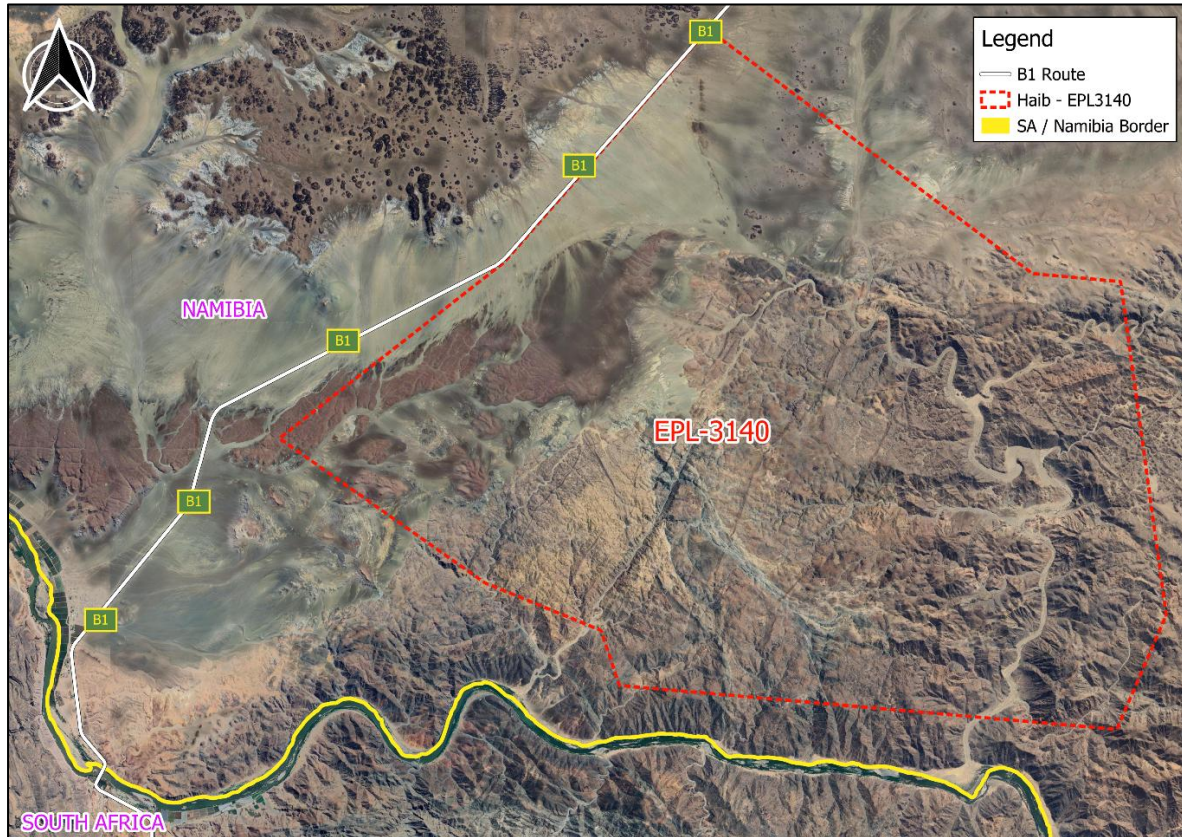


Traffic Impact Assessment

Haib Copper Project, Karas, Namibia



Final Report

February 2026



PREPARED BY:

LOUD Consulting Engineers (Pty) Ltd

Unit 16, Mountain View Office Park
28 Bella Rosa St
Kenridge
7530

CONTACT PERSON:

Louw Venter Pr Eng
Tel no: 083 448 4081
Email: louw.venter@loud-engineers.co.za



PREPARED FOR:

Knight Piésold Consulting (Pty) Ltd

Corner 45 Nelson Mandela Ave
and Hugo Hann Street
Klein Windhoek,
Windhoek.

CONTACT PERSON:

Joseph Mülders
Tel no: 011 806 7111
Email: jmulders@knightpiesold.com

DOCUMENT CONTROL SHEET

DATE	REPORT STATUS	AUTHORED BY	APPROVED BY
January 2026	Final	NAME Jake Brand, BEng	NAME Louw Venter, PrEng MEng
		SIGNATURE  18 February 2026	SIGNATURE  18 February 2026
TITLE: Traffic Impact Assessment – Haib Copper Project (EPL 3140), Karas, Namibia			
PROJECT NUMBER: J2515/Haib Copper Mine TIA			
PREPARED BY: LOUD Consulting Engineers (Pty) Ltd Unit 16, Mountain View Office Park 28 Bella Rosa St Kenridge 7530		COMMISSIONED BY:	
SYNOPSIS: This report assesses the key transportation issues pertaining to the proposed Haib copper mine in the Karas region of Southern Namibia.			

This traffic impact assessment was prepared by a suitably qualified and registered professional engineer. The report is presented in a summary format and any details of the calculations on which the results of this report are based will be made available upon request.

Executive Summary

This Traffic Impact Assessment evaluates the expected traffic impacts of the proposed Haib Copper Mine on the surrounding road network near Noordoewer in the Karas Region of Namibia. The assessment considers existing traffic conditions, projected background growth, and mine-generated traffic during both construction and operational phases, with emphasis on the B1 national route and its key intersections.

Two access options were assessed: upgrading the existing B1/D316 intersection or constructing a new access approximately 3 km north. Both locations meet the required 360 m sight-distance standard for a 120 km/h operating speed. However, the current D316 geometry is inadequate for safe heavy-vehicle turning without encroachment, necessitating formalisation of the intersection.

Traffic counts conducted in November 2025 confirm that existing traffic volumes in the study area are low, with all intersections currently operating at Level of Service (LOS) A. Heavy vehicles make up a substantial proportion of movements at the existing mine access (D316), highlighting the importance of safe geometric design for heavy-vehicle operations.

Peak-hour trip generation based on data provided by the client exceeds standard TMH17 estimates, accordingly, the client-provided data was used in the analysis. Despite the increased traffic, the B1 corridor has sufficient capacity to accommodate the development traffic.

Overall, the assessment concludes that the proposed Haib Copper Mine can be supported by the existing road network, subject to targeted geometric improvements at the mine access to improve safe heavy-vehicle turning movements.

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- Annexure B: Classified Traffic Counts
- Annexure C: Heavy Vehicle Traffic Generation Estimates Provided by Client
- Annexure D: SIDRA Traffic Analysis

1. Introduction

1.1 Terms of reference

Loud Consulting Engineers (Pty) Ltd was appointed by Knight Piésold Consulting (Pty) Ltd, on behalf of their client, Koryx Copper Inc, to prepare a Traffic Impact Assessment (TIA) for the proposed copper mine located in southern Namibia near the settlement of Noordoewer on the Namibian–South African border.

1.2 Purpose of the report

The purpose of this report is to determine the amount of traffic that will be generated by the mining operations, assess the impact of this traffic on the surrounding road network, and recommend mitigation measures to minimise the effects of mine-related traffic.

This assessment considers traffic conditions at the existing intersections that will be directly affected by the mining operations, as well as at the proposed mine access intersections. It further evaluates the mine's generated trips, access requirements, and the overall impact of the development on the surrounding road network.

1.3 Locality

The Haib Copper Project is in the Karas Region of southern Namibia, the existing access is approximately 26 km north of the South African border along the B1 highway, with the mine site approximately 12–15 km east of the B1 highway. A locality plan is provided in **Figure 1-1** below. The Orange River lies to the south of the project area, while agricultural farms and rural properties forming the settlement of Noordoewer lie west of the proposed mine site.

