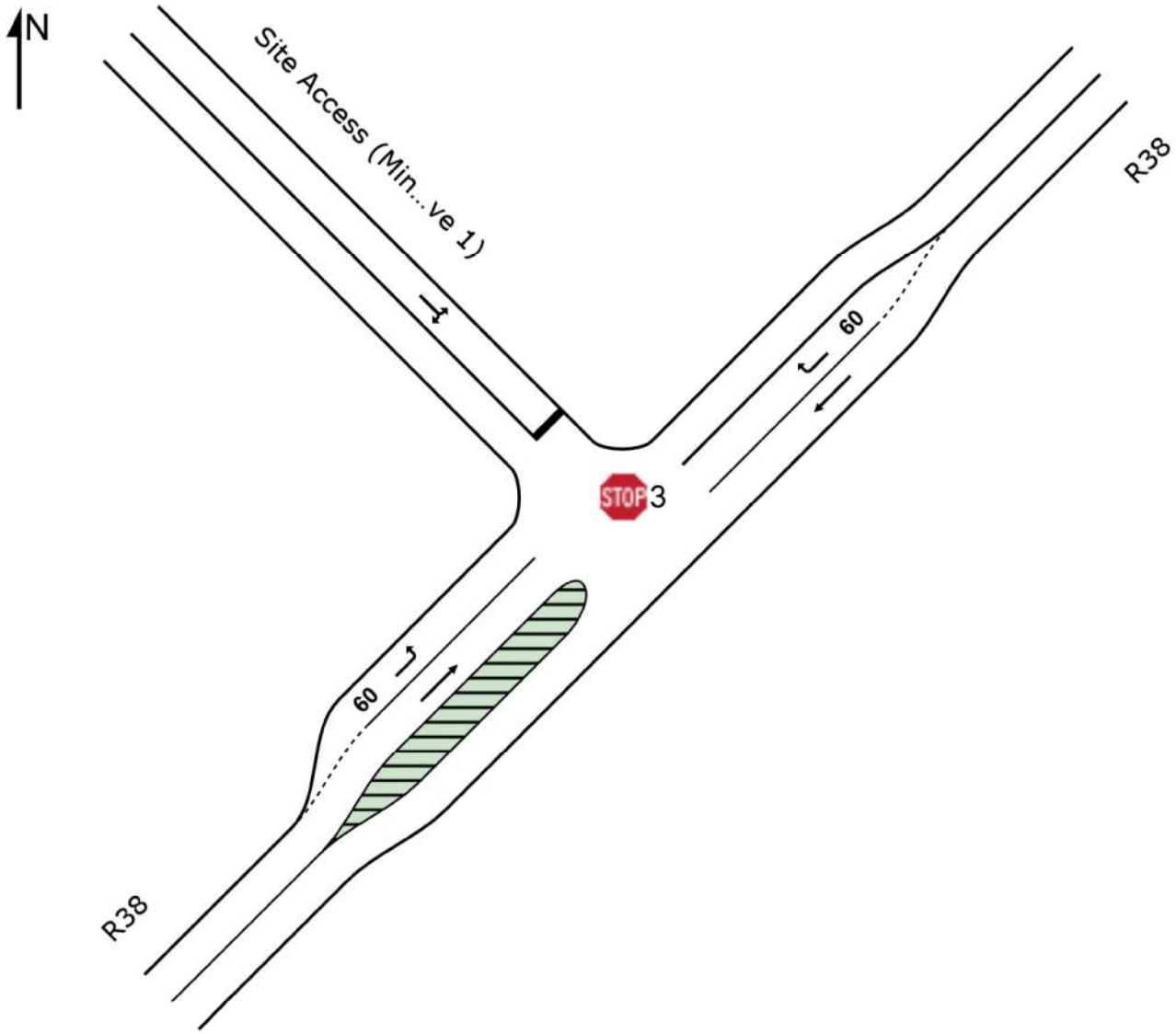
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
NorthEast: R38												
8	T1	141	20.0	0.081	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	19	20.0	0.017	6.5	LOS A	0.1	0.6	0.29	0.57	0.29	51.6
Approach		160	20.0	0.081	0.8	NA	0.1	0.6	0.03	0.07	0.03	58.8
NorthWest: Site Access (Mine Layout Alternative 1)												
10	L2	5	20.0	0.019	9.6	LOS A	0.1	0.6	0.36	0.88	0.36	49.9
12	R2	7	20.0	0.019	12.2	LOS B	0.1	0.6	0.36	0.88	0.36	49.8
Approach		13	20.0	0.019	11.1	LOS B	0.1	0.6	0.36	0.88	0.36	49.8
SouthWest: R38												
1	L2	29	20.0	0.018	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
2	T1	132	20.0	0.075	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		161	20.0	0.075	1.1	NA	0.0	0.0	0.00	0.10	0.00	58.5
All Vehicles		334	20.0	0.081	1.3	NA	0.1	0.6	0.03	0.12	0.03	58.3

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 [2025 PM + Operational Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) Intersection
Site Category: -
Stop (Two-Way)



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MOVEMENT SUMMARY

Site: 3 [2025 PM + Operational Phase]

R38 / Future Site Access (Alternative 1 Mine Layout) 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
NorthEast: R38												
8	T1	109	20.0	0.062	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	5	20.0	0.005	6.3	LOS A	0.0	0.1	0.25	0.54	0.25	51.7
Approach		115	20.0	0.062	0.3	NA	0.0	0.1	0.01	0.02	0.01	59.5
NorthWest: Site Access (Mine Layout Alternative 1)												
10	L2	19	20.0	0.068	9.6	LOS A	0.3	2.1	0.34	0.91	0.34	50.1
12	R2	29	20.0	0.068	11.4	LOS B	0.3	2.1	0.34	0.91	0.34	50.1
Approach		48	20.0	0.068	10.7	LOS B	0.3	2.1	0.34	0.91	0.34	50.1
SouthWest: R38												
1	L2	7	20.0	0.004	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
2	T1	118	20.0	0.067	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		125	20.0	0.067	0.3	NA	0.0	0.0	0.00	0.03	0.00	59.5
All Vehicles		288	20.0	0.068	2.1	NA	0.3	2.1	0.06	0.18	0.06	57.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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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.