GREENMINED ENVIRONMENTAL (PTY) LTD

TRAFFIC IMPACT ASSESSMENT FOR THE PROPOSED MINING RIGHT OVER PORTION 2 (A PORTION OF PORTION 1), REMAINDER PORTION, REMAINDER PORTION OF PORTION 1 AND PORTION 3 OF THE FARM MAKGANYENE NO. 667, NEAR POSTMASBURG, NORTHEN CAPE

34273.02C-REP-001-01

TRAFFIC IMPACT ASSESSMENT

JUNE 2025

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EXECUTIVE SUMMARY

PURPOSE OF THE ASSESSMENT

This Traffic Impact Assessment (TIA) was commissioned to evaluate the potential transport-related impacts of the proposed Makganyane Iron Ore Mine, located approximately 25 km north-west of Postmasburg in the Northern Cape Province. The assessment is intended to inform planning approvals, guide mitigation strategies, and ensure that the existing road network – primarily the R385 – can accommodate the development's traffic demand safely and efficiently throughout its lifecycle, which includes construction, operational, and decommissioning phases.

SCOPE OF STUDY

The scope of the TIA includes:

- A description of the proposed mine development and its location relative to Postmasburg,
- An assessment of existing traffic conditions using 2023 data from the permanent counting station (22062: Postmasburg New),
- Traffic generation projections for the construction (2028), operational (2038), and decommissioning (2043) phases,
- A comprehensive traffic operations assessment, including methodology, peak hour analysis, Level of Service (LOS), capacity analysis, and accident review,
- Consideration of cumulative traffic impacts and environmental effects of increased vehicle volumes, particularly heavy mining vehicles,
- Identification of safety risks and access requirements at the proposed site entrance on the R385,
- Recommendations for road upgrades, mitigation measures and monitoring frameworks in line with *TMH 16 Volume 2* and *Highway Capacity Manual (HCM)* guidelines, and
- Alignment with applicable regulatory requirements, and integration of stakeholder consultation and feedback.

KEY FINDINGS AND RECOMMENDATIONS

KEY FINDINGS

- The R385 is paved for the first 12 km north of Postmasburg and gravel thereafter, which poses capacity and safety concerns as traffic increases.

- Current traffic volumes are manageable, but by the operational and decommissioning phases, traffic demand is expected to approach the gravel road's capacity, with volume-to-capacity (v/c) ratios of 0,84 and 0,86 respectively during peak hours, indicating constrained but not exceeded capacity conditions.

- Sight distances at the proposed access point are sufficient in both directions, but geometric improvements will be required to accommodate heavy vehicle movements.

- No historical accident data was available, limiting quantitative safety assessment, although qualitative risks were identified.

- Environmental and community impacts are anticipated, particularly related to dust, noise, and road deterioration.

RECOMMENDATIONS

- Routine maintenance of the R385 should be carried out throughout the lifecycle of the mine to ensure the continued safe and efficient operation of the road, particularly given the anticipated increase in heavy vehicle usage.

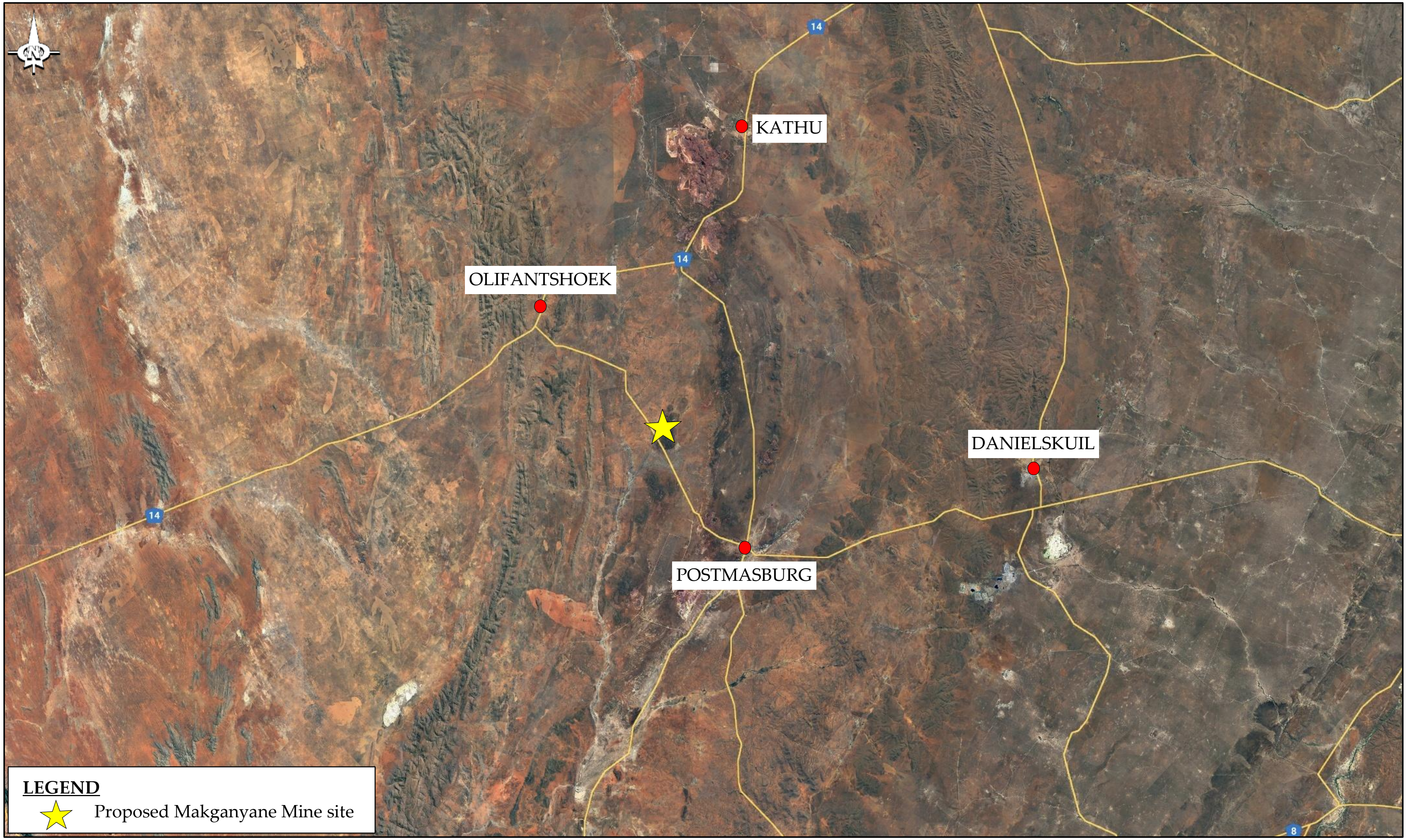
- Implement access road enhancements, including widening the entrance road to at least 7,5 m to allow two 36-ton trucks to pass comfortably, provision of 15 m bellmouth radii to accommodate turning movements, and installation of regulatory and warning signage to guide truck drivers and improve safety at the mine entrance.

- Establish monitoring protocols to evaluate traffic conditions and LOS throughout the mine's lifecycle.

- Engage with stakeholders and regulatory authorities continuously to address safety, community, and compliance concerns.

- Integrate environmental mitigation measures such as dust suppression and periodic surface maintenance.

These findings and recommendations form the basis for ensuring that the transport network can sustainably support the proposed Makganyane Iron Ore Mine development.



Locality Plan

ISSUE AND REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
By author	Candidate Engineer	Liza Botha Candidate: 201651236	Botha	19/06/2025
Reviewed by	Professional Engineer	Adrian Tarrant Pr Eng: 201705088		19/06/2025
Approved by Design Centre Leader	Director	Dirk van der Merwe Pr Eng: 20120186		19/06/2025

This report has been prepared in accordance with BVi Consulting Engineers Quality Management System. BVi Consulting Engineers is ISO 9001: 2015 registered and certified by NQA Africa.

REVISION RECORD

Revision number	Objective	Change	Date
0	Issue to *Client* for comments	None	24/04/2025
1	Issue to *Client* for submission	Minor changes resulting from comments.	19/06/2025

TRAFFIC IMPACT ASSESSMENT COVER PAGE

INFORMATION ITEM	DETAILS/ DESCRIPTION
Municipality Name	*Tsantsabane* Local Municipality and *ZF Mgcawu* District Municipality
Type of Assessment	Traffic Impact Assessment
Erf Numbers /Farm Names	• Remainder of the Farm Makganyene No. 667, • Remainder portion of Portion 1 of the Farm Makganyene No. 667, • Portion 2 (a portion of Portion 1) of the Farm Makganyene No. 667, and • Portion 3 of the Farm Makganyene No. 667.
Date of Report	19 June 2025
Details of Assessor	AJ Tarrant Pr Eng adriant@bviwc.co.za ECSA registration number: 201705088 M Eng (Transportation Studies), University of Cape Town
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AJ Tarrant Pr Eng

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CHAPTER 1 INTRODUCTION

1.1 TERMS OF REFERENCE

BVi Consulting Engineers Western Cape (Pty) Ltd was appointed by *Greenmined Environmental (Pty) Ltd* to conduct a Traffic Impact Assessment (TIA) for the proposed mining right over Portion 2 (a portion of Portion 1), remainder portion, remainder portion of Portion 1 and Portion 1 and Portion 3 of the Farm Makganyene No. 667, near Postmasburg, Northern Cape. This specialist assessment forms part of the Environmental Impact Assessment (EIA) application to the *Department of Mineral Resource and Energy (DMRE)*.

1.2 PURPOSE AND OBJECTIVES

The primary aim of this TIA is to evaluate how the proposed mining project's traffic will affect the surrounding road network. It identifies potential issues such as congestion, safety risks, and road capacity, and recommends measures to mitigate these impacts. The TIA ensures that the local transportation infrastructure can handle the increased traffic while minimizing disruptions to communities and the environment.

1.2.1 Purpose

The main purpose of the Traffic Impact Assessment (TIA), for the proposed mining right project, is to:

- Assess traffic impacts: To understand how the increased traffic volumes (e.g. from mining trucks, machinery, and employees) will affect the surrounding road network, including local roads, haulage routes, and intersections.

- Ensure safe and efficient road use: To identify and mitigate potential traffic safety hazards that could arise from mining operations sharing public roads with other vehicles (e.g. passenger vehicles, buses, cyclists).

- Comply with regulatory requirements: The TIA is a mandatory part of the environmental and planning approval process. It was conducted to ensure compliance with local, provincial, and national regulations concerning transportation and road safety.

- Provide mitigation measures: To recommend and design solutions for addressing any identified issues, such as road improvements, traffic signalization, or new traffic control measures, ensuring smooth and safe traffic flow during and after the mining operation's construction and operational phases.

- Support decision-making: To provide key stakeholders (government authorities, communities, and investors) with the necessary information to make informed decisions about the approval and conditions of the mining right.

1.2.2 Objectives

The objectives of the TIA are to ensure that the transportation-related aspects of the proposed mining project are carefully considered and managed. Key objectives include:

1. **Traffic volume prediction and analysis**:
    - Predict the additional traffic volumes that will be generated by the mining operation, including trucks carrying mining materials, workers' vehicles, and equipment transport.
    - Assess peak traffic hours, the frequency of truck movements, and potential congestion on roads used for mining purposes.

2. **Impact on road infrastructure**:
    - Analyse the ability of existing road infrastructure to accommodate the increased traffic without leading to congestion, deterioration, or safety concerns.
    - Evaluate the condition of the current road network, identifying any potential needs for upgrades, repairs, or new infrastructure.

3. **Safety assessment**:
    - Identify potential safety hazards and risks resulting from the increase in heavy vehicle traffic. This includes evaluating intersections, road alignment, pedestrian crossings, and vulnerable road users (e.g., cyclists or pedestrians).
    - Recommend measures to minimize accidents, such as signage improvements, speed limit adjustments, or road realignment.

4. **Accessibility and connectivity**:
    - Evaluate how the mining operation will impact the accessibility of surrounding communities, businesses, or agricultural areas that rely on the same road network.
    - Consider how mining vehicles can be managed to avoid blocking or impeding local traffic, particularly in densely populated or high-traffic areas.

5. **Environmental and community impact**:
   - Assess the environmental and social implications of the increased traffic, including noise pollution, air quality, dust, and vibration from heavy trucks.
   - Evaluate the potential disruption to local communities, including the safety and comfort of residents living near transport routes.

6. **Propose mitigation and management measures**:
   - Develop strategies to mitigate any identified negative impacts on traffic and road safety.
   - Propose timing and scheduling of truck movements to minimize peak hour traffic disruptions and avoid community inconvenience.

7. **Compliance with legislation and regulations**:
   - Ensure that the proposed mining activities comply with local, regional, and national transport and planning regulations.
   - Meet the requirements set by relevant authorities, such as local municipalities, road traffic management authorities, and environmental agencies.

1.3 METHODOLOGY

The subsequent methodology was adopted for carrying out the TIA for the proposed mining right project:

- **Data collection**: Gather existing traffic data for the area, including traffic volumes, road conditions, accident history, to establish a baseline understanding of the current traffic environment.

- **Project description**: Define the mining project’s scope, including the type and scale of operations, expected number of vehicles, and the transportation routes to be used.

- **Traffic forecasting**: Estimate the additional traffic demand generated by the project, considering factors such as workforce size, delivery schedules, and operational hours.

- **Traffic operations assessment**: Conduct a detailed evaluation of how projected mining-related traffic will interact with the existing road network, using established methodologies and analytical tools.

- **Impact evaluation**: Assess how the increased traffic will affect road capacity, level of service, and overall safety, and identify any required improvements or mitigation measures.

- **Mitigation measures**: Propose solutions to address identified issues, such as road upgrades, improved signage, or changes to traffic management strategies.

- **Reporting**: Compile the findings into a comprehensive report that outlines the assessment process, results, and recommendations for addressing potential impacts on the local traffic network.

The above-mentioned methodology ensures that the potential traffic-related impacts of the mining project are thoroughly evaluated and appropriately managed.

1.4 REFERENCE DOCUMENTATION

The following documents/ sources were used in compiling this report and reference will be made where necessary:

- *Assmang (Pty) Ltd: Mining Work Programme – Submitted for a Mining Right Application for Makganyane Iron Ore Mine – Mining Right*, compiled by *Assmang (Pty) Ltd*, n.d.
- *Proposed Mining Right Over Portion 2 (A Portion of Portion 1), Remainder Portion, Remainder Portion of Portion 1 and Portion 3 of the Farm Makganyene No. 667, Tsantsabane Local Municipality, Northern Cape – Final Scoping Report*, compiled by *Greenmined Environmental (Pty) Ltd*, January 2025.
- *TMH 16, Volume 1 – South African Traffic Impact and Site Traffic Assessment Manual*, published by *Committee of Transport Officials (COTO)*, August 2012.
- *TMH 16, Volume 2 – South African Traffic Impact and Site Impact Assessment Standards and Requirements Manual*, published by *Committee of Transport Officials (COTO)*, February 2014.
- *TMH 17, Volume 1 - South African Trip Data Manual*, published by *Committee of Transport Officials (COTO)*, September 2012.
- *TRH 26 – South African Road Classification and Access Management Manual*, published by *Committee of Transport Officials (COTO)*, August 2012.

CHAPTER 2 PROJECT DESCRIPTION

2.1 PROJECT LOCATION

The proposed Makganyane Iron Ore Mine will be located in the Northern Cape province of South Africa, within the well-known Postmasburg ore belt. This belt is one of the richest iron ore regions in South Africa, known for its significant deposits of high-grade iron ore. Specifically, the Makganyane Mine is situated approximately 28 km north of the Kolomela Mine, a major iron ore producer, and around 25 km north of Postmasburg, a town that serves as a logistical hub for the iron ore mining industry in the region. The geographical location of the proposed Makganyane Mine, in relation to the town of Postmasburg, is depicted in *Figure 2.1* below.