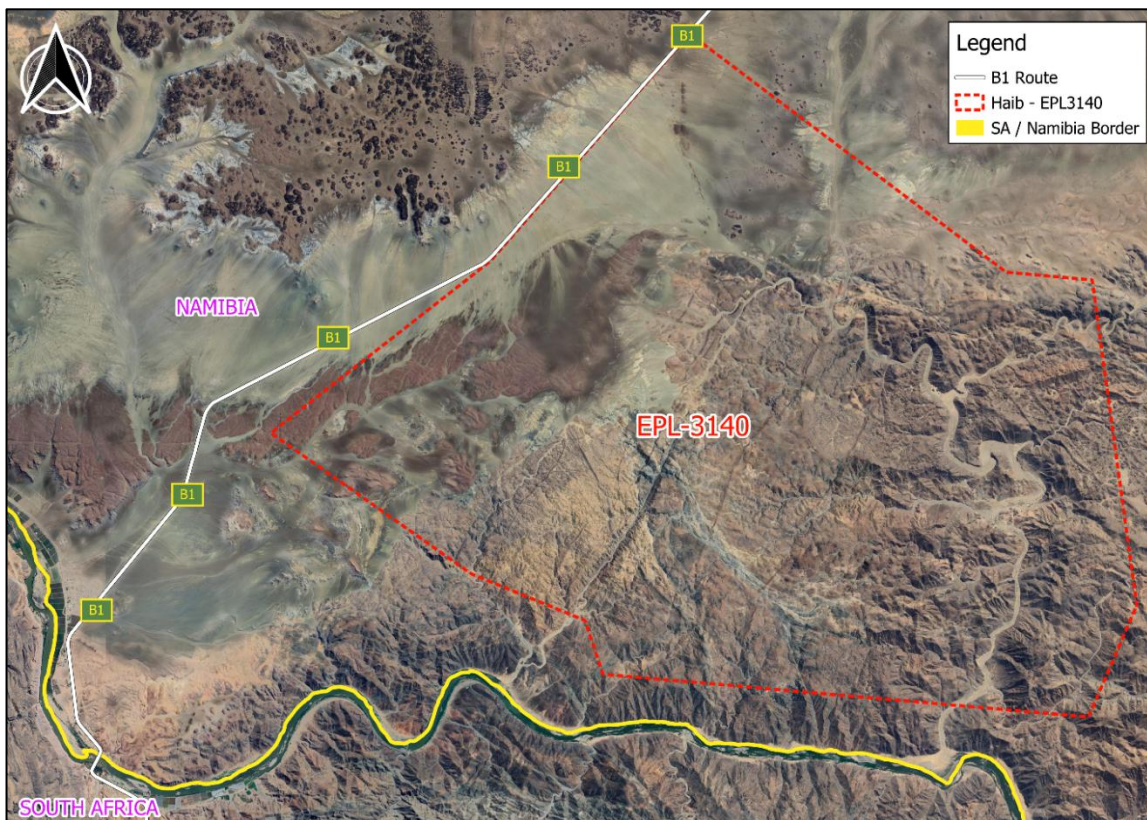


Figure 1-1: Location of proposed development site

1.4 Proposed development

The proposed development involves establishing the Haib Copper Mine, a large-scale copper extraction and processing operation. The project area covers approximately 36 571 ha, with most of the site located on state-owned land. The development aims to transition the existing exploration operations into a fully operational open pit mine and long-term copper production facility. The pit comprises of four target areas that will ultimately combine to form a single larger pit.

The project area is located roughly 6 km north of the South African border and 12–15 km east of the B1 national highway. The proposed mine layout includes several key components that collectively support a production throughput of approximately 35 million tonnes per annum (Mtpa). The open-pit mining area will be supplying mineral-rich material to a nearby processing facility. Mine infrastructure will include waste-rock dumps, ore stockpiles, tailings storage facilities, pipelines and water abstraction systems, access and haul roads, power supply infrastructure, administrative buildings, and other essential services.

The operation is expected to maintain production for approximately 23 years, based on a total planned material movement of around 87.5 Mtpa, which equates to roughly 1.58 billion tonnes of material mined over the life of the project.

A site layout plan is shown in **Figure 1-2** below.

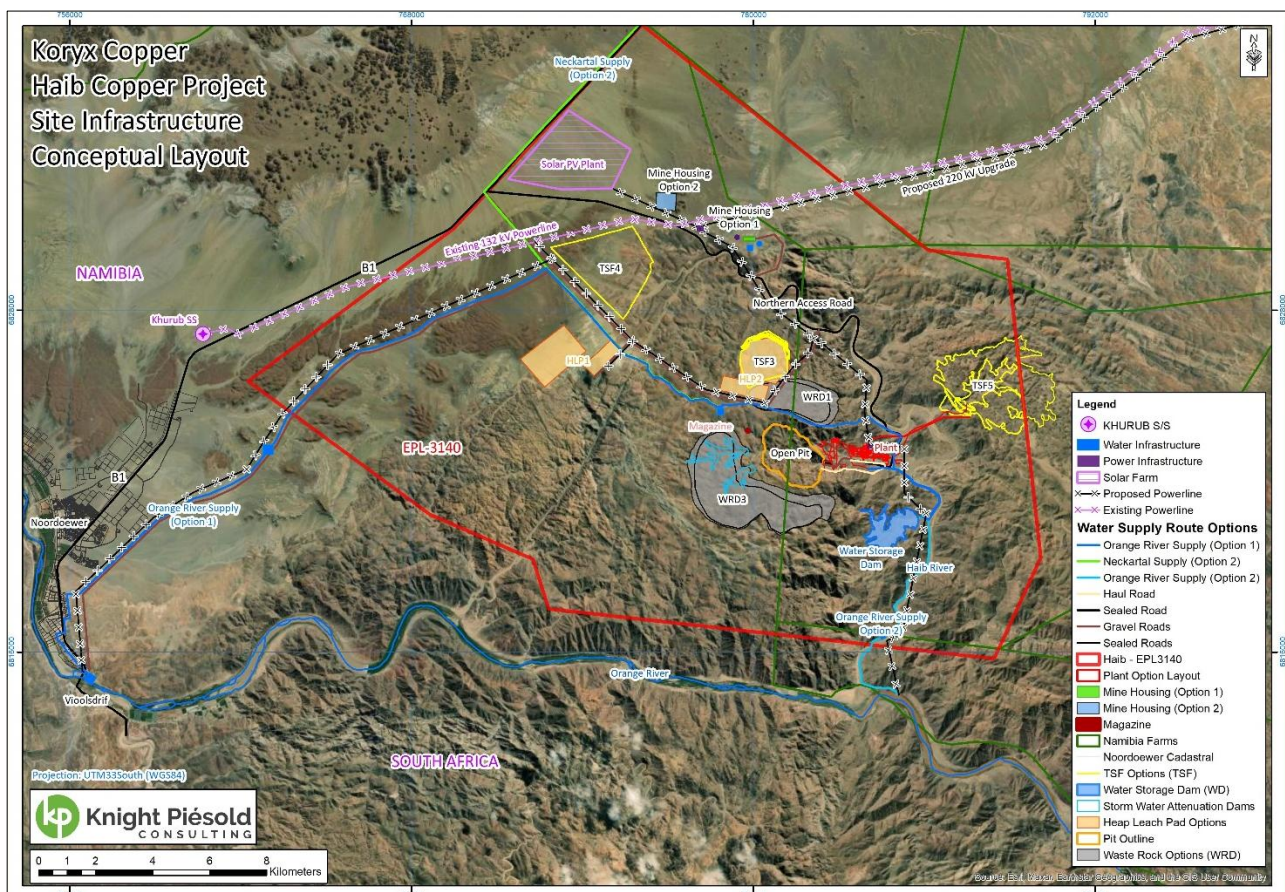


Figure 1-2: Conceptual layout of the proposed development

2. Study Area

The study area for the TIA was defined in accordance with the guidelines provided in the TMH16. The study area includes external roads and intersections that are likely to be impacted by the proposed development.

The selection of elements was limited to Class 4 and 5 roads in the vicinity of the development, extending up to and including the first intersections with Class 1 to 3 roads that can be accessed via the Class 4 and 5 road networks from the development site.

The scope of the study was extended beyond the guidelines definition to include intersections and roads that will be impacted by staff transport. Four (4) intersections and five (5) roads were included in the study and are presented in the chapters to follow.

3. Site Observations and Data Collection

A site investigation was undertaken over 3 days from 17 – 19 November 2025. The purpose of the investigation was primarily to conduct traffic counts of the intersections in the study area on a normal weekday. The site investigation included road width measurements of the study area, photographs of various elements, site distance measurements and general familiarisation of the traffic flow conditions in the area.

Classified traffic counts were conducted from 06:00 to 18:00 (12 hour) at the following four (4) intersections on 18 November 2025. The counted vehicles were classified into 3 classes namely, Light, Heavy and Bus and captured in 15-minute intervals for each movement through the intersection. The intersection count locations are shown in **Figure 3-1** below.

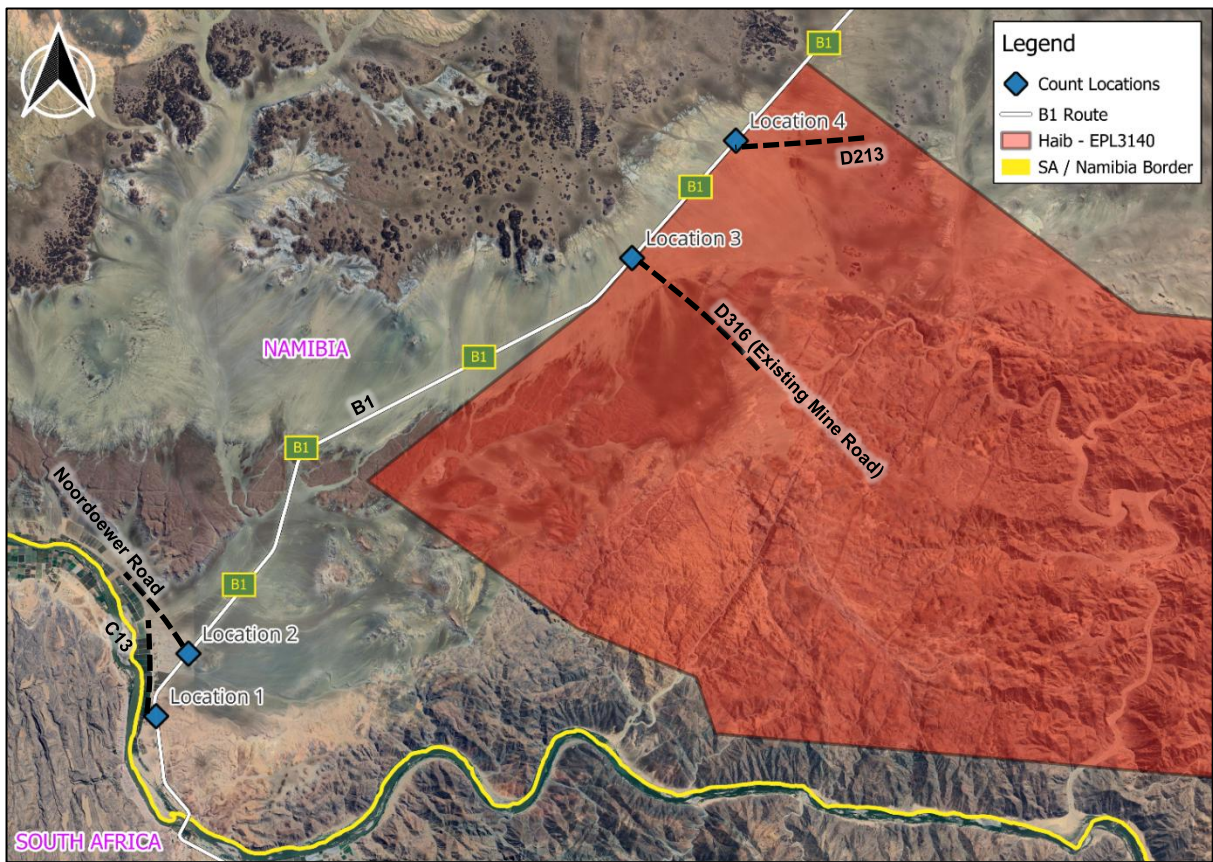


Figure 3-1: Traffic count locations

4. Road Infrastructure

4.1 Surrounding road network

Road functional classification for the purposes of this assessment is based on the South African Road Classification and Access Management Manual (TRH 26). Roads are classified according to their primary function, being either mobility or access/activity, and are assigned to one of six functional classes. As the study area is located within a rural environment, the rural functional road classification system (R1–R6) is applied.

The primary focus of this study is the B1 Road, which connects directly to the N7 at the South African border and extends northwards through Namibia. The B1 functions as a R1 (Rural Class 1 Principal Arterial) and represents the only direct access to the study area. Several roads intersect the B1 within the study area, most notably the C13 Road, the Noordoewer access road, and the existing Haib mining access road (D316).

The road network elements expected to be directly affected by the proposed mining development are summarised below in accordance with the rural functional road classification system defined in TRH 26:

- B1 - R1 (Rural Class 1 Principal Arterial)
- C13 - R3 (Rural Class 3 Minor Arterial)
- Noordoewer Road - R4 (Rural Class 4 Collector Road)
- D316 - R5 (Rural Class 5 Access Road)
- D213 - R5 (Rural Class 5 Access Road)

4.1.1 National Route B1

The B1 Road, extends directly from the N7 at the South African border and continues northwards through Namibia. It is classified as an R1 (Rural Class 1 Principal Arterial) and serves as the only direct access to the study area.

The B1 is a two-lane, two-way, highway with 2 x 3.7 m surfaces lanes and a 0.3 m surfaced shoulder on each side. The typical cross-section of the B1 is shown in **Figure 4-1**, underneath.

The posted speed of the B1 is 120 km/h with a road reserve of 60 m.

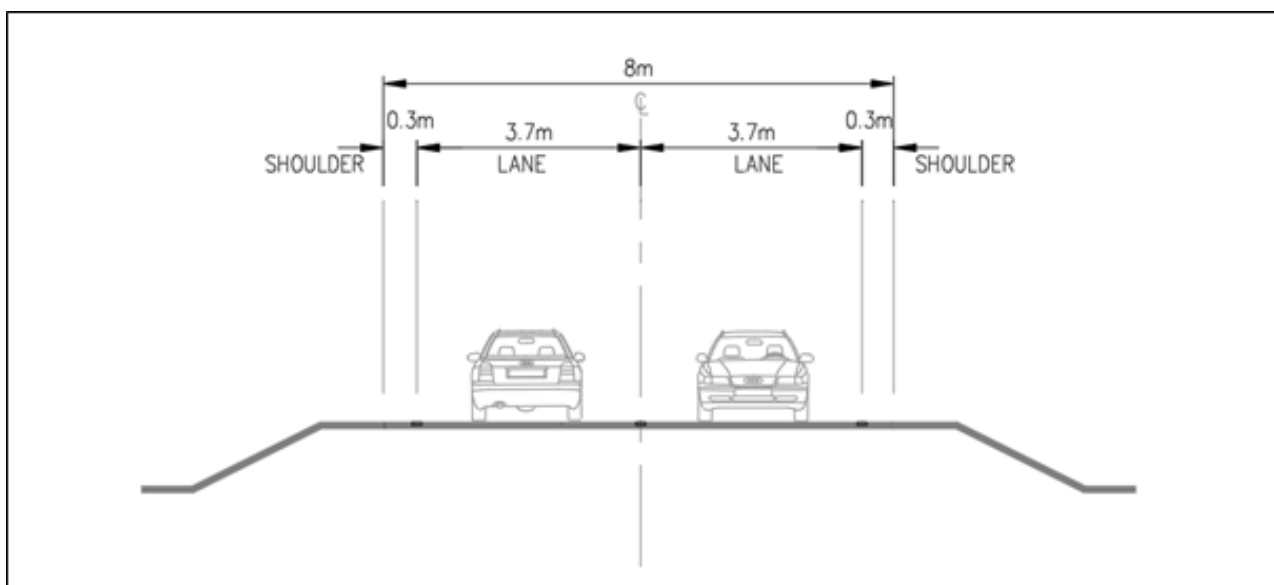


Figure 4-1: B1 typical cross-section

4.1.2 C13 – Rundreise Namibia

The C13 intersects the National Route B and serves as the primary access road to the settlement of Noordoewer. It is classified as a R3 (Rural Class 3 Minor Arterial). It provides regional connectivity between Sendelingsdrif, Rosh Pinah, and Aus.

The C13 is a two-lane, two-way surfaced road comprising 2 × 3.7 m lanes with 0.3 m surfaced shoulders on each side.

The posted speed limit along this section of the C13 is 80 km/h.

4.1.3 Noordoewer Road

Noordoewer Road is the main east–west connector through Noordoewer and is classified as a R4 (Rural Class 4 Collector Road). It provides connectivity between the town’s residential areas, commercial activities and institutional land uses, and the higher-order B1 and C13 roads.

The road is a two-lane, two-way surfaced route comprising 2 × 3.7 m lanes, with unsurfaced shoulders on both sides.

There is no posted speed limit, and the road reserve width is approximately 20 m.

4.1.4 D213 and D316

The D213 and D316 roads provide access to the mining site and do not serve any broader distribution function beyond this role. They carry only localised traffic associated with the mine and can therefore be classified as R5 (Rural Class 5 Access Roads).

Both roads are unsurfaced, with widths ranging between 3.7 m and 5.4 m.

4.2 **Intersections**

Four intersections were included in the study area, as illustrated in **Figure 3-1**. These intersections were selected as they are expected to be directly impacted by the proposed mine development and therefore represent the key locations at which traffic counts were undertaken.

The intersections are listed below.

- B1 and C13 (Count Location 1)
- B1 and Noordoewer Road (Count Location 2)
- B1 and D316 (Count Location 3)
- B1 and D213 (Count Location 4)

4.2.1 B1 and C13 intersection (Count Location 1)

The intersection of the B1 and C13 is a T-intersection with two lanes on each approach. A central island, approximately 9 m wide is provided on the Noordoewer Road approach to accommodate heavy vehicle turning movements. There are no dedicated turning lanes or deceleration tapers on the B1.

The C13 is surfaced from the intersection into the fuel station access on the southern side, as well as to the north of the intersection. An aerial image of the intersection is shown in **Figure 4-2**, overleaf.



Figure 4-2: Aerial image of the B1 and C13 intersection

4.2.2 B1 and Noordoewer Road Intersection (Count Location 2)

The intersection of B1 and Noordoewer Road is a T-intersection with two lanes on each approach of the intersection with a central island on the Noordoewer Road intersection of approximately 9 m wide to accommodate heavy vehicle turning movements. There are no dedicated turning lanes, or deceleration tapers, on the B1. An aerial image of the intersection is shown in Figure 4-3 below.



Figure 4-3: Aerial image of the B1 and Noordoewer Road Intersection

4.2.3 B1 and D316 Intersection (Count Location 3)

The B1 and D316 is the existing intersection to the Haib mine and is the location of the proposed new formalised intersection to the mine.