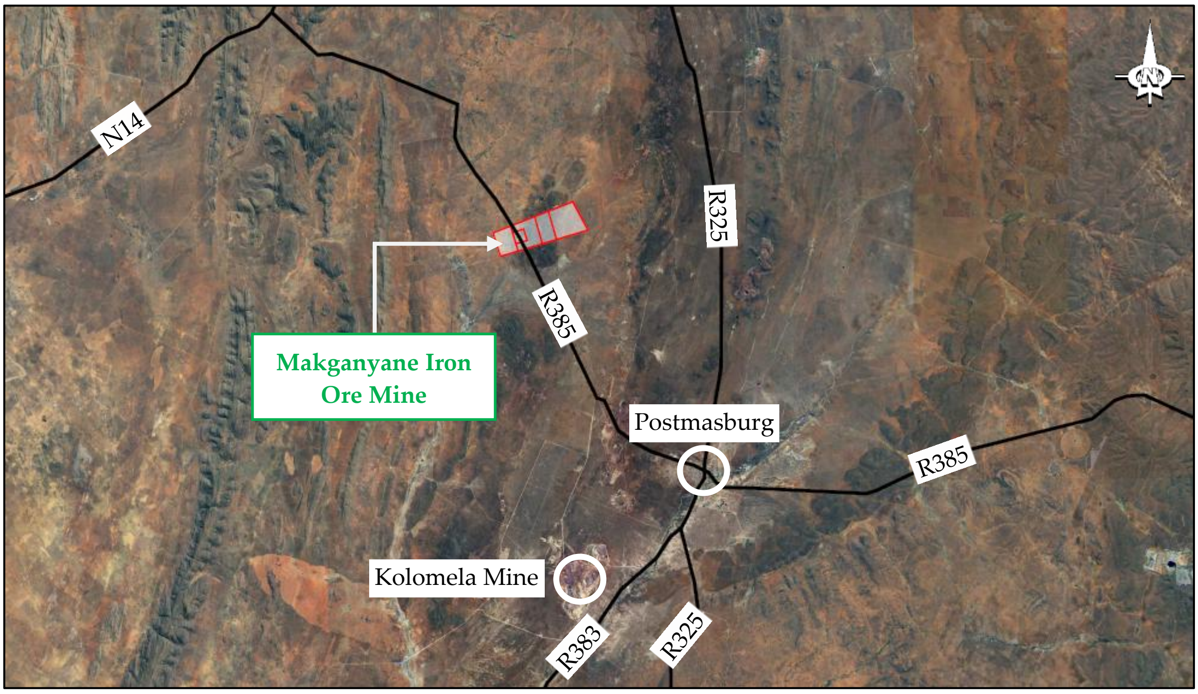


Figure 2.1: Location of the Makganyane Iron Ore Mine, near Postmasburg

The area is characterized by a semi-arid climate, and it's located within a relatively remote part of the Northern Cape, with well-established mining infrastructure in the surrounding area. The proximity to other iron ore operations, such as Kolomela, enhances the potential for collaborations in terms of infrastructure, including transport networks for the movement of ore, water, and energy. The location of the Makganyane Mine offers strategic access to key logistical routes, including railways that connect the area to ports such as Saldanha Bay, which is critical for the export of iron ore. This makes the region an ideal location for the development of iron ore mining projects aimed at contributing to South Africa's iron ore exports.

2.2 TYPE OF MINING OPERATION

The Makganyane Iron Ore Mine is expected to primarily employ open-pit mining techniques due to the relatively shallow nature of the iron ore deposits in the region. This method is highly effective for extracting large volumes of ore from near-surface deposits, which is ideal for the initial phase of the project. Open-pit mining will involve the removal of overburden to access the iron ore, with advanced equipment and technology being utilized to ensure efficient extraction, minimize costs, and reduce environmental impact.

2.3 SCALE OF OPERATION

The scale of operations at the Makganyane Iron Ore Mine is set to be significant, given the expansive mineral resources in the region. The project spans 1 549,61 ha within the Postmasburg iron ore belt, which is known for its rich deposits of high-quality iron ore. The mining operation will involve large-scale open-pit mining. The mine is expected to operate for approximately 10 years, with production levels aimed at making a moderate contribution to both local and national economies.

2.4 WORKFORCE AND HOURS OF OPERATION

The workforce required for the Makganyane Iron Ore Mine, operating 24 hours a day over three (3) shifts, will depend on the scale and complexity of the mining operations. Typically, for mining projects like this, each shift would require a multidisciplinary team to cover all necessary tasks. These tasks include extraction, equipment operation, maintenance, safety, logistics, administration, and management.

Assuming an average of 20 to 30 workers per shift to cover various roles such as mining equipment operators, engineers, geologists, safety officers, and support staff, the total workforce would be approximately 80 workers. This figure accounts for the need to ensure the mine operates efficiently, while maintaining safety standards and addressing the demands of a 24-hour operational cycle.

2.5 ACCESS POINTS

2.5.1 Provision of site access

Access to the proposed Makganyane Mine will be provided via an existing farm access located along the R385, and approximately 25 km north-west of the town of Postmasburg. This access point currently serves agricultural operations on the property and will be formalised and upgraded to support the anticipated increase in traffic volumes associated with mining activities. The access will be designed in accordance with applicable geometric and safety standards to ensure safe ingress and egress for all vehicle types, including heavy vehicles associated with the mine’s operations. It should be noted that a wayleave application to the *Northern Cape Department of Roads and Public Works* will, in all probability, be required should any upgrades to the access be undertaken. The location of the proposed site access is illustrated in *Figure 2.2* below.

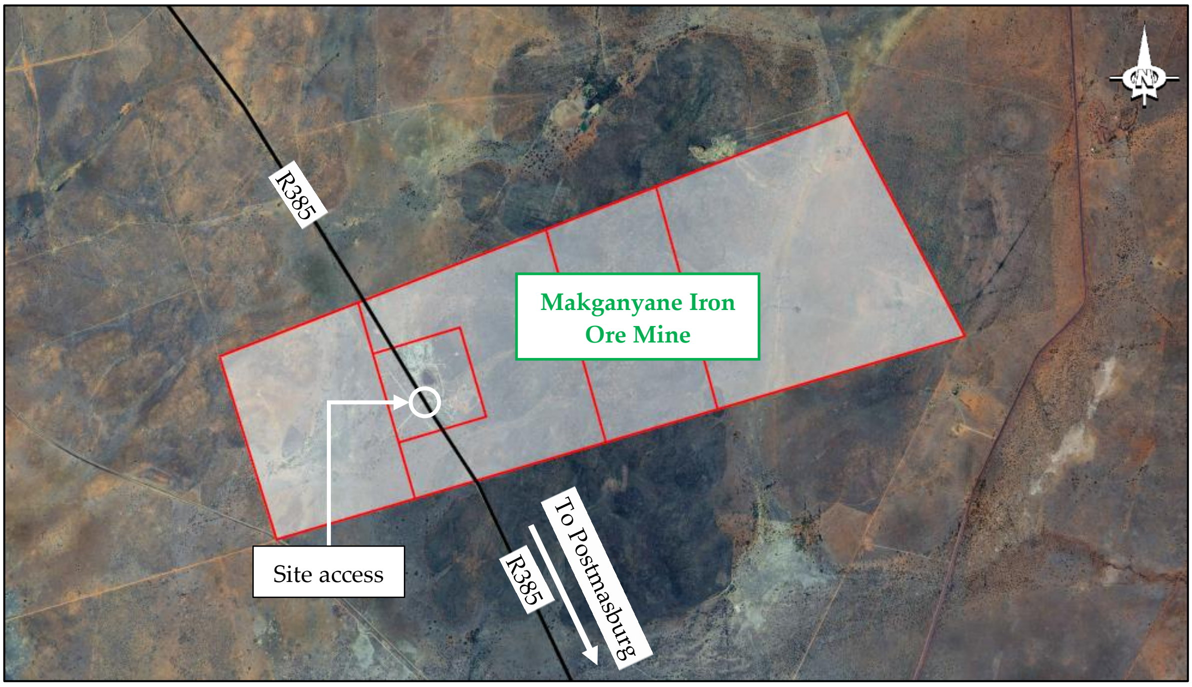


Figure 2.2: Location of proposed access point to Makganyane Iron Ore Mine

2.5.2 Intersection and access management

The minimum allowable intersection and access spacing is dependent on the development environment, road classification and type of intersection control. The minimum spacing requirements for the R385, in the vicinity of the Makganyane Mine, are shown in *Table 2.1* overleaf. The existing intersection and access spacings, as measured from aerial imagery, are provided in *Table 2.2* and corresponding *Figure 2.3*.

Table 2.1: Minimum intersection and access spacing requirements

DEVELOPMENT ENVIRONMENT	ROAD CLASS	MINIMUM SPACING		
		FROM	TO	DISTANCE (m)
Rural	Class R2 – Rural major arterial	Public road/ access	Public road/ access	5 000 m

Table 2.2: Existing intersection and access spacing

FROM		TO		EXISTING SPACING (m)
R385 (CLASS R2 – RURAL MAJOR ARTERIAL)				
1	Access to PTN 0 of the Farm Metseatsididi No. 666	2	Proposed access to the Makganyane Mine	2 500 m

FROM		TO		EXISTING SPACING (m)
R385 (CLASS R2 – RURAL MAJOR ARTERIAL)				
2	Proposed access to the Makganyane Mine	3	PTN 0 of the Farm No. 432	2 400 m

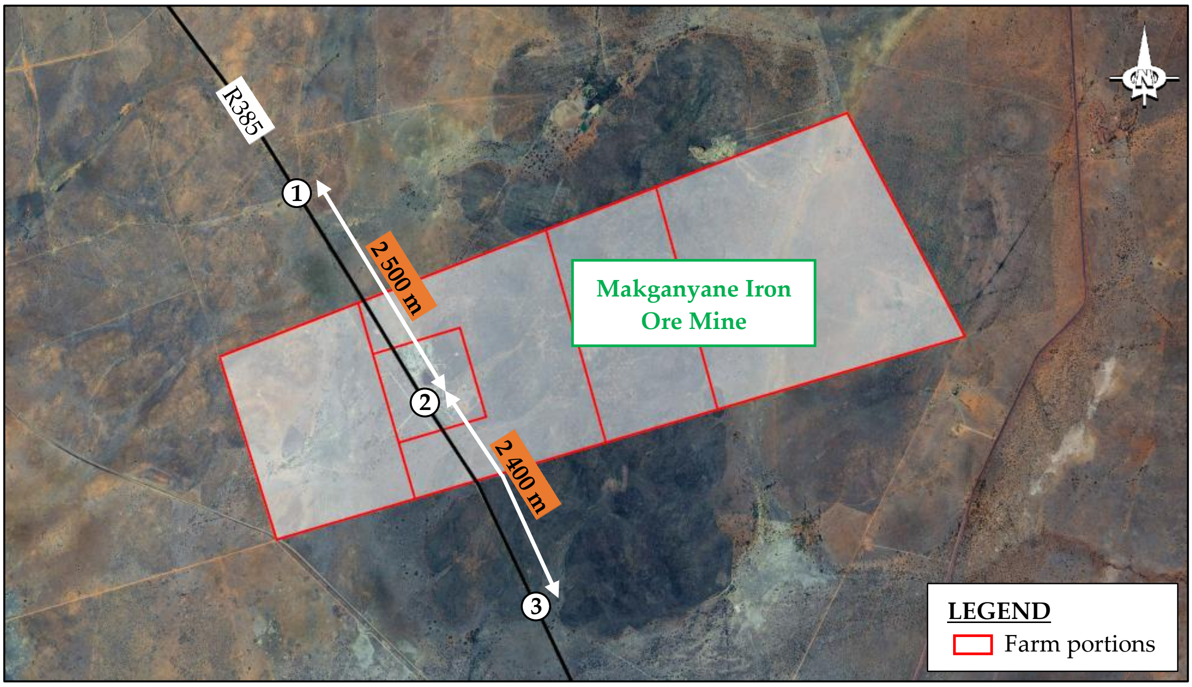


Figure 2.3: Existing intersection and access spacing

2.5.3 Sight distance assessment

2.5.3.1 Introduction

Sight distance is a critical component of safe road design, particularly where new access points are introduced on high-speed rural routes such as the R385. Adequate sight distance ensures that drivers have sufficient visibility to detect and respond to hazards in time to avoid collisions. In this regard, the proposed access to the Makganyane Mine has been evaluated to determine compliance with the relevant sight distance criteria as prescribed in the *TMH 16 Volume 2: South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual*.

2.5.3.2 Design speed and road classification

The R385 in the vicinity of the proposed access is classified as a rural Class 3 minor arterial road, typically associated with high mobility and limited access. Based on the prevailing road geometry, surrounding land use, and speed environment, a design speed of 100 km/h has been adopted for the assessment. This is consistent with the typical operating speeds observed on similar rural corridors in the Northern Cape.

2.5.3.3 Sight distance criteria

TMH 16 Volume 2 specifies minimum sight distance requirements based on road classification and design speed. The relevant criteria applicable to the R385 at the proposed access location are summarised below:

- Stopping Sight Distance (SSD):
  - At 100 km/h: 180 m
- Passing Sight Distance (PSD):
  - At 100 km/h: 600 m (not required at access points, but relevant for route continuity)

These distances are measured along the centreline of the lane and account for driver perception-reaction time, vehicle deceleration, and safety margins under standard conditions.

2.5.3.4 Desktop assessment

A desktop assessment was undertaken at the proposed access location to assess the available sight distance in both directions along the R385. The assessment considered vertical and horizontal alignment, vegetation, and roadside obstructions.

- Northbound direction (towards Postmasburg): Approximately 320 m of sight distance available.
- Southbound direction (away from Postmasburg): Approximately 280 m of sight distance available.

Both measurements exceed the minimum SSD requirement of 180 m at a design speed of 100 km/h. There are no significant vertical curves or obstructions in the vicinity that would impede a driver's line of sight to and from the access.

2.5.3.5 Conclusion

Based on the desktop assessment and in accordance with *TMH 16 Volume 2* guidelines, the available sight distance at the proposed access to the Makganyane Mine is deemed sufficient in both directions. The existing geometry supports safe ingress and egress for both light and heavy vehicles associated with the mining operation. No sight distance-related mitigation measures are required at this stage.

CHAPTER 3 EXISTING TRAFFIC CONDITIONS

3.1 CURRENT TRAFFIC VOLUMES

3.1.1 Traffic data source

Traffic volume data for the R385 was obtained from a permanent counting station (22062: Postmasburg New), which is owned and operated by the *Northern Cape Department of Roads and Public Works*. The data was supplied by *Mikros Traffic Monitoring (Pty) Ltd*, with formal permission granted by the *Northern Cape Roads Authority*, and reflects the most recent complete calendar year, i.e., 2023.

The station is located approximately 19 km south of the proposed Makganyane Mine access along the R385 and provides consistent, long-term traffic monitoring data representative of the corridor.

3.1.2 Historical traffic volumes (2023)

The following traffic volumes were recorded at the permanent station (22062: Postmasburg New) for both directions:

- Average Daily Traffic (ADT) : 3 705 vehicles per day, and
- Average Daily Truck Traffic (ADTT) : 546 heavy vehicles per day.

These volumes reflect a moderately trafficked rural arterial route with a significant proportion of heavy vehicles, typical of regions supporting agricultural and mining activities.

3.1.3 Projected traffic volumes (2025)

To estimate current traffic conditions for the year 2025, a conservative annual growth rate of 3% was applied to the 2023 base data, in line with standard traffic engineering practice. The resulting projections are as follows:

- ADT (2025):

$$ADT_{2025} = 3\,705 \times (1 + 0{,}03)^2 \approx 3\,932\ vehicles/\ day$$

- ADTT (2025):

$$ADTT_{2025} = 546 \times (1 + 0{,}03)^2 \approx 580\ heavy\ vehicles/\ day$$

These projected volumes represent the estimated background traffic conditions on the R385 near the proposed access point to the Makganyane Mine.

3.1.4 Conclusion

The R385 north-west of Postmasburg currently accommodates moderate traffic volumes, with a substantial share of heavy vehicle movements. The use of data from the permanent counting station (22062: Postmasburg New), situated 19 km from the proposed site access, provides a reliable and relevant basis for evaluating the potential traffic impacts associated with the proposed mining development.

3.2 ROAD NETWORK DESCRIPTION

The table below outlines the main roads in the vicinity of the proposed Makganyane Iron Ore Mine. The R385 is the most significant route, acting as a key connector between Postmasburg and the mines, including the Makganyane site. Other roads, such as the R31, and the R325, serve various levels of access, with some being more directly involved in mining logistics and local access. The road classification mentioned has been obtained from the *TRH 26: South African Road Classification and Access Management Manual*.

Table 3.1: External road network near the proposed Makganyane Mine

ROAD NAME	ROAD TYPE	ROAD CLASSIFICATION	ROUTE DESCRIPTION	PRIMARY FUNCTION	CONDITION
N14	National Route	Class R1 – Rural principal arterial	A major route connecting the Northern Cape to the rest of South Africa.	Vital for inter-provincial connections, though not directly near the proposed Makganyane Mine.	Paved, well-maintained, handles heavy inter-city and mining traffic.
R325	Regional Route	Class R2 – Rural major arterial	Connects Griekwastad to Postmasburg and continues northwards to Kathu via the N14.	Regional connector between towns.	Postmasburg to Kathu (northwards): Segment is paved and generally maintained in good condition. Postmasburg to Griekwastad (southwards): Section is primarily a gravel road. Potential challenges in its condition.

ROAD NAME	ROAD TYPE	ROAD CLASSIFICATION	ROUTE DESCRIPTION	PRIMARY FUNCTION	CONDITION
R31	Regional Route	Class R2 – Rural major arterial	Connects Postmasburg to Kuruman and the broader Northern Cape region.	Serves as a regional link to other mining areas and commercial centres.	Paved and in good condition, though high traffic volumes can cause wear.
R385	Regional Route	Class R3 – Rural minor arterial	Main road connecting Postmasburg to the surrounding area, including access to various mines, including the Makganyane Mine.	Key transport route for mining traffic. Local travel, and goods transportation.	The R385, beyond the paved section approximately 12 km north-west of Postmasburg, transitions into a gravel road that is generally in a fair condition.

3.3 CAPACITY ANALYSIS AND LEVEL OF SERVICE (LOS)

3.3.1 Methodology and assumptions

The capacity and Level of Service (LOS) of the R385 in the vicinity of the proposed Makganyane Mine access were assessed using the methodologies outlined in the *Highway Capacity Manual (HCM)* and supported by guidance from *SANRAL*'s *Geometric Design Guide* and the *South African Road Traffic Signs Manual (SARTSM)*.

The assessment focuses on a two-lane rural highway segment, which is the prevailing cross-section in this section of the R385. The analysis considers:

- The projected 2025 Average Daily Traffic (ADT) of 3 932 vehicles/ day,
- An Average Daily Truck Traffic (ADTT) of approximately 580 heavy vehicles/ day,
- A rural environment with relatively few access points, uninterrupted flow, and a posted speed of 100 km/h, and
- A Class 3 rural road classification (two-lane, undivided, gravel beyond 12 km from Postmasburg).

The key performance metric is Level of Service (LOS), which describes operational efficiency based on traffic flow, speed, and delay. LOS ranges from A (free flow) to F (highly congested conditions).

3.3.2 Capacity of the R385 segment

For a typical two-lane rural road, the practical daily capacity is influenced by surface type, vehicle mix, terrain, and road geometry. For gravel-surfaced rural roads, the effective capacity is lower than for paved roads due to reduced travel speeds and increased following distances.

Based on prevailing standards and engineering practice:

- Estimated capacity (gravel surface) : ~ 800 vehicles per hour
- Heavy vehicle adjustment factor : ~ 0,85 (reflecting the impact of trucks on flow and overtaking)

Adjusting for the observed heavy vehicle composition (~ 15% trucks), the adjusted capacity is estimated at approximately 680 vph.

3.3.3 Level of Service analysis (2025)

Before the volume-to-capacity (v/c) ratio can be calculated, the projected 2025 Average Daily Traffic (ADT) must first be converted into an estimated peak hour volume. In line with typical rural arterial road characteristics, it is assumed that 10% of the ADT occurs during the peak hour. Based on this assumption, the peak hour volume is estimated at 393 vehicles per hour (vph).

Using the adjusted capacity of 680 vehicles per hour (vph) and the projected 2025 hourly traffic volume of 393 vph, the v/c ratio can be calculated to assess the operational performance of the R385 in the vicinity of the proposed mine access.

$$Volume - to - Capacity \left(\frac{v}{c}\right) Ratio = \frac{393}{680} \approx 0{,}57$$

This v/c ratio corresponds to a Level of Service B, indicating stable traffic flow with some restriction on manoeuvrability, particularly during peak hours or in the presence of multiple heavy vehicles.

LOS B is considered acceptable for rural roads and aligns with national and provincial standards for road performance in low-density areas.

3.3.4 Conclusion

The R385 in the vicinity of the proposed mine access is expected to continue operating within acceptable capacity limits in the short to medium term. Based on the projected 2025 traffic volumes, the route is expected to operate at LOS B, reflecting stable conditions with moderate potential delays due to the high proportion of heavy vehicles and gravel surface conditions.

No immediate capacity upgrades are required; however, ongoing monitoring is recommended once mining operations commence, particularly to detect deterioration in LOS or increased safety risks linked to heavy vehicle operations.

3.4 TRAFFIC ACCIDENTS

There have been several traffic accidents reported on the R385 near Postmasburg, particularly due to the high volume of heavy mining-related traffic in the area. The road, which connects key mining operations like the Kolomela Mine and the proposed Makganyane Iron Ore Mine, often sees large haul trucks transporting iron ore, alongside local and commuter traffic. These trucks, which can be cumbersome and difficult to manoeuvre, frequently pose risks to smaller vehicles, especially during peak hours when mining shifts change. Additionally, the road's condition, particularly near intersections and smaller access points, can deteriorate due to the heavy traffic, contributing to accidents.

While specific accident statistics or high-profile incidents may not be readily available, local authorities have acknowledged the increased risk, especially with the continuous growth of the mining sector in the region, and have recommended further safety measures, including road upgrades and enhanced traffic management.

3.5 ACCESS TO TRANSPORTATION CORRIDORS

The proposed Makganyane Iron Ore Mine is strategically located approximately 25 km north-northeast of Postmasburg in the Northern Cape Province of South Africa. This region is well known for its extensive mining activities, particularly in iron ore and manganese, and benefits from established transportation infrastructure. Access to key transportation corridors is critical for the efficient movement of extracted ore to domestic and international markets.

One of the primary roadways serving the area is the R325, which connects Postmasburg to the N14, a major national route running east-west. The N14 links Upington, Kathu, and Kuruman, providing a critical corridor for transporting goods to and from the region. Additionally, the R385, another regional route, facilitates connectivity between Postmasburg, Olifantshoek, and Douglas, enhancing logistical flexibility for the mining sector. These roads ensure that ore from the Makganyane Mine can be transported efficiently by truck to processing facilities and distribution points.

Rail infrastructure is also a vital component of the region's mining logistics. The Sishen-Saldanha Railway Line, one of the world's longest and heaviest freight railway lines, is located within the broader mining belt of the Northern Cape. While the Makganyane Mine itself is not directly adjacent to this railway, proximity to Postmasburg enables potential access to rail terminals where ore can be loaded and transported to Saldanha Bay Port on the Western Cape coast. This deep-water port is South Africa's primary export terminal for iron ore, facilitating large-scale shipments to international markets, particularly in Asia and Europe.

Given the mine's location and access to both road and rail infrastructure, it is well positioned to leverage existing transportation corridors for efficient ore distribution. Investment in further road improvements and potential rail linkages would enhance logistical efficiency and reduce transportation costs, supporting the long-term viability of the mining operation.

3.6 PUBLIC TRANSPORT AND PEDESTRIAN INFRASTRUCTURE

3.6.1 Public transport infrastructure

Public transport infrastructure along the R385 and in the vicinity of the proposed Makganyane Iron Ore Mine near Postmasburg is relatively limited due to the region's rural and mining-focused nature. The R385, which connects Postmasburg to Olifantshoek and Douglas, primarily serves as a regional transport corridor for private vehicles, mining-related freight, and occasional public transport services. While small passenger transport services such as minibus-taxis and private shuttle operators are available in Postmasburg, dedicated public transport infrastructure such as bus stops, formal taxi ranks, or scheduled bus services is scarce along this route.

In the immediate vicinity of the Makganyane Mine, there is no established public transport system, as the area is primarily accessed via gravel and secondary roads leading to the mining site. Employees and contractors that will be working at the mine are likely to rely on private vehicles, company-arranged transport, or informal taxi services from nearby towns like Postmasburg. Given the region's strong mining presence, companies operating in the area often arrange shuttle buses or staff transport to accommodate workers commuting from nearby settlements. However, the absence of a formalized public transport system may present challenges for individuals without access to private transport, potentially requiring further infrastructure investment to support workforce mobility in the future.

3.6.2 Pedestrian infrastructure

Pedestrian infrastructure along the R385 and in the vicinity of the proposed Makganyane Iron Ore Mine near Postmasburg is minimal, as the region is primarily designed for vehicle and freight transport rather than pedestrian movement. The R385, a regional route connecting Postmasburg with Olifantshoek and Douglas, is a high-speed roadway with no dedicated pedestrian walkways or crossings. Given its rural nature and function as a corridor for mining-related transport, the road is primarily used by heavy trucks and private vehicles, making pedestrian movement along it both challenging and hazardous.

Near the Makganyane Mine, pedestrian infrastructure is even more limited. The area consists of gravel roads and unpaved access routes leading to the mining site, with little to no dedicated pedestrian facilities. Employees that will be working at the mine who do not have access to private transport may have to rely on company-arranged shuttles, minibus-taxis, or informal transport services, reducing the need for pedestrian infrastructure. However, in areas where foot traffic from local communities or mine workers is present, the absence of sidewalks and safe pedestrian crossings poses potential safety risks, particularly near high-traffic zones and heavy machinery operations. Future infrastructure planning could benefit from incorporating pedestrian-friendly pathways to improve accessibility and worker safety.

CHAPTER 4 PROPOSED DEVELOPMENT AND ITS IMPACT

4.1 PROJECTED TRAFFIC VOLUMES

Typical trip generation rates for mining activities are not included in the *TMH 17, Volume 1: South African Trip Data Manual*. It is for this reason that certain assumptions were made with regards to the trip generation of the proposed Makganyane Iron Ore Mine. These assumptions are as follows:

- **Mine production**: 3 000 000 tonnes of iron ore per annum,
- **Working days per year**: 300
- **Workforce**:
  - *Construction Phase*: 80 workers
  - *Operational Phase*: 80 workers
  - *Decommissioning Phase*: 32 workers
- **Ore transport**: Road haulage (trucks carrying 36 tonnes per trip)
- **Employee transport**:
  - 70% use company buses (35 passengers per bus)
  - 30% use personal vehicles (1,5 workers per vehicle)
- **Construction vehicles**: Includes heavy trucks delivering cement, steel, and equipment.
- **Equipment deliveries**: Includes mining machinery such as excavators, crushers, and haul trucks.
- **Supply trucks**: Includes fuel, lubricants, explosives, and maintenance supplies.

4.1.1 Construction Phase (2 – 3 years)

During this phase, traffic will be generated by material deliveries, equipment installation, and workforce transport.

- **Traffic contributors**:
  - Construction materials delivery (cement, steel, gravel, fuel, etc.),
  - Heavy equipment transport (excavators, crushers, haul trucks),
  - Employee commuting, and
  - Contractors and Engineers' vehicles.

Table 4.1 overleaf provides the expected trip generation during the *Construction Phase* of the proposed Makganyane Iron Ore Mine.

Table 4.1: Trip generation (Construction Phase)

VEHICLE TYPE	TRIPS PER DAY (ONE-WAY)	ROUND TRIPS PER DAY
Construction trucks (Cement, steel, fuel, etc.)	50	100
Heavy equipment transport (excavators, crushers, etc.)	10	20
Employee buses (35 passengers per bus)	2	4
Employee personal vehicles (1,5 workers per vehicle)	16	32
Contractor and Engineering vehicles	8	16
TOTAL CONSTRUCTION PHASE TRAFFIC	**86**	**172**

Therefore, the total estimated daily traffic, during the *Construction Phase*, will be **172 trips/ day** (for 2 – 3 years).

4.1.2 Operational Phase (Mine producing 3 Mtpa)

This phase includes ore transportation, workforce movement, and supply deliveries.

- **Traffic contributors**:
  - Ore transportation:
    - Ore per year: 3 000 000 tonnes
    - Truck capacity: 36 tonnes per trip
    - Truck loads per year:
      $$\frac{3\,000\,000}{36} = 83\,334 \text{ truckloads per year}$$
    - Daily truckloads (assuming 300 workdays per year):
      $$\frac{83\,334}{300} = 278 \text{ truckloads per day}$$
    - Total ore truck trips (round trip included):
      $$278 \times 2 = 556 \text{ trips per day}$$
  - Employee transport (80 workers):
    - Buses: $\frac{80\times0,7}{35}$ = 2 bus trips one way → 4 round trips per day
    - Personal vehicles: $\frac{80\times0,3}{1,5}$ = 16 vehicles one way → 32 round trips per day
  - Supply and equipment deliveries:
    - Explosives, fuel, lubricants, parts: 20 trucks one way → 40 round trips per day
    - Maintenance and special equipment trucks: 5 trucks one way → 10 round trips per day

Table 4.2 overleaf provides the expected trip generation during the *Operational Phase* of the proposed Makganyane Iron Ore Mine.

Table 4.2: Trip generation (Operational Phase)

VEHICLE TYPE	TRIPS PER DAY (ONE-WAY)	ROUND TRIPS PER DAY
Ore transport trucks	278	556
Employee buses	2	4
Employee personal vehicles	16	32
Supply trucks (fuel, explosives, etc.)	20	40
Equipment maintenance vehicles	5	10
TOTAL OPERATIONAL PHASE TRAFFIC	**321**	**642**

Therefore, the total estimated daily traffic, during the *Operational Phase*, will be **642 trips/ day** (for 10 years).

4.1.3 Decommissioning Phase (3 – 5 years)

This phase focuses on dismantling infrastructure, moving heavy equipment, and site rehabilitation.

- **Traffic contributors**:
  - Heavy equipment removal (haul trucks, crushers, conveyors),
  - Employee transport (workforce reduced to 32), and
  - Rehabilitation materials delivery (soil, vegetation, water management equipment).

Table 4.3 below provides the expected trip generation during the *Decommissioning Phase* of the proposed Makganyane Iron Ore Mine.