The intersection of B1 and D316 is a T-intersection with two lanes on each approach of the intersection. There are no dedicated turning lanes, or deceleration tapers, on the B1.

The layout of the existing B1 and D316 T-intersection is shown in **Figure 4-4** below.



Figure 4-4: Aerial image of the existing B1 and D316 T-intersection

4.2.4 B1 and D213 Intersection (Count Location 4)

The intersection of B1 and D213 is a T-intersection with two lanes on each approach of the intersection. There are no dedicated turning lanes, or deceleration tapers, on the B1. The layout of the existing B1 and D316 T-intersection is shown in **Figure 4-5** below.



Figure 4-5: Aerial image of the existing B1 and D213 T-intersection

4.3 Proposed Mine Accesses

4.3.1 Proposed Mine Access Locations

Two locations are being considered for the intersection of the proposed mine access road with the B1. The first option utilises the existing mine access intersection at the junction of the B1 and the D316 (Count Location 3). The second option is located approximately 3.0 km north of the existing intersection along the B1 (at or near Count Location 4, exact location to be determined). A locality plan of the proposed intersection options is shown in **Figure 4-6** below.

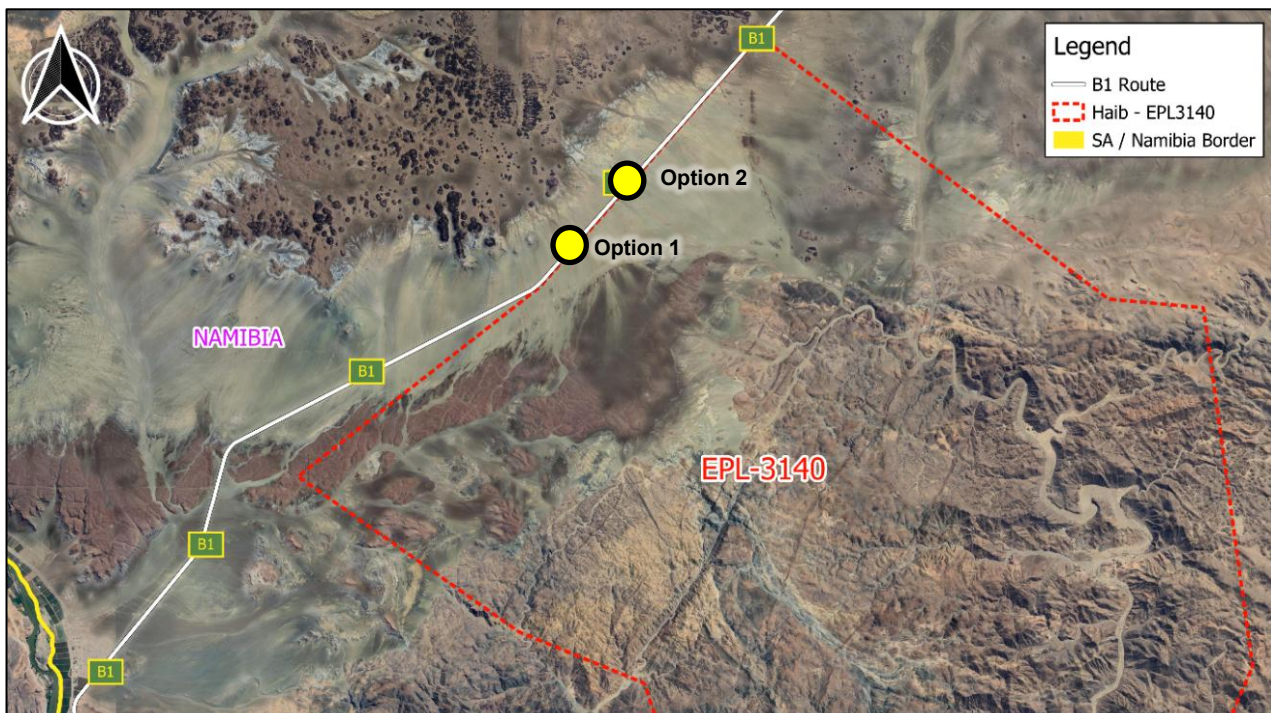


Figure 4-6: Proposed Intersection Locations

4.3.2 Option 1: B1 and D316

The B1 and D316 is the existing intersection to the Haib mine and is the location of the proposed new formalised intersection to the mine.

It is evident from the narrow 5 m cross-section of D316, at the B1 and D316 T-intersection, that a heavy vehicle will not be able to turn left from the B1 into D316 without encroaching into the oncoming lane or the north-eastern corner of the intersection. An image of the intersection is shown in **Figure 4-7**.



Figure 4-7: B1 and D316 T-intersection

A swept path analysis was undertaken at the B1/D316 intersection using Vehicle Tracking software. **Figure 4-8** below illustrates the swept path of a standard WB-19 truck. The analysis indicates that a typical truck-and-trailer delivery/hauling vehicle can complete a left-turn movement from the B1 into the D316 without encroaching into the opposing traffic lane; however, the manoeuvre does result in encroachment onto the north-eastern corner of the T-intersection.



Figure 4-8: Heavy vehicle swept path

It is recommended that the bell-mouth radius and access width of the proposed mine access be increased to accommodate the turning requirements of heavy vehicles. This will ensure sufficient space for large articulated vehicles to safely turn into and out of the access without encroaching into opposing traffic lanes or the road shoulder, thereby improving operational safety and reducing the risk of conflict with through traffic.

The Namibia Roads Authority (NRA) *Standard Drawings – Typical Accesses to Roads*, specifically the requirements for a Type A Access (see **ANNEXURE A**) should be used as a basis for the design of the T-intersection, with appropriate signage in accordance with the Southern African Development Community Road Traffic Signs Manual (SADC-RTSM).

The required shoulder sight distance for the B1, for a vehicle stopping at the stop line on D316, should be 360 m for an operating speed of 120 km/h on the B1. The shoulder sight distance on the B1 to the south (looking left from D316) is approximately 500 m and to the north (looking right from D316) is approximately 600 m. The shoulder sight distances are shown in **Figure 4-9** and **Figure 4-10**, underneath.



Figure 4-9: Shoulder sight distance looking left



Figure 4-10: Shoulder sight distance looking right

4.3.3 Option 2: Proposed New Intersection

The second option is a new intersection approximately 3.0 km north along the B1 from the existing access road (at or near Count Location 4, exact location to be determined).

Similarly to option 1, it is recommended that the bell-mouth radius and access width of the proposed mine access be increased to accommodate the turning requirements of heavy vehicles. This will ensure sufficient space for large articulated vehicles to safely turn into and out of the access without encroaching into opposing traffic lanes or the road shoulder, thereby improving operational safety and reducing the risk of conflict with through traffic.

The Namibia Roads Authority (NRA) *Standard Drawings – Typical Accesses to Roads*, specifically the requirements for a Type A Access (see **ANNEXURE A**) should be used as a basis for the design of the T-intersection, with appropriate signage in accordance with the Southern African Development Community Road Traffic Signs Manual (SADC-RTSM).

The shoulder sight distance on the B1 to the south (looking left from the proposed intersection) is approximately 500 m and to the north (looking right from the proposed intersection) is about 700 m. The shoulder sight distances are shown in **Figure 4-11** and **Figure 4-12**, overleaf.



Figure 4-11: Shoulder sight distance looking left



Figure 4-12: Shoulder sight distance looking right

5. Traffic

5.1 Existing traffic conditions

The 2025 existing traffic conditions were analysed to establish the status quo capacity of the surrounding road network at the time the traffic surveys were undertaken. The intersection traffic counts indicate that the study area experiences generally very low traffic volumes, with the highest volumes recorded at the B1/C13 intersection, where a total of 537 vehicles were observed during the 12-hour count period, as shown in **Table 5-1**.

Table 5-1: 2025 Peak hour and Total Traffic Volumes

No	Intersection	Weekday AM Peak	Weekday Midday Peak	Weekday PM Peak	Total (06:00-18:00)
		volume (veh/h)	volume (veh/h)	volume (veh/h)	volume
1	B1 and C13	69	87	100	537
2	B1 and Noordoewer Main Road	39	32	46	358
3	B1 and D316	26	27	37	286
4	B1 and D213	22	26	35	251

The B1 and D316 (existing Haib mine access) intersection traffic volume graph for the 06:00-18:00 traffic count indicated that the AM and Midday peak periods are similar with the PM peak period the highest peak hour with approximately 30% (10 vehicles) more traffic. The existing heavy vehicle percentage was found to be 43% at the B1 and D316 (existing Haib mine access) intersection. The 12-hour traffic volumes at the intersection are shown in the graph in **Figure 5-1**.