Table 4.3: Trip generation (Decommissioning Phase)

VEHICLE TYPE	TRIPS PER DAY (ONE-WAY)	ROUND TRIPS PER DAY
Heavy equipment removal trucks	30	60
Employee buses and vehicles	8	16
Rehabilitation supply trucks	15	30
TOTAL CONSTRUCTION PHASE TRAFFIC	**53**	**106**

Therefore, the total estimated daily traffic, during the *Decommissioning Phase*, will be **106 trips/ day** (for 3 – 5 years).

4.1.4 Summary of projected traffic volumes

The table overleaf provides a summary of the projected traffic volumes for the proposed Makganyane Iron Ore Mine.

Table 4.4: Summary of projected traffic volumes

PHASE	DAILY TRIPS (ROUND TRIPS INCLUDED)
Construction Phase (2 – 3 years)	**~ 172 trips/ day**
Operational Phase (10 years, peak mining)	**~ 642 trips/ day**
Decommissioning Phase (3 – 5 years)	**~ 106 trips/ day**

4.2 TYPE AND FREQUENCY OF TRAFFIC

The Makganyane Iron Ore Mine will likely follow a delivery and transportation schedule aligned with its 24-hour, 3-shift operation. The traffic generated by the mine will primarily consist of iron ore transport (haul trucks), workforce transport (buses and private vehicles), and logistics (supply trucks, equipment). Understanding the delivery schedule and peak periods will help assess traffic management needs and ensure minimal disruption to the local road network.

4.2.1 Typical delivery schedule

- **Ore delivery**: The mine will operate 24/7 in 3 shifts, typically lasting 8 hours per shift. The delivery schedule for the transport of ore will depend on production targets, but typically iron ore mines operate at a steady flow of ore shipments to ensure continuous output and avoid stockpile buildup at the mine.

- **Ore production and haulage**: Given the 3 million tonnes per annum production capacity, with a truck capacity of 36 tonnes per trip, the mine will need to move 278 trips per day (or 556 roundtrips) to meet its targets. This would be spread over the 24-hour operational period.

- **Shift times and ore haulage schedule**:
  - First shift (06:00 to 14:00): This peak period for ore haulage in the morning is expected as trucks begin hauling ore early in the shift.
  - Second shift (14:00 to 22:00): Ore transport continues with fewer trucks during off-peak hours, although there may still be some congestion during shift changes or peak delivery times.
  - Third shift (22:00 to 06:00): This shift may have reduced ore transport volume, but it will still contribute significantly to the overall haulage demand. The reduced number of deliveries during this shift could help ease congestion during peak daytime hours.

  Ore will typically be transported in daylight hours (06:00 to 18:00) to minimize safety risks. However, night-time transport may still occur for operations running 24/7.

- **Logistics deliveries**: Apart from ore haulage, the mine will need to receive a continuous supply of materials, fuel, and equipment. These deliveries may occur at specific times.

- **Fuel and materials**: Logistics trucks will typically arrive early in the morning or late in the evening likely between 04:00 to 07:00 and 18:00 to 22:00, to avoid congestion and ensure that the mine's operations are uninterrupted during the day.

- **Equipment transport**: Heavy equipment delivery is less frequent but will usually occur during non-peak times or planned intervals, often requiring special permits or routes.

- **Workforce transport**: Workers will be transported to and from the mine in shift rotations. The workforce schedule will include:
  - Shift change times: Workers arriving for or leaving their shifts, typically at the beginning and end of each shift. These times will influence traffic flow significantly:
    - **Arrival**: Workers will arrive approximately 30-60 minutes before the start of their shift (i.e., 05:00 for the first shift, 13:00 for the second, and 21:00 for the third).
    - **Departure**: Workers will leave the mine at the end of their shift, typically 30-60 minutes after the shift finishes (i.e., 14:30, 22:30, and 06:30).

  Transportation will likely be organized via buses to reduce the number of vehicles on the road, but private vehicles may also be used.

4.2.2 Expected peak periods

Peak periods for traffic on the roads surrounding the Makganyane Iron Ore Mine will occur due to several factors: shift changes, ore deliveries, and logistics schedules. These periods will be critical in understanding the traffic impacts on the R385 and other nearby roads.

- Shift change times (high traffic periods):
  - **Morning (06:00 – 07:00)**: Trucks hauling ore and buses transporting workers will be at their highest volume before the start of the first shift.
  - **Afternoon (14:00 – 15:00)**: As the second shift workers arrive and the first shift workers leave, there will be an increase in traffic volume.
  - **Night (22:00 – 23:00)**: The third shift change will see another peak in workforce transport and ore deliveries, although the ore delivery traffic may be lower than daytime hours.

- Ore haulage peaks:
  - **Early morning (06:00 – 09:00)**: Ore trucks will likely be concentrated in the early morning, as the mine ramps up its operations after the night shift.
  - **Midday (12:00 – 13:00)**: This is generally a peak time for ore transport, as it coincides with the arrival of the second shift and the completion of earlier ore deliveries.
  - **Late afternoon (16:00 – 18:00)**: As the second shift continues, this period will see increased ore haulage and logistics deliveries.

- Logistics traffic (medium traffic periods):
  - **Morning (04:00 – 07:00)**: Supply trucks carrying materials, equipment, and fuel are expected to deliver early in the morning before the peak traffic of ore trucks begins.
  - **Evening (18:00 – 20:00)**: Supply deliveries may occur again in the evening to ensure the mine has the necessary materials for the next shift.

- Night-time operations (lower traffic periods):
  - The **late night (22:00 – 06:00)** shift will experience lower traffic volumes, but this period is still critical for continuous ore transport and workforce changes. However, the volume of traffic will be lower compared to daytime operations, providing relief for the surrounding road network.

4.2.3 Impact of peak periods on local road infrastructure

During peak periods, particularly around shift changes and ore haulage windows, there will be noticeable traffic congestion along the R385 and surrounding roads. The concentration of heavy trucks, workforce buses, and other logistics vehicles may cause delays, especially in areas near the mine entrance and along key intersections. Key impacts include:

- **Road congestion** at key intersections and access points to the mines,
- **Safety concerns**, particularly where roads are not designed to handle high volumes of heavy trucks and buses, and
- **Longer travel times** for local commuters and goods transportation during shift change periods and ore haulage peaks.

To mitigate the impact of these peak traffic periods, the following recommendations should be considered:

- **Traffic management systems**: Implement speed enforcement, and real-time traffic monitoring at key access points to manage congestion during peak periods.

- **Dedicated haul roads**: Consider upgrading haul roads for mining trucks to reduce congestion and improve safety.

- **Shuttle buses for workers**: Increase the frequency of shuttle buses to ensure fewer private vehicles on the road, especially during shift changes.

- **Staggered shift changes**: Staggering the arrival and departure times of the workforce to reduce the peak load on local roads could alleviate some congestion.

Understanding the typical delivery schedule and expected peak periods of the Makganyane Mine will help plan for the associated traffic volumes and ensure that appropriate infrastructure and traffic management measures are in place to support the safe and efficient operation of the mine and the surrounding area.

4.3 VEHICLE ROUTEING PLAN

The Makganyane Iron Ore Mine will generate significant traffic from ore transport trucks. A detailed Vehicle Routing Plan (VRP) ensures that the mine's vehicles will travel along the safest, most efficient routes while minimizing the impact on the surrounding infrastructure, ensuring smooth operations and safety. This plan will outline the routes for trucks hauling ore, and supply vehicles.

4.3.1 Key locations:

The following key locations have been identified for the vehicle routeing plan of the Makganyane Mine:

- **Makganyane Iron Ore Mine**: The mine site, located just off the R385 between Postmasburg and Sishen, will be the origin and destination for the trucks.
- **Main access roads**: The primary road that will be used by trucks are the R385, which serves the main access road to and from the mine.
- **Postmasburg**: The nearby town is the most likely source for logistics supply deliveries.
- **Japies Rus Mine, Beeshoek Mine and other local mines**: As these mines are in the vicinity, routes may overlap or require special coordination with local road authorities.

4.3.2 Routes for ore transport trucks:

Ore transport will be the main traffic flow from the mine, with trucks making regular trips to the Beeshoek Mine for processing. Trucks are expected to travel in large numbers, and their routes should minimize disruptions to local traffic. *Table 4.5* overleaf provide the two (2) possible routes that the ore transport trucks might travel.

Table 4.5: Possible routes for ore transport trucks

ROUTE 1: DIRECT VIA R385	ROUTE 2: HAUL ROAD OR MINE-INTERNAL ROADS (*if available and permitted*)
• **Start**: Trucks leave the mine's weighbridge and access point on the Makganyane Mine site. • **Exit**: Travel towards the R385 heading south. • **Route**: ○ Travel southeast on the R385 toward Beeshoek Mine, ○ Turn off onto the Beeshoek Mine access road, located about 9 km northwest of Postmasburg.	• **Start**: Trucks exit the mine site, and travel on the Makganyane Mine access road. • **Route**: ○ From the Makganyane Mine access point, travel southeast via internal mining roads or designated haul roads, if available. ○ These roads may traverse privately owned or mining-controlled land and are commonly used for inter-mine ore or materials transport. ○ Proceed in the direction of the Beeshoek Mine, located approximately 9 km northwest of Postmasburg, without entering the town itself. ○ Join the Beeshoek Mine access road directly from the internal road network.

4.3.3 Routes for supply and logistics vehicles:

Supply vehicles (fuel, maintenance, food deliveries, etc.) will also use the same roads as ore trucks but with less frequent and more specific delivery times. These vehicles should avoid peak hours of truck traffic.

- Start: Supply trucks will depart from the main Postmasburg area.
- Route:
  - Travel northwest on R385 towards the Makganyane Mine site.
  - Follow the same route as ore transport trucks but expect to stop at weighbridges and possibly make more localized deliveries at the mine facilities.
- Supply delivery times: These trucks will likely operate primarily during early morning (04:00 – 07:00) and evening (18:00 – 22:00) hours to avoid peak traffic congestion caused by ore trucks and worker transport.

4.3.4 Routes for workforce transport (buses and private vehicles):

Workforce buses will be a critical component of the transportation plan, helping to minimize the number of private vehicles on the road. These buses will follow carefully scheduled routes to and from the mine, with pick-up points in Postmasburg and possible remote camps.

- Route for buses from Postmasburg:
  - Start: Buses will depart from a central Postmasburg pick-up point (such as a bus depot or designated stop).
  - Route:
    - Pick-up workers along the R385 heading north, and
    - Follow the R385 heading north until they reach the Makganyane Mine entrance.
    - For night shifts, the buses will head to the mine for drop-off at approximately 05:00.
    - For day shifts, the buses will leave the mine at 14:00 to transport workers back to Postmasburg.
    - Buses should ideally arrive 30 minutes to 1 hour before shift start times for safety and efficiency.

- Private worker vehicles:
  - Private vehicles (if allowed) will generally follow the same route, with workers commuting from their homes or accommodation in Postmasburg.
  - They will use the R385 to reach the mine, and access points will be provided for parking near the mine entrance.
  - Peak arrival times will be synchronized with the start of each shift (05:00 for the morning shift, 13:00 for the afternoon shift, and 21:00 for the night shift).

4.3.5 Summary of vehicle routeing plan

Table 4.6 below provides the detailed routing plan for each of the groups as discussed above.

Table 4.6: Vehicle routeing plan

TYPE OF VEHICLE	ROUTE DESCRIPTION	ROUTE LENGTH	TYPICAL TRAFFIC VOLUME	PEAK PERIOD
Ore transport trucks	From Makganyane Mine → R385 → Beeshoek Mine	30 – 50 km	High (556 trips/ day, round trips)	06:00 – 09:00 and 16:00 – 18:00 (shift change)
Logistics trucks	From Postmasburg → R385 → Makganyane Mine	30 – 40 km	Medium (40 trucks/ day, round trips)	04:00 – 07:00 (morning) and 18:00 – 20:00 (evening)
Workforce buses	From Postmasburg → R385 → Makganyane Mine	20 – 30 km	Low (4 buses/ day, peak during shift changes)	05:00 (morning), 14:00 (afternoon), 22:30 (night)

TYPE OF VEHICLE	ROUTE DESCRIPTION	ROUTE LENGTH	TYPICAL TRAFFIC VOLUME	PEAK PERIOD
Private worker vehicles	From Postmasburg → R385 → Makganyane Mine	20 – 30 km	Low (32 vehicles/ day, peak during shift changes)	05:00, 13:00, 21:00

4.3.6 Road infrastructure and traffic management recommendations

Given the volume of traffic that the Makganyane Iron Ore Mine will generate, it is crucial that the road infrastructure supports the needs of the mine and the surrounding communities. Subsequently, below is a list of some key recommendations for effective traffic management and road safety.

- Dedicated haul roads: Where feasible, create or upgrade dedicated haul roads to ensure that ore trucks do not mix with local traffic. This can reduce congestion, improve safety, and prolong the lifespan of local roads.
- Workforce shuttle timing: Stagger shuttle bus schedules slightly to avoid large groups of buses arriving simultaneously. This can minimize congestion during shift change hours.
- Regular maintenance: Given the heavy traffic from mining vehicles, regular maintenance schedules should be implemented to repair road wear and tear ad ensure the safe passage of all vehicles.
- Speed control: Install speed bumps or speed reduction signs near populated areas, schools, and mine entrances to control vehicle speeds and enhance safety for workers and local residents.
- Signage and communication: Ensure that appropriate signage and traffic control measures are in place to alert drivers about heavy truck traffic, bus transport, and potential disruptions.

4.3.7 Conclusion

The Vehicle Routeing Plan (VRP), for the proposed Makganyane Iron Ore Mine, provides a comprehensive plan for the safe and efficient transport of ore, logistics supplies, and workers. With proper coordination of truck routes, workforce shuttle schedules, and necessary infrastructure improvements, traffic congestion and safety risks can be minimized while ensuring the smooth operation of the mine.

4.4 ROAD NETWORK ADEQUACY AND IMPROVEMENT REQUIREMENTS

The potential impact of the proposed Makganyane Mine on the surrounding road network, specifically the R385, has been assessed across all key lifecycle phases of the project: construction, operation, and decommissioning. This assessment considers both the 2025 projected background traffic volumes and the additional mine-related traffic, with a focus on the R385's current condition, capacity, and ability to accommodate increased demand.

4.4.1 Construction phase

During the construction phase, traffic volumes on the R385 are expected to increase temporarily due to:

- Delivery of construction materials and equipment,
- Earthmoving operations and infrastructure development, and
- Commuting by construction personnel.

This will result in short-term spikes in both light and heavy vehicle traffic, particularly during peak construction periods. While the total volumes are expected to remain below the adjusted capacity of approximately 680 vehicles/ hour, the unpaved section of the R385 may experience increased wear.

Recommended interventions:

- Temporary traffic control and signage,
- Increased frequency of road maintenance (e.g. grading, dust suppression), and
- Reinforcement of shoulders or specific segments if deterioration is observed.

4.4.2 Operational phase

Once the mine is operational, traffic will stabilize and primarily consist of:

- Regular heavy vehicle movements for material haulage,
- Light vehicle trips by mine employees and service personnel, and
- Periodic deliveries and contractor access.

With the projected 2025 background volume of approximately 393 vehicles/ hour, and considering anticipated mine traffic, the R385 is expected to continue operating at an acceptable Level of Service (LOS C or better). The daily demand will remain below the road's effective capacity.

Recommended interventions:

- Scheduled maintenance of the gravel road segment, and
- Monitoring of road condition to ensure safe operation under sustained heavy vehicle traffic.

4.4.3 Decommissioning phase

The decommissioning phase will involve:

- Removal of infrastructure and equipment,
- Rehabilitation of the mining site, and
- Movement of decommissioning personnel and materials.

This phase will again introduce short-term, construction-like traffic patterns, with moderate to high heavy vehicle volumes over a limited duration. Traffic impacts will likely be less intense than during initial construction, but more variable and dependent on rehabilitation methods.

Recommended interventions:

- Implementation of a traffic management plan to coordinate decommissioning logistics,
- Continued maintenance of the gravel road segment to prevent excessive wear, and
- Restoration of any access improvements, if required, based on final land use.

4.4.4 Conclusion

Throughout all project phases, the R385 is expected to have sufficient capacity to accommodate the additional mine-related traffic without the need for major upgrades or widening. However, the gravel surface condition and high proportion of heavy vehicles warrant targeted improvements and ongoing maintenance. Specific recommendations include:

- Possible access road improvements,
- Routine and responsive maintenance of gravel segments,
- Traffic control and safety enhancements during construction and decommissioning, and
- Long-term monitoring of road condition and Level of Service.

These measures will ensure the road remains safe and functional over the life of the mine and beyond.

CHAPTER 5 TRAFFIC OPERATIONS ASSESSMENT

5.1 TRAFFIC ANALYSIS METHODOLOGY

The traffic analysis for the proposed Makganyane Mine was undertaken to assess the capacity, operational performance, and safety of the affected section of the R385. The methodology followed the principles outlined in the *Highway Capacity Manual (HCM), 7th Edition*, with adaptations made to reflect South African road conditions and standards, including the *South African Traffic Impact and Site Traffic Assessment Manual (TMH 16, Volume 2)*.

5.1.1 Analytical framework

The traffic analysis framework comprised the following core components:

1. **Assessment of existing traffic conditions** using 2023 count data from a permanent counting station (22062: Postmasburg New),
2. **Projection of background traffic volumes** to the 2025 horizon year using a 3% annual growth rate,
3. **Estimation of mine-related traffic volumes** for construction, operational, and decommissioning phases,
4. **Capacity and Level of Service (LOS) evaluation** of the R385 based on total projected volumes, and
5. **Geometric and operational evaluation of the proposed site access.**

Each step in the methodology was informed by applicable capacity models and performance thresholds outlined in the *HCM* and *TMH 16* guidelines.

5.1.2 Highway segment analysis

The relevant section of the R385, extending approximately 25 km north-west of Postmasburg, was analysed as a two-lane rural highway segment with a partially unpaved (gravel) surface. The following elements were considered:

- **Traffic composition**, including a high percentage of heavy vehicles,
- **Adjusted capacity estimates**, using passenger car equivalents (PCEs) for heavy vehicles,
- **Volume-to-capacity (v/c) ratios**, accounting for surface type and terrain,
- **Functional classification** of the road (Class 3 rural road with an assumed design speed of 100 km/h), and
- **Sight distance availability**, particularly at the proposed access point.

The performance of the R385 was benchmarked against standard LOS thresholds, and the adequacy of the road under future demand conditions was evaluated accordingly.

5.1.3 Access and intersection evaluation

The proposed mine access, which will make use of an existing farm entrance on the R385, was evaluated for its suitability to accommodate increased traffic volumes, particularly larger mining vehicles. The evaluation included:

- Review of sight distance requirements, as per *TMH 16 Volume 2* standards,
- Turning movement assessments for safe entry and exit of heavy vehicles, and
- Basic intersection layout checks, considering anticipated peak hour volumes.

Although detailed intersection capacity modelling was not required due to relatively low turning volumes, geometric adequacy and safety considerations were addressed.

5.1.4 Evaluation metrics

The analysis relied on the following key performance indicators:

- Average Daily Traffic (ADT) and Average Daily Truck Traffic (ADTT),
- Volume-to-capacity (v/c) ratios,
- Level of Service (LOS A to F), based on vehicle flow characteristics and traffic density, and
- Sight distance compliance, to ensure safe vehicle operations near the access point.

5.1.5 Tools and data sources

The analysis was supported by a combination of authoritative data sources and industry-standard analytical tools to ensure the accuracy and reliability of the traffic impact assessment.

- Traffic count data: Permanent counting station (22062: Postmasburg New), 2023,
- Traffic projections: Spreadsheet-based growth modelling using a 3% annual rate, and
- Reference documents:
  - *HCM 7TH Edition (Transportation Research Board)*,
  - *TMH 16 Volume 2 (South Africa Committee of Transport Officials)*, and
  - *SANRAL Geometric Design Guide (2013)*.

5.2 PEAK TRAFFIC ANALYSIS

This sub-chapter presents the peak hour traffic analysis for the R385 in the vicinity of the proposed Makganyane Mine access, structured according to the framework outlined in the previous sub-chapter. The assessment considers cumulative traffic conditions during the construction (2028), operational (2038), and decommissioning (2043) phases of the mine, and evaluates the impact of mine-related traffic when added to the projected background traffic volumes.

5.2.1 Background peak hour traffic volumes

Background traffic volumes were projected using 2023 data from the Postmasburg New permanent traffic counting station (Station ID: 22062), obtained from *Mikros Traffic Monitoring (Pty) Ltd* with permission from the *Northern Cape Department of Roads and Public Works*. A growth rate of 3% per annum was applied to estimate future volumes for each scenario year.

Table 5.1: Background traffic projections

YEAR	ADT (veh/ day)	PEAK HOUR VOLUME (10%) *
2028	4 294	**429 veh/ h**
2038	$4\,294 \times (1{,}03)^{10} \approx 5\,771$	**~ 577 veh/ h**
2043	$4\,294 \times (1{,}03)^{15} \approx 6\,690$	**~ 669 veh/ h**

* Note: Peak hour volume is assumed as 10% of ADT, consistent with rural arterial road characteristics and *TMH 16 Volume 2*.

5.2.2 Mine-related traffic estimates by phase

Mine-related trips were converted into total vehicle movements and peak hour trips, assuming each round trip consists of two one-way movements and that 15% of daily trips occur during the peak hour, which is typical for mining and construction-related activities.

Table 5.2: Mine-related traffic estimates

PHASE	YEAR	DAILY ROUND TRIPS	TOTAL DAILY TRIPS	PEAK HOUR PROPORTION	PEAK HOUR TRIPS
Construction	2028	86	172	15%	**26 veh/ h**
Operational	2038	321	642	15%	**96 veh/ h**
Decommissioning	2043	53	106	15%	**16 veh/ h**

These trips are assumed to be equally distributed in both directions on the R385.

5.2.3 Total peak hour traffic volumes

The table below combines background traffic and projected mine-related traffic to provide total anticipated two-way peak hour volumes during each mine phase.

Table 5.3: Total peak hour traffic volumes

PHASE	YEAR	BACKGROUND PEAK HOUR	MINE PEAK HOUR	TOTAL PEAK HOUR VOLUME
Construction	2028	429 veh/ h	26 veh/ h	**455 veh/ h**
Operational	2038	577 veh/ h	96 veh/ h	**673 veh/ h**
Decommissioning	2043	669 veh/ h	16 veh/ h	**685 veh/ h**

These totals are used for further capacity and LOS assessments in subsequent chapters.

5.2.4 Interpretation and implications

The following sub-chapter interprets the projected peak hour traffic volumes in the context of the R385's functional capacity and provides an overview of potential operational implications across the various phases of the Makganyane Mine development.

- During all phases, the combined peak hour volumes remain below 1 000 veh/ h, which is generally acceptable for a two-lane rural road, even with a gravel surface north of Postmasburg,
- The operational phase (2038) results in the highest combined peak hour volume, though the mine's proportional impact is greatest during the construction phase (2028), and
- The decommissioning phase (2043) has a relatively minor impact on peak hour traffic but still necessitates consideration due to the projected background growth.

This analysis confirms that the R385 is expected to maintain adequate operational performance under the projected traffic conditions for all mine phases, subject to appropriate access control, signage, and ongoing monitoring.

5.3 LEVEL OF SERVICE (LOS)

This sub-chapter evaluates the Level of Service (LOS) for the R385 in the vicinity of the proposed Makganyane Mine access. The LOS analysis builds upon the foundational approach described in *Chapter 5.1: Traffic Analysis Methodology* and is informed by the projected peak hour traffic volumes established in *Chapter 5.2: Peak Traffic Analysis*.

5.3.1 Methodology overview

The LOS assessment is conducted in accordance with the procedures set out in the *Highway Capacity Manual (HCM)*, as referenced in the *TMH 16 Volume 2: South African Traffic Impact and Site Traffic Assessment Manual*. LOS is used as a qualitative measure describing traffic operations in terms of speed, travel time, freedom to manoeuvre, and comfort and convenience, and is graded on a scale from A (best) to F (worst).

For rural two-lane highways such as the R385, LOS is primarily influenced by traffic flow rate, percentage of heavy vehicles, and available passing opportunities. Since a portion of the R385 is unpaved, surface condition was also considered in the qualitative interpretation of LOS.

5.3.2 Level of Service assessment by phase

The LOS was assessed for each key project year – 2028 (construction), 2038 (operation), and 2043 (decommissioning) – by evaluating the total two-way peak hour traffic volumes on the R385 in the vicinity of the proposed access.

Table 5.4: LOS summary

YEAR	PHASE	PEAK HOUR VOLUME (veh/ h)	ESTIMATED LOS *	INTERPRETATION
2028	Construction	455	**LOS B**	Stable flow, minimal delay, good manoeuvrability
2038	Operational	673	**LOS C**	Stable flow but with noticeable delay; limited overtaking
2043	Decommissioning	685	**LOS C**	Stable flow but with noticeable delay; limited overtaking

* Note: LOS thresholds were estimated based on *HCM* standards for two-lane rural roads, adjusted to reflect surface condition and expected heavy vehicle composition during mine operations.

5.3.3 Interpretation and network implications

The following sub-chapter provides a contextual interpretation of the LOS results, highlighting their implications for traffic operations, safety, and infrastructure performance on the R385 throughout the various phases of the proposed development.

- In 2028, during the construction phase, the combined traffic volume results in LOS B, indicating that the R385 will continue with a high level of service and only minimal impact from construction-related traffic,

- By 2038, during the operational phase, increased background growth combined with mine-related trips results in LOS C, suggesting a stable flow but with limited opportunities for overtaking, particularly given the presence of heavy vehicles and gravel sections, and
- The 2043 decommissioning phase maintains similar operating conditions, with total volumes close to those observed in 2038. LOS C is still acceptable but indicates a need for ongoing maintenance, and continued traffic monitoring to ensure long-term efficiency and safety.

This LOS assessment reinforces the conclusion that while the Makganyane Mine will add measurable traffic to the R385 corridor; the road is projected to retain acceptable operational performance throughout all phases of the development. The findings will inform access design, traffic safety measures, and any required mitigation strategies presented in later chapters of this report.

5.4 CAPACITY ANALYSIS

This sub-chapter presents the capacity analysis of the R385 in the vicinity of the proposed Makganyane Mine access. The assessment builds directly upon the methodologies outlined in *Chapter 5.1: Traffic Analysis Methodology*, the projected traffic volumes established in *Chapter 5.2: Peak Traffic Analysis*, and the qualitative operational insights from *Chapter 5.3: Level of Service (LOS)*.

5.4.1 Analytical framework

The capacity analysis is conducted in accordance with the procedures and performance thresholds defined in the *Highway Capacity Manual (HCM)*, as locally interpreted through *TMH 16 Volume 2*. For rural two-lane highways such as the R385, capacity is a function of several factors, including:

- Total two-way traffic volumes,
- Percentage of heavy vehicles,
- Roadway geometry and shoulder width,
- Presence of passing opportunities, and
- Surface condition (notably, gravel vs. paved sections).

In this context, road capacity refers to the maximum sustainable hourly flow rate under prevailing conditions, beyond which service levels and safety may deteriorate significantly.

5.4.2 Assumed capacity thresholds

Given the mixed surface conditions of the R385 – paved for the first 12 km north of Postmasburg, and gravel thereafter – the analysis assumes differentiated capacity thresholds:

- Paved section: ~ 1 200 vehicles per hour (vph) in both directions, and
- Gravel section: ~ 800 vph (adjusted for surface and safety constraints).

These values align with industry norms and *TMH 16* guidelines for Class 3 rural roads under mixed-vehicle conditions.

5.4.3 Projected peak hour demands

Based on the peak hour demand volumes calculated in *Chapter 5.2: Peak Traffic Analysis*, the following table compares projected traffic volumes against available capacity in each assessment year:

Table 5.5: Projected traffic volumes versus available capacity

YEAR	PHASE	TOTAL PEAK HOUR VOLUME (veh/ h)	AVAILABLE CAPACITY (GRAVEL SECTION) *	VOLUME-TO-CAPACITY RATIO (v/c)
2028	Construction	455	800	**0,57**
2038	Operational	673	800	**0,84**
2043	Decommissioning	685	800	**0,86**

* Note: While the paved section has higher capacity, the gravel section north of km 12 is the operational bottleneck and was used for capacity comparison.

5.4.4 Interpretation of results

The following sub-chapter interprets the calculated volume-to-capacity ratios to assess the adequacy of the R385 in accommodating the projected traffic demand during each phase of the Makganyane Mine development.

- In 2028, the volume-to-capacity (v/c) ratio remains well below 1,0, indicating sufficient reserve capacity on the gravel section during the construction phase,
- By 2038, during peak operational activity, the v/c ratio approaches 0,84, nearing saturation but still within acceptable limits. While it does not exceed capacity, it signals reduced flexibility and a need for proactive traffic management, and
- In 2043, during decommissioning, the v/c ratio reaches 0.86, indicating continued strain on the network and limited spare capacity, particularly during peak hours. Without mitigation, this could lead to operational inefficiencies or safety concerns.

These results align with the LOS analysis presented in *Chapter 5.3*, which observed a transition from LOS B to LOS C as traffic volumes approach the gravel section's capacity. The findings indicate while traffic volumes will increase over time, the gravel section is expected to operate within acceptable capacity limits throughout all phases of the project. As such, no major road upgrades are currently warranted, although monitoring and basic maintenance will be important to ensure safe and efficient operations, particularly during peak periods in the operational and decommissioning phases.

5.5 ACCIDENT ANALYSIS

An assessment of road safety is a key component of any Traffic Impact Assessment (TIA). However, in the case of the R385 in the vicinity of the proposed Makganyane Mine access, no historical accident data was available for analysis at the time of reporting.

In the absence of recorded accident data, the safety evaluation relies on qualitative assessments based on observed road geometry, surface condition (particularly the transition from paved to gravel), and the anticipated increase in traffic volumes and heavy vehicle movements associated with the proposed mine development.

It is recommended that ongoing coordination with provincial road authorities be undertaken to obtain future accident data for monitoring purposes. In addition, the implementation of appropriate road safety measures, including signage, speed control, and sight distance management, will be critical to ensuring safe operations during all phases of the mine's lifecycle.

CHAPTER 6 CUMULATIVE ANALYSIS

6.1 CUMULATIVE TRIP GENERATION

To assess the cumulative trip generation associated with the proposed Makganyane Iron Ore Mine, alongside the existing operations at Kolomela, Beeshoek, Japie's Rus, and Heuningkranz mines, the combined traffic impact from these mining activities needs to be considered. Unfortunately, specific production data for Japie's Rus and Heuningkranz mines are not readily available, so their contributions will be estimated based on typical small to medium-sized mining operations.