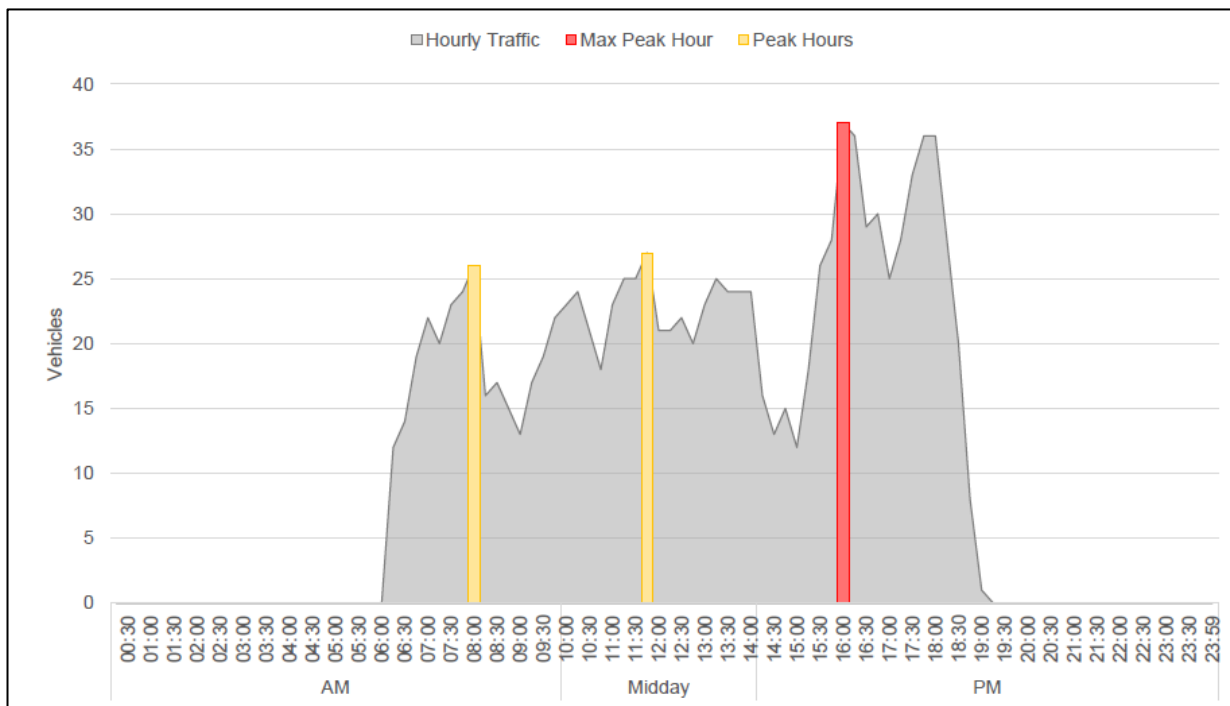


Figure 5-1: 2025 12-hour traffic volumes at existing mine intersection

The traffic counts indicated that traffic analyses should be conducted using the PM peak hour traffic volumes as this hour has the highest traffic volumes for the day.

The traffic volumes at each intersection during the PM peak hour is shown in **Table 5-2**.

The detailed traffic count reports for each intersection are included in **Annexure B**.

Table 5-2: 2025 PM Peak Hour Traffic Volumes

Intersection 1: B1 and C13	Intersection 2: B1 and Noordoewer
Intersection 3: B1 and D316	Intersection 4: B1 and D213

5.2 Background traffic conditions

Background traffic conditions are defined as the existing traffic conditions at a certain future point in time, without the effects of the development taken into consideration. The background traffic conditions were determined for the years 2031 and 2054 (opening year and last year of mining operations) assuming a 23-year operational period.

The TMH 17: South African Trip Data Manual proposes a 0% to 3% annual traffic growth for low development areas and 3% to 4% annual traffic growth for average growth areas as shown in Table 5-3. The proposed mine site area may be considered as a low development area, but a conservative 3% traffic growth rate was used for the background traffic.

Table 5-3: Typical Traffic Growth Rates

Development Area	Growth rate
Low growth areas	0 – 3%
Average growth areas	3 – 4%
Above average growth areas	4 – 6%
Fast growing areas	6 – 8%
Exceptionally high growth areas	> 8%

The South African Trip Data Manual V1.01 September 2013 (TMH17)

The existing traffic peak hour traffic volumes therefore grown with 3% annually for six years (compounded) to calculate the 2031 background traffic conditions. Similarly, the 2031 background traffic was grown by 3% annually for an additional 23 years to obtain the 2054 background traffic conditions.

5.3 Generated traffic

5.3.1 Daily Generated Traffic Volumes

The expected trips generated by the mine was provided by the client. The generated trips are divided into two periods, during construction and during operations. The construction period is expected to take 3 years with the operation period expected to last for 23 years.

The total number of daily trips generated by the mine facility with the expected origin/destination direction of each trip is shown in **Table 5-4**. The expected trip generation data provided by the client is included in **Annexure C**.

Table 5-4: Generated daily traffic

Year	Intersection	Origin/Destination	
		B1 South (veh/day)	B1 North (veh/day)
Construction (3 years)			
1	B1 and Mine Road Intersection	20	7
2	B1 and Mine Road Intersection	18	6
3	B1 and Mine Road Intersection	18	7
Operation (23 years)			
23 years	B1 and Mine Road Intersection	211	85

The operational traffic volumes are significantly higher than those during the construction phase (27 daily trips compared to 296 daily trips). Consequently, the construction period was excluded from the traffic analysis.

5.3.2 Generated Peak Hour Traffic Volumes

Trip generation rates and parameters shown in Figure 5-2 (TRH 17 Trip Data Manual) were used to compare the prescribed trip generation rates during the peak hour with the actual trips provided by the client. It was found that approximately 15% of the daily plant trips (45 trips) will occur during the peak hour according to the TRH 17 guidelines.

Table 3.1: Daily Trip Generation Rates and Parameters

Land Use	Size Units	Daily Trip rate	Peaking Factor	Hourly Trip rate	Percent Heavy	E80 Axles Per HV	Size Adjustment	
		AADT _D	F _{QD}	F _{QD} ·AADT _D	P _{HD}	E _{HD}	1+A/(1+sqm Size/B)	Factor A Factor B
100 Industrial								
110 Service Industry	100 sqm GLA	6.00	0.150	0.90	10%	1.34		
120 Heavy industry/manufacturing	100 sqm GLA	1.25	0.150	0.19	10%	2.35		
121 Mining	1 Employees	0.65	0.150	0.10	10%	2.35		
130 Industrial Area (Park)	100 sqm GLA	6.00	0.150	0.90	10%	2.35		
140 Manufacturing	100 sqm GLA	2.00	0.250	0.50	10%	2.35		
150 Warehousing and Distribution	100 sqm GLA	3.00	0.140	0.42	10%	2.35		
151 Mini-Warehousing	100 sqm GLA	2.50	0.100	0.25				

Figure 5-2: Trip Generation Rates and Parameters

The generated traffic was determined for each hour of the day using data provided by the client, the AM peak hour generated by the facility is expected to be 99 vehicles and the PM 110 vehicles.

The proposed mine will employ approximately 1 350 staff during the operational phase, with personnel accommodated in Noordoewer and the surrounding areas. Staff transport to and from the site will primarily be undertaken by buses, with a small proportion of staff assumed to use private vehicles. These trips will occur during both the AM and PM peak periods. Given the number of staff, it is anticipated that 21 bus trips will be required during each of the AM and PM peak periods. Due to distance between the site and Noordoewer, bus trips are expected to take approximately two hours to complete during peak periods.

The traffic between the AM and PM peaks are expected to be operational truck traffic transporting material to and from the mine which is expected to be 11 vehicles per hour.

The typical hourly generated by the facility is shown in the **Figure 5-3** below.