6.1.1 Assumptions

The following assumptions were made with regards to the production rates at the above-mentioned mines:

- Makganyane Iron Ore Mine: Proposed production of 3 million tonnes per annum (Mtpa).
- Kolomela Mine: Produced approximately 10 Mtpa in 2023.
- Beeshoek Mine: Produced approximately 2,98 Mtpa in 2023.
- Japie's Rus Mine: Production data unavailable; estimated at 1 Mtpa based on typical small-scale operations.
- Heuningkranz Mine: Production data unavailable; estimated at 1 Mtpa.

Furthermore, the following general assumptions were made:

- Working days per year: 300 days,
- Truck capacity: 36 tonnes per truck,
- Employee estimates (30 employees per 1 Mtpa; 80 employees for Makganyane Mine),
- Employee transport:
  - 70% by bus (35 employees per bus)
  - 30% by personal vehicles (1,5 employees per vehicle)
- Supply and equipment deliveries:
  - 25 daily delivery trucks for the Makganyane Mine, and
  - 5 daily delivery trucks per 1 Mtpa for the other mines.

6.1.2 Trip generation calculations

6.1.2.1 Ore transport

Each mine's ore transport is calculated as follows:

$$Daily\ truckloads = \frac{Annual\ production\ (tonnes)}{Truck\ capacity\ \times Working\ days\ per\ year}$$

The table below provides a summary of the trip generation associated with ore transportation.

Table 6.1: Cumulative trip generation (ore transport)

MINE	PRODUCTION (Mtpa)	DAILY TRUCKLOADS	DAILY ROUND TRIPS
Makganyane	3	278	556
Kolomela	10	925	1 850
Beeshoek	2,98	275	550
Japie's Rus	1	93	186
Heuningkranz	1	93	186
TOTAL ORE TRANSPORT TRIPS			**3 328**

6.1.2.2 Employee commuting:

The table below provides a summary of the trip generation associated with employee commuting.

Table 6.2: Cumulative trip generation (employee commuting)

MINE	NO. OF EMPLOYEES	BUS TRIPS (ROUND TRIPS)	PRIVATE VEHICLE TRIPS (ROUND TRIPS)	TOTAL TRIPS
Makganyane	80	4	32	36
Kolomela	300	12	120	132
Beeshoek	90	4	36	40
Japie's Rus	30	2	12	14
Heuningkranz	30	2	12	14
TOTAL EMPLOYEE COMMUTING TRIPS				**236**

6.1.2.3 Supply and equipment deliveries

The table overleaf provides a summary of the trip generation associated with supply and equipment deliveries.

Table 6.3: Cumulative trip generation (supply and equipment deliveries)

MINE	PRODUCTION (Mtpa)	DAILY DELIVERIES (TRUCKS)	DAILY ROUND TRIPS
Makganyane	3	25	50
Kolomela	10	50	100
Beeshoek	2,98	15	30
Japie's Rus	1	5	10
Heuningkranz	1	5	10
TOTAL SUPPLY AND EQUIPMENT TRIPS			**200**

6.1.2.4 Final cumulative trip generation

The table below provides a summary of the final cumulative trip generation associated with the mines in the vicinity of Postmasburg.

Table 6.4: Final cumulative trip generation

TRIP CATEGORY	TOTAL ROUND TRIPS PER DAY
Ore transport	3 328
Employee commuting	236
Supply and equipment deliveries	200
GRAND TOTAL (ALL MINES)	**3 764 TRIPS/ DAY**

6.2 CUMULATIVE IMPACT AND SIGNIFICANCE

6.2.1 Impact assessment by category

The cumulative traffic generated by the mines has various impacts on roads, communities, and the environment. Below is a detailed assessment based on *Impact*, *Consequence*, *Likelihood*, *Frequency*, *Probability*, and *Environmental Effects*.

Table 6.5: Impact assessment by category

IMPACT TYPE	DESCRIPTION	CONSEQUENCE	LIKELIHOOD	FREQUENCY	PROBABILITY	ENVIRONMENTAL EFFECT
Traffic congestion	Increased vehicle movement, especially during peak hours.	High – Slower travel times, delays for local traffic.	Very likely – Traffic will increase significantly.	Continuous (Daily traffic 4 394 trips)	> 90% - Traffic congestion will occur.	Higher emissions from idling vehicles, noise pollution.
Road wear and tear	Heavy trucks (ore transport) degrade road surfaces faster.	Severe – More potholes, structural damage to roads.	Certain – Already observed in mining regions.	Daily, cumulative impact over time.	100% - Roads will require maintenance.	Dust pollution from damaged roads, increased runoff.
Safety and accidents	More vehicles, heavy trucks mixed with local traffic.	Severe – Higher accident risk, especially for small vehicles.	Likely – Especially at intersections and mine access roads.	Frequent, particularly during peak hours.	75% - Increased risk due to high truck volume.	Risk of fuel/ oil spills, hazardous material transport concerns.
Air pollution	Emissions from trucks (diesel engines), dust from roads.	Moderate to high – Affects air quality, respiratory health.	Certain – Diesel vehicles contribute to CO_2, NO_x emissions.	Continuous, daily operations.	100% - Pollution will increase in high-traffic zones.	CO_2, particulate matter (PM10/ PM2,5) increase, dust storms.

IMPACT TYPE	DESCRIPTION	CONSEQUENCE	LIKELIHOOD	FREQUENCY	PROBABILITY	ENVIRONMENTAL EFFECT
Noise pollution	Heavy truck noise, employee vehicles at shift changes.	Moderate – Disturbance to nearby communities.	Very likely – More trucks and buses mean more noise.	Frequent, especially during night shifts.	90% - Noise complaints expected.	Impacts on wildlife and human health (sleep disturbance).
Community disruptions	Increased traffic affects daily life for local residents.	High – More traffic delays, road safety concerns.	Likely – Especially near mine entrances and towns.	Daily impacts, worsens over time.	80% - Community complaints expected.	Loss of rural lifestyle, more vehicle emissions.
Wildlife and biodiversity	Habitat fragmentation, roadkill risk from higher traffic.	Moderate – Wildlife corridors disrupted.	Likely – Especially near undeveloped areas.	Frequent, ongoing risk for animals.	60% - Higher mortality rates for animals.	Disruption of ecosystems, biodiversity loss.

6.2.2 Key observations

The following key observations can be concluded from the impact assessment indicated in the sub-chapter above.

- <u>Environmental concerns</u>
  - **Dust and emissions**: High levels of diesel exhaust, CO_2, and road dust worsen air quality and affect nearby residential areas.
  - **Road runoff and erosion**: Truck-induced road damage increases soil erosion and water contamination.
  - **Wildlife disruption**: Increased road traffic poses threats to animal movement, leading to habitat fragmentation and roadkill incidents.

- <u>Road infrastructure and safety</u>
  - **Higher risk of accidents**: More interactions between trucks and smaller vehicles raise collision risks, especially at mine entrances and local roads.
  - **Accelerated road deterioration**: Frequent heavy truckloads (35t capacity) will increase potholes, cracks, and maintenance costs.

- <u>**Social and community impact**</u>
  - **Shift changes cause traffic peaks**: Local roads near employee drop-off points and settlements will see congestion surges at 6 AM, 2 PM, and 10 PM.
  - **Noise and light pollution**: Truck operations 24/7 will increase road noise and artificial lighting, affecting residents and local businesses.

6.2.3 Risk ratings for each impact

The table below provides the risk ratings for each impact listed in the sub-chapter above.

Table 6.6: Risk ratings

IMPACT	RISK LEVEL (LOW/ MODERATE/ HIGH/ SEVERE)	SUGGESTED MITIGATION
Traffic congestion	High	Shift staggering, truck-only lanes, bypass roads.
Road wear and tear	Severe	Frequent maintenance, heavy-duty road surfacing.
Safety and accidents	Severe	Better signage, truck speed limits, separate truck lanes.
Air pollution	High	Fleet upgrades (low-emission trucks), dust suppression.
Noise pollution	Moderate	Noise barriers, limited truck honking zones.
Community disruptions	High	Public engagement, alternate routes for mining trucks.
Wildlife impact	Moderate	Wildlife crossings, fencing near high-risk zones.

6.2.4 Recommendations to reduce traffic impacts

The following recommendations can be considered to reduce traffic impacts as a result of the mining operations in the area.

- <u>Ore transport (heavy trucks)</u>
  - **Shift some ore transport to rail**: Reduces truck traffic by 30 – 50%,
  - **Dedicated truck bypass roads**: Keeps mining traffic away from town centres, and
  - **Weight restrictions and road reinforcements**: Prevents premature road deterioration.

- <u>Employee commuting</u>
  - **Increase bus usage**: Fewer personal vehicles, reduced congestion at shift changes,

  - **Stagger shift start times**: Avoids major traffic spikes, and
  - **Carpool incentives**: Encourages shared transport, lowering emissions and vehicle volume.

- Supply and equipment deliveries
  - **Limit daytime deliveries**: Prioritize off-peak hours for supply vehicles,
  - **Use local suppliers where possible**: Reduces long-haul truck trips, and
  - **Smart scheduling**: Deliveries spaced out to avoid traffic surges.

- Environmental protection
  - **Dust control measures**: Regular water spraying on roads to reduce airborne dust,
  - **Lower emission standards**: Encourage Euro 6 diesel trucks or electric fleets, and
  - **Wildlife corridors and fencing**: Protect biodiversity and prevent roadkill incidents.

6.3 ENVIRONMENTAL SIGNIFICANCE OF TRAFFIC IMPACTS

To determine the environmental significance of traffic-related impacts from the proposed Makganyane Mine and surrounding mines (Kolomela, Japie's Rus, Beeshoek, and Heuningkranz), the overall consequence and overall likelihood can be calculated based on a scoring system (1 – 5).

6.3.1 Scoring criteria (1 – 5 scale)

The table overleaf provides the scoring criteria that was used, as mentioned above.

Table 6.7: Scoring criteria

FACTOR	1 (LOW IMPACT)	2 (MINOR IMPACT)	3 (MODERATE IMPACT)	4 (HIGH IMPACT)	5 (SEVERE IMPACT)
Severity/ Intensity	Insignificant/ non-harmful	Small/ potentially harmful	Significant/ harmful	Great/ very harmful	Disastrous/ extremely harmful
Duration	Up to 1 month	1 – 3 months	3 months – 1 year	1 – 10 years	Beyond 10 years
Extent/ Spatial Scale	Immediate, fully contained area	Surrounding area	Within business unit area of responsibility	Within the farm/ neighbouring farm area	Regional, National, International
Frequency	Once a year or once/ more during operation	Once/ more in 6 months	Once/ more a month	Once/ more a week	Daily
Probability	Almost never/ almost impossible	Very seldom/ highly unlikely	Infrequent/ unlikely/ seldom	Often/ regular/ likely/ possible	Daily/ highly likely/ definitely

6.3.2 Scoring table for each impact (before mitigation)

Each impact is assessed based on **Consequence** (*(Severity + Duration + Extent)*/3) and **Likelihood** (*(Frequency + Probability)*/2). The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will fall into a range of **LOW**, **LOW-MEDIUM**, **MEDIUM**, **MEDIUM-HIGH** or **HIGH**, as shown in the table below.

Table 6.8: Determination of overall environmental significance

SIGNIFICANCE OR RISK	LOW	LOW - MEDIUM	MEDIUM	MEDIUM - HIGH	HIGH
Overall Consequence x Overall Likelihood	**1 – 4,9**	**5 – 9,9**	**10 – 14,9**	**15 – 19,9**	**20 - 25**

Subsequently, *Table 6.9* below provides the scoring of each impact listed earlier in *Chapter 6.2.1*, before mitigation.

Table 6.9: Scoring of each impact (before mitigation)

IMPACT TYPE	SEVERITY (1 – 5)	DURATION (1 – 5)	EXTENT (1 – 5)	OVERALL CONSEQUENCE	FREQUENCY (1 – 5)	PROBABILITY (1 – 5)	OVERALL LIKELIHOOD	ENVIRONMENTAL SIGNIFICANCE (CONSEQUENCE x LIKELIHOOD)
Traffic congestion	3	5	3	3,67	4	5	4,50	**16,515**
Road wear and tear	4	5	5	4,67	5	5	5,00	**23,35**
Safety and accidents	5	4	3	4,00	4	4	4,00	**16,00**
Air pollution	4	5	5	4,67	5	5	5,00	**23,35**
Noise pollution	3	5	3	3,67	4	4	4,00	**14,68**
Community disruptions	4	5	5	4,67	4	4	4,00	**18,68**
Wildlife disruption	4	5	5	4,67	4	4	4,00	**18,68**

6.3.3 Interpretation of environmental significance scores

- High Impact (Score 20 – 25)
  - **Road wear and tear**: Highest concern, as continuous truck traffic will degrade road permanently, requiring significant maintenance.
  - **Air pollution**: Diesel emissions and dust will cause long-term respiratory and climate effects.

- Medium-High Impact (15 – 19,9)
  - **Traffic congestion**: Major disruptions for local road users, potential for traffic jams.
  - **Safety and accidents**: Higher accident risk due to mixed traffic types and high truck volume.
  - **Community disruptions**: Local communities will experience noise, road stress and congestion.
  - **Wildlife disruption**: Loss of habitat and biodiversity impact.

- Medium Impact (10 – 14,9)
  - **Noise pollution**: Night shift truck movement will increase community noise complaints.

6.3.4 Mitigation strategies

The following mitigation strategies can be implemented to minimize the above-mentioned impacts:

- **Critical mitigation priorities**
  - Shift more ore transport to rail: Reduces road wear, congestion, and air pollution.
  - Improve road design and maintenance: Stronger road materials and dedicated mining truck lanes.
  - Traffic management: Separate truck and employee routes to improve safety and efficiency.
  - Emission reduction programs: Use low-emission or electric fleets, enforce dust suppression.

- **Secondary strategies**
  - Wildlife corridors and fencing: Prevent roadkill and habitat destruction.
  - Noise barriers and curfews: Limit nighttime truck operations near residential zones.
  - Community engagement programs: Address local complaints and mitigate disruptions.

6.3.5 Scoring table for each impact (after mitigation)

Table 6.10 below provides the scoring of each impact listed earlier in *Chapter 6.2.1,* after mitigation.

Table 6.10: Scoring of each impact (after mitigation)

IMPACT TYPE	SEVERITY (1 – 5)	DURATION (1 – 5)	EXTENT (1 – 5)	OVERALL CONSEQUENCE	FREQUENCY (1 – 5)	PROBABILITY (1 – 5)	OVERALL LIKELIHOOD	ENVIRONMENTAL SIGNIFICANCE (CONSEQUENCE x LIKELIHOOD)	CONFIDENCE LEVEL*
Traffic congestion	2	3	2	2,33	2	3	2,50	**5,83**	0,7
Road wear and tear	3	3	3	3,00	3	3	3,00	**9,00**	0,9
Safety and accidents	3	3	2	2,67	3	3	3,00	**8,00**	0,6
Air pollution	3	3	3	3,00	3	3	3,00	**9,00**	0,8
Noise pollution	2	3	2	2,33	2	3	2,50	**5,83**	0,6
Community disruptions	3	3	3	3,00	3	3	3,00	**9,00**	0,7
Wildlife disruption	3	3	3	3,00	3	3	3,00	**9,00**	0,6

* Note: The confidence level indicates the degree of certainty regarding the accuracy and reliability of the impact assessment, as well as the effectiveness of the proposed mitigation measures.

CHAPTER 7 SAFETY IMPACT ASSESSMENT

7.1 SAFETY HAZARDS

Increased vehicle volumes, particularly when heavy trucks used in mining operations share roads with passenger vehicles, pose several safety risks. These risks can impact both the mining operations and the general public. Below are some of the key safety risks associated with larger vehicle volumes on roads shared by mining trucks and passenger vehicles:

1. **Increased risk of collisions**
   - **Speed differentials**: Heavy trucks typically have much slower acceleration and deceleration capabilities than passenger vehicles. When mining trucks and passenger vehicles operate on the same roads, significant speed differences can lead to dangerous situations, such as rear-end collisions or vehicles trying to overtake in unsafe conditions.
   - **Limited visibility**: Larger trucks can obscure the view for passenger vehicles, particularly when overtaking or manoeuvring around curves, leading to higher collision risks. Additionally, drivers of smaller vehicles might have difficulty judging the speed or distance of large trucks, especially in areas with poor lighting or weather conditions.
   - **Turning radius and manoeuvrability**: Heavy trucks often require more space to turn, especially in intersections, and can block lanes or move unpredictably when manoeuvring, creating the potential for accidents, especially if passenger vehicles are in proximity.

2. **Road surface damage and hazardous conditions**
   - **Wear and tear on roads**: Heavy mining trucks can significantly damage road surfaces due to their weight, causing potholes, ruts, and other surface defects. These road conditions can be hazardous for passenger vehicles, leading to the risk of tire blowouts, loss of control, and accidents, especially at higher speeds.
   - **Dust and debris**: Mining trucks often create large amounts of dust, especially on unpaved or poorly maintained roads. This can reduce visibility for all road users and create slippery conditions, increasing the chances of accidents. Loose gravel or debris from mining trucks may also fall onto roads, leading to potential hazards for passenger vehicles.

- **Increased stopping distance**: Heavy trucks require a much longer distance to stop, particularly when fully loaded. If a mining truck suddenly stops, passenger vehicles following behind may not have enough time to react, leading to rear-end collisions.

3. **Driver fatigue and inattention**

- **Driver fatigue**: Mining trucks often operate over long distances and extended hours, which can lead to driver fatigue. Tired drivers of heavy trucks may be less alert, have slower reaction times, and be more prone to errors, especially in high-traffic or challenging road conditions.

- **Distracted driving**: The presence of large trucks on the road can distract drivers of passenger vehicles, particularly if they are trying to pass or navigate around trucks in unsafe conditions. This can lead to accidents as passenger vehicle drivers become more focused on navigating around the truck rather than the road ahead.

4. **Traffic congestion and flow disruption**

- **Slower traffic flow**: Large trucks, especially when loaded, move slower than passenger vehicles, creating traffic congestion. When passenger vehicles attempt to overtake in unsafe conditions, such as narrow roads or blind curves, there is an increased risk of accidents.

- **Difficulty in passing**: On roads with limited lanes or high traffic volumes, passenger vehicles might struggle to safely pass mining trucks. If the road is narrow or if there is insufficient passing space, drivers may make risky manoeuvres, leading to head-on collisions or sideswipe accidents.

5. **Pedestrian and cyclist hazards**

- **Pedestrian safety**: In areas near mining operations, pedestrians and cyclists might be exposed to additional risks if mining trucks and passenger vehicles share the same roads. Dust, noise, and reduced visibility from large trucks can make it difficult for pedestrians to judge the movement of traffic, increasing the risk of pedestrian accidents.

- **Cyclists**: Cyclists are particularly vulnerable when sharing roads with mining trucks due to their size, weight, and the difficulty truck drivers may have in seeing smaller road users. Large trucks might unintentionally create a dangerous situation by failing to notice cyclists or not maintaining a safe distance when passing them.

6. **Environmental factors and road conditions**

- **Weather-related risks**: Heavy trucks moving through adverse weather conditions (rain, snow, fog) may cause reduced traction, slippery surfaces, or even block roads due to breakdowns or accidents. When these trucks share roads with passenger vehicles, the overall safety risk increases because smaller vehicles might be more vulnerable to weather-related hazards or traffic delays caused by the trucks.

- **Flooding and mudslides**: Heavy trucks operating in areas with poor drainage systems, particularly near mining sites, can exacerbate flooding or mudslides. This can disrupt road conditions and create additional hazards for passenger vehicles that need to share the same roads.

7. **Interaction between mining operations and road users**

- **Frequent and unpredictable vehicle movements**: Mining operations can lead to unpredictable and frequent vehicle movements, such as trucks entering and leaving the mine site, making it difficult for passenger vehicles to anticipate traffic flow. Without proper warning signs and traffic management plans, these movements increase the risk of accidents.

- **Traffic jams in high-traffic areas**: Mining vehicles traveling to and from the mining site can cause significant congestion, especially in areas where mining trucks are required to share roads with local or commuter traffic. In some cases, vehicles might be forced to wait behind large trucks, increasing the likelihood of impatience and risky overtaking manoeuvres.

8. **Operational delays and increased risk exposure**

- **Increased reaction times**: Mining trucks might have to stop or slow down unexpectedly, especially when dealing with issues like weight distribution, load security, or technical failures. These unexpected delays can increase the likelihood of accidents for passenger vehicles that are not anticipating sudden changes in truck behaviour.

- **Night operations**: Many mining trucks operate at night when passenger vehicle traffic is lower, but the reduced visibility can create significant safety risks. Large trucks might not be as visible as passenger vehicles, and lighting conditions might not adequately illuminate both the trucks and the surrounding roads, which increases the chances of collisions.

7.2 MITIGATION FOR SAFETY

To reduce these safety risks, mining operations can implement various strategies:

- **Dedicated truck routes**: Where possible, establish specific routes for mining trucks to prevent them from sharing busy public roads with passenger vehicles.

- **Traffic Management Plans**: Develop and enforce Traffic Management Plans that include speed limits, warning signs, designated truck lanes, and timing restrictions to minimize interactions between mining trucks and passenger vehicles.

- **Safety training for drivers**: Ensure that both truck drivers and passenger vehicle drivers are trained in safe driving practices around large vehicles. Mining truck drivers should receive training on how to share the road safely with passenger vehicles.

- **Road maintenance**: Regular maintenance and repair of roads used by mining trucks to prevent surface damage, which could create hazards for passenger vehicles.

- **Enhanced signage and visibility**: Install clear signage and lighting, particularly in areas where mining trucks and passenger vehicles are likely to encounter one another. This includes warning signs for slow-moving vehicles, truck entry/ exit points, and blind spots.

- **Public awareness campaigns**: Educate local communities and road users about the increased presence of heavy trucks on roads near mining sites, as well as the precautions they should take to drive safely around these vehicles.

By addressing these risks through proactive safety measures and cooperation between mining companies, government authorities, and road users, the dangers of increased vehicle volumes can be mitigated.

7.3 ACCIDENT HISTORY

As previously mentioned, the accident history of the R385, near the proposed Makganyane Mine was not available for analysis, as specific accident statistics and high-profile incident records were not readily available from local authorities or traffic monitoring bodies. This limitation hindered the ability to conduct a comprehensive accident analysis for the area.

CHAPTER 8 ENVIRONMENTAL CONSIDERATIONS

8.1 AIR QUALITY AND EMISSIONS IMPACT

Traffic from mining operations adversely affects air quality due to vehicle emissions and dust release. Diesel-powered haul trucks and other mining equipment emit harmful pollutants, such as carbon dioxide (CO_2), nitrogen oxides (NO_x), and particulate matter (PM), which contribute to air pollution and respiratory issues. Additionally, dust from unpaved roads and hauling operations increases fine particulate pollution (PM10 and PM2.5), which can degrade air quality and pose health risks to workers and nearby communities. The combination of emissions and dust makes mining traffic a significant source of air pollution, affecting both human health and the environment.

8.2 NOISE IMPACTS

The noise pollution caused by mining activities is largely due to the continuous movement of heavy machinery such as haul trucks, excavators, and bulldozers. These vehicles produce loud engine noises, especially during acceleration, braking, and when carrying heavy loads. The ongoing traffic, along with the operation of mining equipment, creates persistent noise throughout the day and sometimes at night, disrupting nearby communities and wildlife. The cumulative impact of continuous vehicle noise can lead to sleep disturbances, stress, and health problems for people living in surrounding areas, while also disturbing the natural habitats of local wildlife.

8.3 DUST GENERATION

Traffic from mining operations plays a major role in dust creation, especially when heavy vehicles and haul trucks operate on unpaved or inadequately maintained roads. The movement of these large vehicles stirs up dust, which contains fine particulate matter (PM10 and PM2.5) that can be carried by the wind and settle on nearby surfaces, including water bodies and vegetation. This dust not only degrades air quality but can also affect soil health, water quality, and respiratory health in nearby communities. The continuous movement of mining traffic exacerbates dust accumulation, making it a major concern for both the environment and public health.

8.4 EFFECTS ON WATER QUALITY

Traffic from mining operations can adversely affect water quality by allowing contaminants to run off from roads and vehicles. As haul trucks and other heavy vehicles move along mining roads, they can release oils, fuels, and dust, which, when it rains, wash into nearby water bodies. The increased sedimentation from eroded roads can also clog waterways, disrupting aquatic habitats and lowering water clarity. These pollutants can degrade water quality, harm aquatic ecosystems, and pose risks to human health, especially in communities relying on nearby water sources. Overall, mining traffic contributes to the contamination and alteration of water systems.

8.5 VEGETATION AND WILDLIFE IMPACT

Traffic produced by mining operations can negatively impact plant life and animal species. The constant movement of heavy vehicles along mining roads can damage plant life by compacting soil, disturbing roots, and crushing vegetation. Additionally, the dust and pollutants from traffic can settle on plants, reducing their ability to photosynthesize and potentially poisoning them. For wildlife, the noise, dust, and physical disturbance from traffic can lead to habitat fragmentation, stress, and displacement. Animals may be forced to move away from their natural habitats, affecting their feeding, breeding, and migration patterns. The cumulative impact of mining traffic disrupts local ecosystems and threatens biodiversity.

CHAPTER 9 MITIGATION MEASURES

9.1 ROAD UPGRADES AND IMPROVEMENTS

Based on the findings of the capacity and level of service analyses (*Chapter 5*), limited road upgrades are recommended to accommodate projected traffic demand and ensure safe and efficient access to the proposed Makganyane Mine. The most critical constraint is identified on the gravel section of the R385, beyond 12 km north of Postmasburg, where capacity shortfalls are anticipated during the operational and decommissioning phases.

Recommended improvements include:

- Widening of shoulders and access improvements at the proposed mine entrance to accommodate turning movements by heavy vehicles:
  - Design the access road with a minimum carriageway width of 7,0 m to allow two 3,5 m wide 36-ton trucks to pass each other comfortably with adequate clearance,
  - Provide bellmouth (entrance flare) radii with a minimum of 15 m on both entry and exit to facilitate smooth turning manoeuvres of heavy trucks and minimize off-tracking, and
  - Include shoulders of at least 1,5 m width on either side of the access road to accommodate vehicle recovery and enhance operational safety.
- Installation of appropriate signage and markings to support visibility, especially at the mine access point, and
- Regular maintenance schedules should be implemented to repair road wear and tear and ensure the safe passage of all vehicles.

These recommended upgrades are intended to support the safe integration of mine-related traffic into the existing road network. The implementation of such measures form part of the broader mitigation strategy, discussed in the subsequent sub-chapters.

9.2 TRAFFIC MANAGEMENT MEASURES

To minimize disruption caused by construction traffic, from mining activities, several mitigation measures can be implemented. These include:

- **Detours and alternative routes**: Designating specific haul routes for mining vehicles, ensuring temporary detours are clearly marked to guide traffic around construction areas and avoid residential or sensitive zones.

- **Signage and traffic control**: Installing clear, consistent signage to warn drivers of construction activities, speed limits, and detours. Variable message signs can provide real-time updates on road conditions and traffic changes.

- **Working hours restrictions**: Limiting construction traffic to off-peak hours, such as early mornings or late evenings, to reduce congestion. Nighttime operations should be minimized in noise-sensitive areas, and shifts can be used to spread traffic evenly throughout the day.

- **Traffic flow optimization**: Employing traffic control personnel at critical points, staggering vehicle movements, and managing queues to ensure smooth traffic flow and minimize bottlenecks.

- **Public awareness and communication**: Providing local residents and businesses with timely information about traffic patterns, detours, and road closures. Real-time updates via websites or mobile apps can help drivers plan alternative routes.

- **Monitoring and evaluation**: Continuously monitoring traffic conditions, using cameras or personnel to adjust measures as needed, and setting up a feedback mechanism for the public to report issues.

- **Implementation of a comprehensive Traffic Management Plan (TMP)**: The TMP will coordinate all traffic-related mitigation measures, including designated haul routes, signage, scheduling of vehicle movements, and emergency response protocols to ensure the safe and efficient movement of all vehicles associated with mining operations.

By applying these measures, mining operations can minimize traffic disruptions, reduce congestion, and ensure smoother, safer transportation routes for both construction vehicles and the public.

9.3 EMPLOYEE TRANSPORTATION SOLUTIONS

To reduce the number of individual vehicles on roads, several employee transportation solutions can be implemented:

- **Carpooling and ride-sharing programs**: Encourage employees to carpool or use ride-sharing services, reducing the number of vehicles on the road. This can be facilitated by providing ride-matching services or designated carpool parking areas.

- **Shuttle services**: Provide shuttle buses or vans to transport employees to and from the mining site, reducing the need for individual vehicles. These shuttles can be scheduled to align with shift changes and accommodate many workers at once.

- **Flexible work hours**: Implement staggered work shifts or flexible working hours to reduce peak-time congestion on roads. This can help minimize traffic bottlenecks and reduce the number of vehicles on the roads during busy times.

- **Encourage use of public transportation**: Promote the use of public transportation options where available, by providing subsidies or incentives for employees who use buses, or other public transport services to reach the mining site.

- **Telecommuting and remote work**: Where feasible, allow employees to work remotely for part of their shifts or complete administrative tasks off-site, reducing the need for daily commuting.

By implementing these solutions, mining operations can reduce traffic congestion, lower emissions, and improve overall transportation efficiency, benefiting both the environment and the surrounding communities.

9.4 SAFETY MEASURES

To enhance safety at mining sites, several safety measures and infrastructure improvements can be implemented:

- **Warning signs**: Clear and visible warning signs should be placed at strategic locations to alert drivers about potential hazards, such as steep slopes, sharp turns, or heavy truck traffic. These signs can help prevent accidents by preparing drivers for specific road conditions.

- **Pedestrian crossings**: Designating safe pedestrian crossings near high-traffic areas or work zones ensures the safety of employees and visitors walking around the site. Marked crossings, with proper signage and barriers, help keep pedestrians separated from vehicles.

- **Guardrails and barriers**: Installing guardrails or barriers in high-risk areas, such as sharp bends, steep inclines, or near drop-offs, can prevent vehicles from leaving the road and help protect employees and vehicles from accidents.

- **Speed limits and monitoring**: Establishing speed limits tailored to the specific conditions of the mining site and enforcing them through speed bumps, radar signs, or speed monitoring systems can help reduce the likelihood of accidents caused by excessive speed.

- **Adequate lighting**: Ensuring proper lighting for roads, walkways, and work areas, particularly for night-time operations, improves visibility and reduces the risk of accidents in low-light conditions.

- **Safety training for drivers**: Ensure that both truck drivers and passenger vehicle drivers are trained in safe driving practices around large vehicles.

- **Emergency access routes**: Clearly marked emergency access routes should be established to ensure that emergency vehicles can quickly reach any part of the mining site in case of an accident or incident.

By implementing these safety measures, mining sites can significantly reduce the risk of accidents, enhance worker and visitor safety, and create a safer working environment.