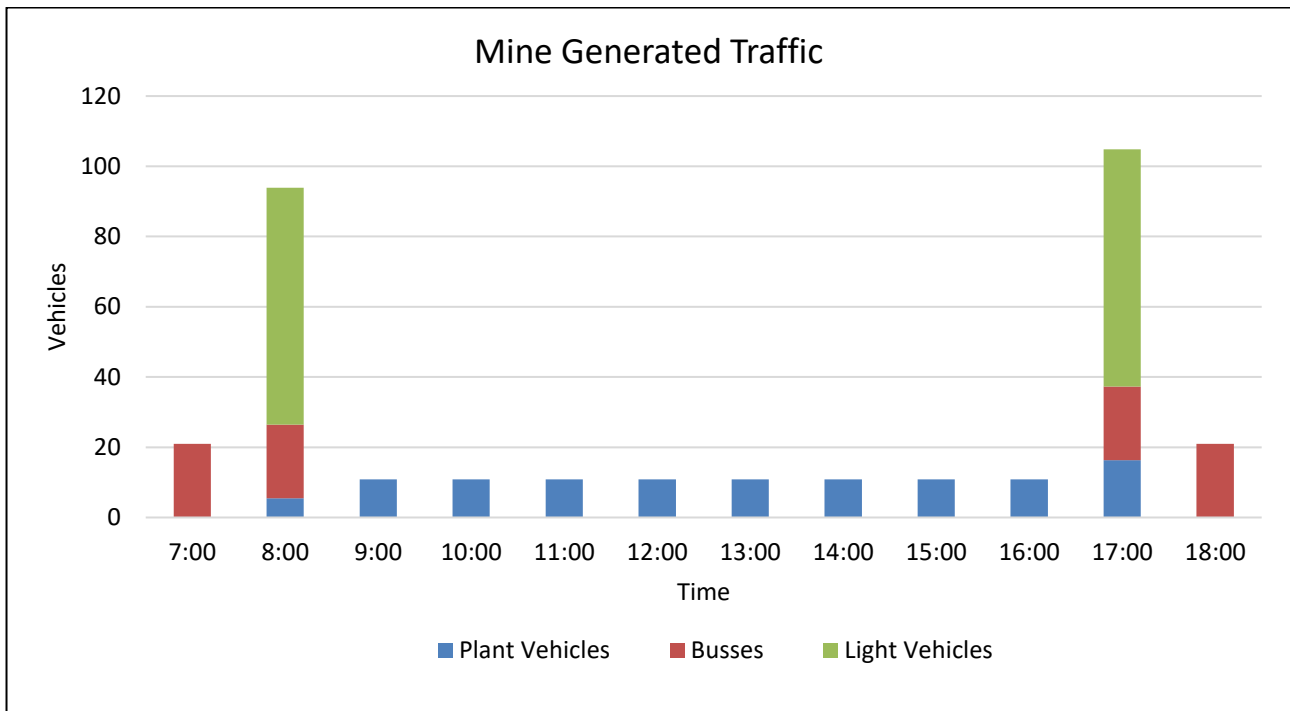


Figure 5-3: Generated traffic for the proposed mine facility

The peak hour generated traffic volumes provided by the client is more than double that prescribed in the TRH 17, for this reason the trip generations provided by the client was used in further analysis.

5.3.3 Generated Peak Hour Traffic Volumes

The trips generated during the PM peak hour were assessed to understand the traffic composition and directional distribution associated with the proposed mine. Of these trips, 21 are buses transporting staff to housing in Noordoewer. It was assumed that 5% of staff would use private vehicles, resulting in 68 light vehicles travelling south towards Noordoewer and the Vioolsdrift border post. The remaining 22 vehicles comprise heavy vehicles transporting materials to and from the site.

The generated traffic volumes of each movement at the proposed mine intersection with the B1 for the PM peak period is shown in **Figure 5-4**.

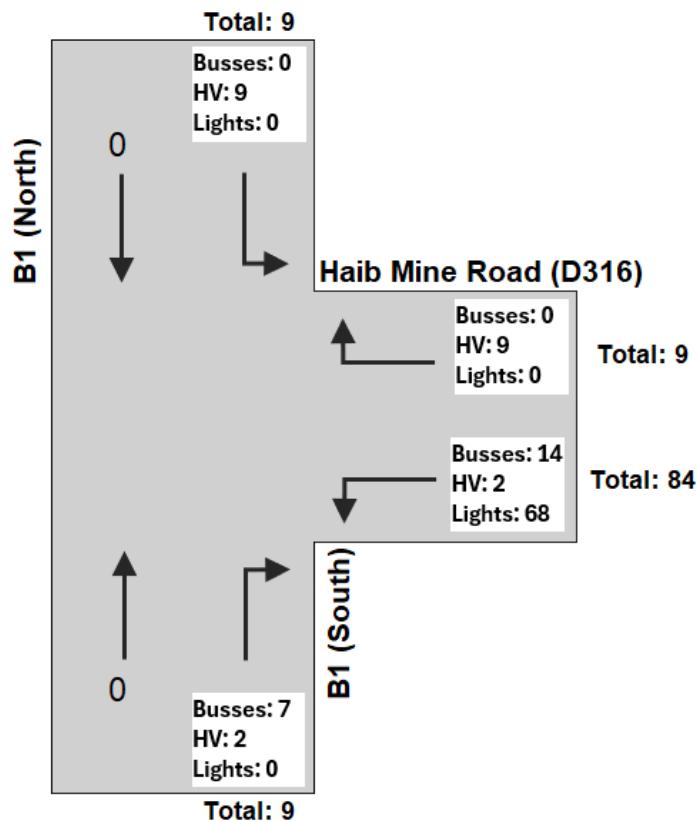


Figure 5-4: Generated mine traffic for the PM peak hour

6. Traffic analysis

6.1 Analysis Method

The afore-mentioned intersections were analysed in SIDRA, an intersection capacity analysis software programme, for the future 2031 and total 2054 scenarios during the Weekday PM peak hour to determine the impact of mine on the surrounding road network.

The analysis method used in the capacity analysis software measures the average delay per vehicle (measured in seconds per vehicle) to determine the Level-of-Service (LOS) for each lane within an intersection. The criteria for determining the LOS for stop-controlled intersections and signalised intersections are shown in Table 6 below.

Table 6-1: Intersection LOS Criteria

LOS	Stopped-controlled, average delay (s/veh)	Signalised-controlled, average delay (s/veh)
A	0 – 10	≤ 10
B	> 10 – 15	> 10 – 20
C	> 15 – 25	> 20 – 35
D	> 25 – 35	> 35 – 55
E	> 35 – 50	> 55 – 80
F	> 50	> 80

The LOS, for any lane, during the peak hour should not be worse than LOS D during normal days or LOS E on abnormal days. If LOS E or LOS F is experienced, mitigation measures should be considered to improve the LOS of an intersection. Right-turn movements at traffic signal-controlled intersections may, however, operate at a LOS E provided that sufficient provision is made to accommodate the 90th percentile queue lengths.

For analysis purposes, heavy vehicles are converted to equivalent vehicle units (evu), by multiplying the number of heavy vehicles by a factor of 1.65. All demand volumes are then reported in evu/h.

To assess the impact of a new development on traffic flow, a comprehensive analysis of all affected intersections is imperative, particularly during peak hour volumes. This analysis should evaluate whether the current infrastructure can accommodate the anticipated traffic efficiently.

The SIDRA movement summaries are included in **Annexure D**.

6.2 Scenario 1: 2025 Existing Traffic

Scenario 1 assessed the existing 2025 traffic conditions at each of the 4 intersections to determine the current traffic condition during the weekday PM peak hour.

The results of scenario 1 traffic analysis are shown in **Table 6-2** overleaf.

Table 6-2: Scenario 1 SIDRA analysis results

Intersection	Control Measure	Each Approach					Intersection		
		Approach	Demand (veh/h)	Degree of Saturation (v/c)	Delay (s/veh)	LOS	Degree of Saturation (v/c)	Delay (s/veh)	LOS
1 - B1 and C13	Stop controlled	North	29	0.021	2.8	A	0.032	4.9	A
		South	49	0.032	3.4	A			
		West	26	0.029	9.9	A			
2 - B1 and Noordoewer Main Road	Stop controlled	North	16	0.010	3.5	A	0.014	5.5	A
		South	17	0.010	4.6	A			
		West	16	0.014	8.4	A			
3 - B1 and D316	Stop controlled	North	14	0.008	0.4	A	0.017	2.6	A
		South	25	0.002	0.2	A			
		East	2	0.017	7.9	A			
4 - B1 and D213	Stop controlled	North	15	0.010	0.9	A	0.017	2.0	A
		South	25	0.017	0.5	A			
		East	3	0.004	10.4	B			
		West	3	0.004	10.5	B			

Intersections 1 - 4 all operate at an acceptable LOS, ranging between LOS A to LOS B and no upgrades are required or proposed to address this scenario.

6.3 Scenario 2: 2031 Total Traffic

The Scenario 2 Total Traffic (2031 with development traffic) was determined by growing the existing traffic by 6 years to 2031 and superimposing the estimated development-generated traffic onto the background 2031 traffic. This scenario represents the anticipated future traffic conditions at the time when the proposed mine is expected to be fully operational (after construction is complete).

The results of scenario 2 traffic analysis are shown in **Table 6-3** below.

Table 6-3: Scenario 2 SIDRA analysis results

Intersection	Control Measure	Each Approach					Intersection		
		Approach	Demand (veh/h)	Degree of Saturation (v/c)	Delay (s/veh)	LOS	Degree of Saturation (v/c)	Delay (s/veh)	LOS
1 - B1 and C13	Stop controlled	North	73	0.050	1.4	A	0.050	3.8	A
		South	61	0.039	3.3	A			
		West	32	0.037	10.3	B			
2 - B1 and Noordoewer Main Road	Stop controlled	North	107	0.067	3.4	A	0.067	4.5	A
		South	23	0.013	4.1	A			
		West	26	0.024	9.0	A			
3 - B1 and D316	Stop controlled	North	24	0.018	3.4	A	0.087	6.6	A
		South	39	0.028	2.7	A			
		East	99	0.087	9.6	A			
4 - B1 and D213	Stop controlled	North	26	0.018	0.5	A	0.027	1.3	A
		South	39	0.027	0.3	A			
		East	3	0.004	10.6	B			
		West	3	0.004	10.7	B			

The results of the SIDRA intersection analysis indicated that during the 2031 Total PM peak hour traffic conditions, intersections 1-4 will have negligible change and all operate at acceptable LOS conditions.

6.4 Scenario 3: 2054 Total Traffic

The Scenario 3 Total Traffic (2054 with development traffic) was determined by growing the existing traffic by 29 years to 2054 and superimposing the estimated development-generated traffic onto the background 2054 traffic. This scenario represents the anticipated future traffic conditions towards the end of the mine's design life.

The results of scenario 3 traffic analysis are shown in **Table 6-4** below.

Table 6-4: Scenario 3 SIDRA analysis results

Intersection	Control Measure	Each Approach					Intersection		
		Approach	Demand (veh/h)	Degree of Saturation (v/c)	Delay (s/veh)	LOS	Degree of Saturation (v/c)	Delay (s/veh)	LOS
1 - B1 and C13	Stop controlled	North	107	0.077	2.1	A	0.080	4.5	A
		South	119	0.076	3.4	A			
		West	62	0.080	10.9	B			
2 - B1 and Noordoewer Main Road	Stop controlled	North	125	0.079	3.5	A	0.079	4.8	A
		South	42	0.021	4.4	A			
		West	44	0.038	9.0	A			
3 - B1 and D316	Stop controlled	North	39	0.027	2.6	A	0.091	5.6	A
		South	68	0.046	2.0	A			
		East	100	0.091	9.7	A			
4 - B1 and D213	Stop controlled	North	42	0.029	0.5	A	0.046	1.5	A
		South	67	0.046	0.3	A			
		East	3	0.004	11.0	B			
		West	3	0.004	11.0	B			

The results of the SIDRA intersection analysis indicated that during the 2054 Total PM peak hour traffic conditions, intersections 1-4 will have negligible change and all operate at acceptable LOS conditions.

6.5 Traffic Analysis Summary

The traffic analysis evaluated the LOS at key intersections along the B1 for the weekday PM peak hour under existing (2025) conditions and future scenarios for 2031 and 2054, representing the opening year of full mine operations and the final year of the mine's operational life, respectively.

Across all scenarios, the analysed intersections operate with low delays and acceptable degrees of saturation, generally achieving LOS A to LOS B. While future scenarios show marginal increases in demand due to background growth and mine-generated traffic, intersection performance remains well within acceptable limits.

The analysis confirms that the B1 corridor and associated access intersections have sufficient long-term capacity to accommodate the proposed development, subject to the formalisation and geometric upgrading of the mine access to safely accommodate heavy-vehicle movements.

7. Non-Motorised Transport (NMT)

7.1 NMT Facilities

Non-motorised transport activity in the vicinity of the proposed Haib Copper Mine is expected to be minimal due to the remote rural location of the site, long travel distances, and the absence of nearby residential areas within walking or cycling distance of the mine access.

The B1 is a high-speed national route with a posted speed limit of 120 km/h and functions primarily as a national mobility corridor. It is therefore not conducive to pedestrian or cyclist movement, and no formal NMT infrastructure currently exists along the B1 or at the proposed mine access locations.

During the operational phase, mine personnel will predominantly be transported to and from the site by dedicated staff buses, with a small proportion of trips undertaken by private vehicles. As a result, the proposed development is not expected to generate any meaningful increase in NMT demand on the surrounding road network.

Given the low anticipated NMT activity and the rural, high-speed road environment, the provision of dedicated pedestrian or cyclist facilities at the mine access intersections is not considered warranted. Appropriate signage and road-marking must, however, be provided as part of the access design to ensure general road safety and to minimise potential conflicts with any incidental non-motorised road users.

8. Traffic Impact Significance Ratings

The impacts associated with traffic-related activities were assessed in accordance with the Environmental Impact Assessment (EIA) significance tables. The objective of these ratings is to evaluate the overall impact of each traffic-related activity on the surrounding environment, both prior to and following the implementation of mitigation measures.

The ranking criteria was scored according to the following criteria.

- Severity / Magnitude (M)
- Reversibility (R)
- Duration (D)
- Spatial Extent (S)
- Probability (P)

The ranking criteria scoring is as per Table 8-1.

Table 8-1: Ranking criteria scoring

Ranking criteria				
Severity / magnitude (M)	Reversibility (R)	Duration (D)	Spatial extent (S)	Probability (P)
5 – Very high – The impact causes the characteristics of the receiving environment/ social receptor to be altered by a factor of 80 – 100 %	5 – Irreversible – <u>Environmental</u> - where natural functions or ecological processes are altered to the extent that it will permanently cease. <u>Social</u> - Those affected will not be able to adapt to changes and continue to maintain pre-impact livelihoods.	5 – Permanent - Impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.	5 – International - Impacts that affect internationally important resources such as areas protected by international conventions, international waters etc.	5 – Definite - The impact will occur.
4 – High – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 60 – 80 %		4 – Long term - impacts that will continue for the life of the Project, but ceases when the Project stops operating.	4 – National - Impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.	4 – High probability – 80% likelihood that the impact will occur
3 – Moderate – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 40 – 60 %	3 – Recoverable <u>Environmental</u> - where the affected environment is altered but natural functions and ecological processes may continue or recover with human input. <u>Social</u> - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support or intervention.	3 – Medium term - Impacts are predicted to be of medium duration (5 – 15 years)	3 – Regional - Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem.	3 – Medium probability – 60% likelihood that the impact will occur u
2 – Low – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 20 – 40 %		2 – Short term - Impacts are predicted to be of short duration (0 – 5 years)	2 – Local - Impacts that affect an area in a radius of 2 km around the site.	2 – Low probability - 40% likelihood that the impact will occur
1 – Minor – The impact causes very little change to the characteristics of the receiving environment/ social receptor and the alteration is less than 20 %	1 – Reversible <u>Environmental</u> - The impact affects the environment in such a way that natural functions and ecological processes are able to regenerate naturally. <u>Social</u> - People/ communities are able to adapt with relative ease and maintain pre-impact livelihoods.	1 – Temporary - Impacts are predicted to be intermittent/ occasional over a short period.	1 – Site only - Impacts that are limited to the site boundaries.	1 – Improbable - 20% likelihood that the impact will occur

The significance score was calculated by summing the magnitude, reversibility, duration and special extent scores and multiplying it by the probability score as per the formula below.

$$(M + R + D + S) * P = \text{Significance score}$$

The significance score was ranked as Low, Moderate and High significance based on the significance points ranges shown in Table 8-2.

Table 8-2: Significance tables scoring

Significance		
Score According to Impact Assessment Matrix	Colour Scale Ratings	
	Negative Ratings	Positive Ratings
Between 0 and 29 significance points indicate Low Significance	Low	Low
Between 30 and 59 significance points indicate Moderate Significance	Moderate	Moderate
60 to 100 significance points indicate High Significance	High	High

8.1 Pre-Construction Phase Scoring

No traffic mitigation measures are proposed during the construction phase of the mine due to the low traffic volumes anticipated during this phase. The five identified activities are expected to result in impacts of low significance.

The significance ratings for each project activity during this phase is shown in Table 8-3.

Table 8-3: Pre-construction phase traffic impact scoring table

Project activity or issue	Potential impact	Nature of impact		Significance before mitigation							SP	Significance after mitigation as per EMP							SP
		+ / -	D//C	M	R	D	S	P	TOTAL	M		R	D	S	P	TOTAL			
TRAFFIC																			
Pre-construction workforce transport (bus-based)	Concentrated peak-hour bus movements at the mine access intersection with B1 road deterioration	-	D	2	1	2	3	3	24	L	2	1	2	3	3	24	L		
Pre - construction workforce private vehicles	Minor increase in light vehicle volumes during AM and PM peak periods	-	D	2	1	2	3	3	24	L	2	1	2	3	3	24	L		
Pre - construction freight and supply transport (heavy-vehicles)	Increased HV traffic on B1 with degradation of national roads leading to required increased maintenance and burden on state	-	D	2	1	2	3	3	24	L	2	1	2	3	3	24	L		
Pre - construction abnormal or over dimensional loads	Temporary disruption to traffic flow and increased safety risk during abnormal load movements	-	D	3	1	2	3	2	18	L	3	1	2	3	2	18	L		
Pre - construction traffic Interaction with non-motorised road users	Potential safety risk on high-speed B1	-	D	2	1	1	3	1	7	L	2	1	1	3	1	7	L		

All identified activities, including workforce transport, freight movement, abnormal load transport, and interaction with public road users, are expected to have minimal impact on the surrounding road network and are considered acceptable for this phase of the project.

8.2 Construction Phase Scoring

No traffic mitigation measures are proposed during the construction phase of the mine due to the low traffic volumes anticipated during this phase.

The significance ratings for each project activity during this phase is shown in Table 8-4.

Table 8-4: Construction phase traffic impact scoring table

Project activity or issue	Potential impact	Nature of impact		Significance before mitigation							Significance after mitigation as per EMP							
		+ / -	D/I/ C	M	R	D	S	P	TOT AL	SP	M	R	D	S	P	TOT AL	SP	
TRAFFIC																		
Construction phase workforce transport (bus-based)	Concentrated peak-hour bus movements at the mine access intersection with B1 road deterioration	-	D	3	1	2	3	3	27	L	3	1	2	3	3	27	L	
Construction phase workforce private vehicles	Minor increase in light vehicle volumes during AM and PM peak periods	-	D	2	1	2	3	3	24	L	2	1	2	3	3	24	L	
Construction phase freight and supply transport (heavy-vehicles)	Increased HV traffic on B1 with degradation of national roads leading to required increased maintenance and burden on state	-	D	3	1	2	3	2	18	L	3	1	2	3	2	18	L	
Construction phase abnormal or over dimensional loads	Temporary disruption to traffic flow and increased safety risk during abnormal load movements	-	D	4	1	2	3	3	30	M	4	1	2	3	3	30	M	
Construction phase traffic interaction with non-motorised road users	Potential safety risk on high-speed B1	-	D	3	1	2	3	1	9	L	3	1	2	3	1	9	L	

Four of the five identified activities are expected to result in impacts of low significance. However, the transportation of abnormal loads is anticipated to cause temporary disruptions to traffic flow, resulting in a negative impact of low to moderate significance. Due to its temporary nature, this impact is considered acceptable during this phase.

8.3 Operation Phase Scoring

It is recommended that the mine access intersection be upgraded to the Namibia Roads Authority (NRA) Standard Drawings – Typical Accesses to Roads, Type A Access prior to the commencement of the mine's operational phase. The upgrade will reduce the impact of light, heavy, and abnormal operational vehicles on the surrounding road network during the operational and subsequent phases of the mine.

The significance ratings for each project activity during this phase is shown in Table 8-5.

Table 8-5: Operation phase traffic impact scoring table

Project activity or issue	Potential impact	Nature of impact		Significance before mitigation							SP	Significance after mitigation as per EMP							SP
		+ / -	D//C	M	R	D	S	P	TOTAL	M		R	D	S	P	TOTAL			
TRAFFIC																			
Operational workforce transport (bus-based)	Concentrated peak-hour bus movements at the mine access intersection with B1 road deterioration	-	D	3	1	4	3	4	44	M	2	1	4	3	3	30	M		
Operational workforce private vehicles	Minor increase in light vehicle volumes during AM and PM peak periods	-	D	2	1	4	3	3	30	M	2	1	4	3	2	20	L		
Operational freight and supply transport (heavy-vehicles)	Increased HV traffic on B1 with degradation of national roads leading to required increased maintenance and burden on state	-	D	3	1	4	3	3	33	M	2	1	4	3	3	30	M		
Abnormal or over dimensional loads	Temporary disruption to traffic flow and increased safety risk during abnormal load movements	-	D	4	1	1	3	3	27	L	3	1	1	3	3	24	L		
Interaction with non-motorised road users	Potential safety risk on high-speed B1, although NMT demand is minimal	-	D	4	1	4	3	2	24	L	3	1	4	3	2	22	L		

The intersection upgrade is expected to reduce the significance rating of all project-related activities during this phase. High-frequency peak-hour transport activities, including bus-based workforce transport and private vehicle movements, are anticipated to benefit most from the upgrade. Following implementation of the upgraded intersection, bus and freight transport activities are expected to have a low to moderate significance rating, while the remaining three mine related transport activities are expected to have a low significance rating during this phase. The surrounding road network is anticipated to accommodate the projected mine traffic during the operational phase, provided that the intersection upgrade is implemented.

8.4 Decommissioning Phase Scoring

The upgraded mine access intersection implemented during the operational phase will mitigate the impacts associated with mine related traffic activities during the decommissioning phase. It is expected that all five project activities during this phase will result in impacts of low significance.

The significance ratings for each project activity during this phase is shown in Table 8-6.

Table 8-6: Decommissioning phase traffic impact scoring table

Project activity or issue	Potential impact	Nature of impact		Significance before mitigation							SP	Significance after mitigation as per EMP							SP
		+ / -	D/I C	M	R	D	S	P	TOT AL	M		R	D	S	P	TOT AL			
TRAFFIC																			
Decomm phase workforce transport (bus-based)	Concentrated peak-hour bus movements at the mine access intersection with B1 road deterioration	-	D	2	1	2	3	3	24	L	2	1	2	3	2	16	L		
Decomm phase workforce private vehicles	Increase in light vehicle volumes during AM and PM peak periods	-	D	2	1	2	3	3	24	L	2	1	2	3	2	16	L		
Decomm phase freight and supply transport (heavy-vehicles)	Increased HV traffic on B1 with degradation of national roads leading to required increased maintenance and burden on state	-	D	2	1	2	3	3	24	L	3	1	2	3	1	9	L		
Decomm phase abnormal or over dimensional loads	Temporary disruption to traffic flow and increased safety risk during abnormal load movements	-	D	3	1	2	3	2	18	L	3	1	2	3	2	18	L		
Decomm phase traffic interaction with non-motorised road users	Potential safety risk on high-speed B1	-	D	2	1	1	3	1	7	L	3	1	1	3	1	8	L		

The upgraded mine access intersection, implemented during the operational phase, is expected to effectively mitigate potential traffic impacts associated with the decommissioning activities. Although abnormal load movements may result in temporary disruptions to traffic flow, these impacts remain acceptable due to their short-term nature and are deemed acceptable. Overall, the road network is expected to accommodate decommissioning phase traffic without significant adverse effects.

8.5 Conclusion

The traffic-related activities across all project phases; pre-construction, construction, operation, and decommissioning are of low to moderate significance when evaluated against the EIA criteria. Temporary disruptions, particularly from abnormal load movements during construction and decommissioning phases, are expected but remain acceptable due to their short-term nature. The most critical mitigation measure is the upgrade of the mine access intersection to NRA Type A Access standards prior to operations, which will reduce impacts from workforce transport, freight, and abnormal loads during both the operational and decommissioning phases. Overall, with the recommended intersection upgrade, the surrounding road network is expected to accommodate mine-related traffic with an acceptable significance rating for all mine phases.

9. Conclusions and recommendations

9.1 Summary of conclusions and impacts

The conclusions and impacts of the proposed mine are summarised below:

The study area comprises four key intersections along the B1 that will be directly influenced by traffic generated by the Haib Copper Mine during its operational phase.

- Sight distances at the two proposed access locations exceed the minimum 360 m requirement for a 120 km/h operating speed, indicating compliance with the Namibia Roads Authority standards.
- The B1/D316 intersection geometry is insufficient for safe heavy-vehicle turning movements, with encroachment into intersection corners observed.
- Existing (2025) traffic volumes on all study intersections are very low, with the highest 12-hour count recorded at the B1/C13 intersection (537 vehicles).
- Heavy vehicles constitute a significant proportion of traffic at the existing mine access (D316), with a 43% heavy-vehicle share recorded during the 12-hour count.
- SIDRA analysis of the 2025 existing traffic shows all intersections operating at LOS A with very low delays and minimal saturation levels.
- Background traffic growth was conservatively modelled at 3% per annum, resulting in moderate increases for the 2031 and 2054 scenarios.
- Mine-generated traffic during operations (296 daily trips) is substantially higher than during construction and therefore forms the basis of the impact assessment.
- Peak-hour trip generation provided by the client exceeds TMH17 guideline estimates, particularly due to staff transport requirements and heavy-vehicle movements.
- Overall, the surrounding road network has adequate capacity to accommodate the mine's traffic, provided that appropriate geometric upgrades are implemented at the mine access.
- Non-motorised transport activity in the vicinity of the proposed Haib Copper Mine is expected to be minimal due to the remote rural location of the site, long travel distances, and the absence of nearby residential areas within walking or cycling distance of the mine access.
- Given the low anticipated NMT activity and the rural, high-speed road environment, the provision of dedicated pedestrian or cyclist facilities at the mine access intersections is not considered warranted.
- The upgraded mine access intersection is expected to reduce the significance of impacts associated with traffic-related mining activities during both the operational and decommissioning phases of the project.

9.2 Recommended mitigation measures

- Formalise the mine access intersection (Option 1 or Option 2) in accordance with the Namibia Roads Authority *Standard Drawings – Typical Accesses to Roads*, specifically the requirements for a Type A Access – see **Annexure A**.

ANNEXURE A:

Namibia Roads Authority Standard Drawings - Typical Accesses to Roads

ANNEXURE B:

Classified Traffic Counts

ANNEXURE C:

Heavy Vehicle Traffic Generation Estimates Provided by Client

ANNEXURE D:

SIDRA Traffic Analysis