9.5 ENVIRONMENTAL MITIGATION STRATEGIES

To mitigate the environmental impacts of mining activities, several measures can be implemented to address air quality, noise, dust generation, water quality, and effects on vegetation and wildlife:

- <u>Air quality and emissions</u>:
  - **Use of cleaner technology**: Transitioning to cleaner, more efficient vehicles and equipment (e.g., electric trucks or hybrid machines) can reduce harmful emissions.
  - **Regular vehicle maintenance**: Ensuring that mining vehicles are well-maintained can minimize emissions.
  - **Dust suppression**: Using dust suppressants and water spraying on roads helps reduce airborne particulate matter.

- <u>Noise impacts</u>:
  - **Sound barriers and landscaping**: Installing barriers or planting vegetation around mining sites can help reduce noise pollution.
  - **Time restrictions**: Limiting mining operations to certain hours can minimize disruption to nearby communities.
  - **Quieter equipment**: Employing quieter machinery or retrofitting existing equipment with noise-reduction technologies can help lessen noise levels.

- <u>Dust generation</u>:
  - **Paving roads**: Paving roads or using dust control measures on unpaved roads can significantly reduce dust.
  - **Speed control**: Implementing speed limits on mining roads can reduce dust created by vehicle movement.

  - **Vegetative cover**: Planting vegetation or using soil stabilizers on disturbed areas helps reduce windblown dust.

- **Water quality:**
  - **Stormwater management**: Installing sediment traps, detention ponds, and proper drainage systems helps manage runoff and prevent contamination of water bodies.
  - **Regular road maintenance**: Maintaining roads and controlling runoff can reduce the washing of pollutants into nearby water systems.
  - **Spill containment**: Implementing systems for containing and cleaning up oil, fuel, and chemical spills can prevent water pollution.

- **Vegetation and wildlife impact:**
  - **Habitat restoration**: Rehabilitating disturbed areas by planting native vegetation can help restore habitats.
  - **Wildlife corridors**: Creating wildlife corridors around mining sites can allow animals to move freely and avoid areas of heavy traffic.
  - **Traffic management**: Restricting mining vehicle access to certain areas and using quieter vehicles can minimize disturbances to wildlife and vegetation.

By implementing these mitigation measures, mining operations can reduce their environmental footprint, protect nearby communities, and help conserve ecosystems.

CHAPTER 10 COMMUNITY AND STAKEHOLDER CONSULTATION

10.1 ENGAGEMENT WITH LOCAL COMMUNITIES

To effectively engage with local residents and communities affected by the increased traffic from mining activities, the mining company should establish open channels of communication and actively involve the community in decision-making processes. This can be achieved by holding regular public meetings or forums to inform residents about upcoming projects, traffic patterns, and potential disruptions. Providing clear contact information for community representatives or a dedicated helpline allows residents to voice concerns and receive timely updates.

The company can also work with local leaders and stakeholders to develop traffic management plans, such as detours or adjusted working hours, that address community needs. Additionally, offering compensation or benefits, such as improvements to local infrastructure or community programs, can help foster goodwill and demonstrate a commitment to minimizing negative impacts. Engaging with residents in a transparent and responsive manner helps build trust and ensures that mining activities are conducted with consideration for the well-being of the surrounding communities.

10.2 STAKEHOLDER FEEDBACK

Stakeholder feedback from local governments, transport authorities, and emergency services is crucial in addressing traffic-related concerns arising from mining activities. Local governments can provide insights into how mining traffic impacts community roads, residential areas, and local infrastructure, and may recommend measures like road upgrades, improved signage, or altered traffic patterns to reduce disruptions.

Transport authorities, with their expertise in traffic flow and safety, can offer valuable recommendations for optimizing haul routes, controlling vehicle speeds, and ensuring safe intersections. Emergency services can highlight potential hazards related to increased traffic, such as access challenges for emergency vehicles, and suggest the establishment of clear emergency routes and response protocols. Incorporating their input into the Traffic Management Plan ensures a more comprehensive approach that minimizes risks, enhances public safety, and fosters collaboration between the mining company and the wider community.

CHAPTER 11 REGULATORY REQUIREMENTS AND GUIDELINES

11.1 LOCAL TRAFFIC REGULATIONS AND STANDARDS

In South Africa, mining activities and operations must adhere to several local traffic regulations and standards to ensure safety and compliance with the law. These regulations are primarily governed by a combination of national legislation, local government by-laws, and industry-specific standards. Below are the key traffic regulations and standards that mining operations in South Africa should follow:

1. **National Road Traffic Act (Act No. 93 of 1996)**

The National Road Traffic Act sets the general framework for traffic regulations in South Africa, including the use of public roads for mining-related activities. Some key provisions include:

- **Vehicle registration and licensing**: All vehicles, including those used for mining operations, must be properly registered and licensed.
- **Driver's licences**: Drivers operating vehicles related to mining operations must have the appropriate licenses for the type of vehicle they are driving. Including heavy-duty trucks or specialized mining vehicles.
- **Traffic signs and signals**: Mining operations must comply with road traffic signs and signals, including speed limits, warning signs, and other relevant signage, especially when trucks are transporting materials on public roads.

2. **Mine Health and Safety Act (MHSA) (Act No. 29 of 1996)**

The MHSA ensures that mine operations are conducted safely, including road safety on mine sites. Key traffic-related aspects under this Act include:

- **Traffic Management Plans**: Mining companies must develop and implement Traffic Management Plans to ensure the safe movement of vehicles within mining sites. These plans should address pedestrian and vehicle segregation, speed control, vehicle maintenance, and road signage.
- **Safety standards**: Mining vehicles must meet specific safety standards, such as adequate lighting, signalling systems, and driver safety equipment.

- **Hazardous conditions**: The Act requires the identification and mitigation of hazardous conditions on mining roads, including dust control, proper lighting, and signage to minimize accidents.

- **Training and competence**: Drivers of mining vehicles must be adequately trained in road safety and operation of the vehicles.

3. **The Occupational Health and Safety Act (OHS Act) (Act No. 85 of 1993)**

This Act places emphasis on the overall health and safety of workers, which includes traffic safety within mining operations. Specific provisions relevant to traffic safety include:

- **Risk assessments**: Mining companies are required to conduct risk assessments on their transportation activities, including vehicle movements on site and transportation of materials to and from the site.

- P**ersonal Protective Equipment (PPE)**: Workers involved in vehicle operations must wear appropriate PPE, such as reflective vests, hard hats, and safety boots.

- **Emergency response plans**: Emergency plans must be developed for accidents or incidents involving mining vehicles, including procedures for vehicle collisions or breakdowns.

4. **Road Traffic Management Corporation (RTMC) Regulations**

The RTMC is responsible for overseeing road traffic management in South Africa, including ensuring that heavy vehicles, such as those used in mining, comply with the road traffic regulations. Relevant provisions include:

- **Weight limits**: The RTMC enforces weight restrictions on mining trucks transporting materials on public roads, ensuring that vehicles are not overloaded.

- **Vehicle inspections**: Mining vehicles must undergo regular inspections to ensure they meet safety standards and roadworthiness.

- **Movement permits**: Special permits may be required for the transportation of oversized or heavy loads, which are common in mining operations.

5. South African National Standards (SANS)

- **SANS 3001**: This standard governs the safety of road traffic in mining operations, providing guidance on the safe design of roads, signage, and safety measures to prevent accidents. It also addressed the prevention of dust and maintenance of good road conditions.

- **SANS 10262**: Provides guidelines for the safety of vehicles, focusing on the structural design of vehicles used in mining operations.

- **SANS 313**: Deals with vehicle inspection requirements, ensuring that vehicles used in mining operations comply with safety standards.

6. Local Municipal By-Laws

Municipalities in South Africa may have their own traffic and transport regulations for mining operations, particularly when it comes to the use of public roads for the transportation of materials. These by-laws can include:

- **Speed limits**: Local councils may impose stricter speed limits on mining vehicles passing through urban or populated areas.

- **Road usage fees**: Certain municipalities may charge road usage fees or impose restrictions on the times during which mining vehicles can operate.

- **Weight and load restrictions**: Some local authorities may have additional load restrictions or enforce axle load limits for mining vehicles travelling on municipal roads.

7. Environmental Management and Traffic Control

Mining companies are also required to comply with environmental management and traffic control measures, which are part of the mining environmental management plans:

- **Dust control**: The management of dust on mining roads is a key concern. Dust suppression measures must be implemented to minimize air pollution, which can impact both workers' health and surrounding communities.

- **Traffic flow management**: To reduce congestion and ensure safe vehicle movements, mining companies must implement traffic flow systems, including designated routes for heavy vehicles and segregated lanes for pedestrians and smaller vehicles.

- **Road maintenance**: Mining companies are responsible for maintaining the roads used in their operations, both on-site and off-site, to prevent accidents due to poor road conditions.

8. <u>**Public Road Safety**</u>

When transporting materials from mining sites to processing plants or markets, the following must be adhered to:

- **Complying with road traffic safety standards**: Mining companies must adhere to public road safety rules, including the use of appropriate vehicle markings, lights, and signalling systems to ensure the safety of all road users.

- **Driver fatigue management**: Drivers should not be allowed to operate mining vehicles for extended hours beyond regulated limits, with regular rest breaks mandated to prevent fatigue-related accidents.

- **Speed restrictions**: Mining vehicles should be driven within the legal speed limits and should adjust speed based on weather, road conditions, and other traffic factors.

Mining companies in South Africa must comply with a range of regulations governing traffic safety, both on the mine site and on public roads. Adherence to national laws, safety standards, and local regulations is essential to ensure the safety of workers, the public, and the environment. The implementation of proper Traffic Management Plans, the maintenance of mining vehicles, and the regulation of vehicle operations are all necessary to prevent accidents and ensure smooth mining operations.

11.2 ENVIRONMENTAL REGULATIONS

Adherence to environmental laws regarding emissions, noise, and road usage is essential for ensuring that mining activities are conducted in an environmentally responsible manner. Regulations often require mining companies to limit air pollutants, such as particulate matter and vehicle emissions, through measures like dust control, vehicle maintenance, and the use of cleaner technologies.

Noise regulations mandate that companies reduce noise pollution by implementing noise mitigation strategies, such as sound barriers or limiting operations during certain hours. Additionally, road usage regulations ensure that mining traffic follows designated routes, adheres to speed limits, and minimizes damage to public infrastructure, with proper signage and traffic management in place.

By complying with these above-mentioned laws, mining companies help protect public health, minimize environmental impacts, and maintain positive relationships with local communities and authorities. Regular monitoring and reporting are also typically required to ensure ongoing compliance and address any issues promptly.

11.3 MINING-RELATED PERMITS AND APPROVALS

For the operation of mining activities, several transport-related permits and approvals are typically required by local authorities to ensure safety, environmental protection, and minimal disruption to communities. These permits and approvals may include:

- **Road use permits**: Mining companies may need permits to use public roads for transporting materials, particularly if the roads are not designed for heavy vehicle traffic. These permits regulate the size, weight, and frequency of vehicles to prevent road damage and ensure public safety.

- **Oversized load permits**: If mining trucks or equipment exceed standard size and weight limits, oversized load permits are required. These permits often come with specific conditions, such as escort vehicles, route planning, and timing restrictions to minimize traffic disruption.

- **Traffic Management Plans (TMPs)**: Local authorities may require mining companies to submit a detailed Traffic Management Plan outlining how mining traffic will be controlled, including proposed routes, speed limits, signage, detours, and any measures to mitigate impacts on local traffic and communities.

- **Environmental permits**: These permits address the environmental impacts of transport-related activities, such as emissions from mining vehicles or dust from unpaved roads. Mining companies may need approval for dust control measures, vehicle emissions standards, and monitoring programs to ensure compliance with air quality regulations.

- **Permit for road construction/ upgrades**: If the mining operation requires the construction or upgrading of access roads, permits from local transportation or public works authorities are typically needed. These permits ensure that the roads meet safety and infrastructure standards.

- **Noise and vibration permits**: Local governments may require permits or approval for mining-related traffic activities that generate noise or vibration, especially in residential areas or environmentally sensitive locations. Restrictions on operating hours, noise limits, and mitigation measures may be imposed.

- **Safety and emergency access approvals**: In some cases, local authorities may require the establishment of emergency routes or safety measures for mining operations, ensuring that access for emergency vehicles is maintained. This may include coordination with emergency services to ensure preparedness.

- **Public consultation approvals**: Depending on the local regulations, mining companies may be required to hold public consultations or hearings with local residents, transport authorities, and other stakeholders to discuss potential traffic disruptions and mitigation strategies before receiving approval to proceed.

These permits and approvals are essential for managing the safe and responsible movement of mining traffic and ensuring compliance with local laws and environmental regulations. They help minimize the impact of mining activities on local infrastructure, communities, and the environment.

CHAPTER 12 MONITORING AND REPORTING

12.1 ONGOING MONITORING

Ongoing monitoring of mining activities is crucial to assess their environmental and social impacts, particularly in relation to traffic conditions. A comprehensive traffic monitoring program can help identify and address potential issues such as congestion, road damage, and safety hazards. This program should include regular data collection on vehicle counts, traffic flow, vehicle speeds, and any incidents involving mining traffic. Additionally, it should monitor key areas such as intersections, haul routes, and nearby communities for signs of wear and tear or traffic disruptions.

The program can involve the use of traffic cameras, GPS tracking systems, and manual traffic counts, along with regular inspections of roads to detect any damage caused by mining vehicles. Engaging with local communities to gather feedback on traffic conditions and disruptions can also provide valuable insights. The collected data should be analysed regularly to identify patterns, address concerns proactively, and adjust Traffic Management Plans (TMPs) as needed to minimize negative impacts. By implementing such a program, mining companies can ensure that traffic-related issues are continuously monitored and mitigated, promoting both operational efficiency and community well-being.

12.2 POST-CONSTRUCTION REVIEW

Conducting a post-implementation review is essential to evaluate the effectiveness of mitigation measures once the mine is operational. This review should involve assessing the impact of traffic management strategies, emissions control, noise reduction, and other measures implemented to address environmental and community concerns. Key performance indicators, such as traffic flow, accident rates, air quality, and noise levels, should be monitored to determine whether the mitigation strategies have successfully minimized disruption and met regulatory requirements.

Additionally, feedback from local communities, stakeholders, and employees can provide valuable insights into any new issues that may have emerged after the mine's operations have begun. This may include unexpected traffic congestion, changes in environmental conditions, or unforeseen impacts on local infrastructure. By identifying and addressing any new challenges early, the company can make necessary adjustments to its operations or mitigation plans to further minimize negative impacts, ensuring continued compliance and fostering positive relationships with the community. Regular post-implementation reviews help maintain the long-term sustainability of mining activities and promote proactive problem-solving.

CHAPTER 13 CONCLUSION

13.1 SUMMARY OF FINDINGS

This Traffic Impact Assessment (TIA) has evaluated the potential transport implications associated with the proposed Makganyane Mine, located approximately 25 km north-west of Postmasburg, with access from the R385.

The report examined a wide range of components, beginning with a project description, followed by an analysis of existing traffic conditions, which revealed a 2023 ADT of 3 705 vehicles per day and 546 heavy vehicles, based on data from the permanent counting station (22062: Postmasburg New).

The proposed mine development was analysed across three lifecycle phases – construction (2028), operational (2038), and decommissioning (2043) – with detailed projections of generated trips during each phase. The traffic operations assessment, including capacity and LOS analyses based on *HCM* and *TMH 16 Volume 2* guidelines, confirmed that the gravel section of the R385 may experience capacity constraints during peak operations.

A cumulative traffic analysis identified that mine-related traffic, when added to background growth, may lead to LOS C during the operational and decommissioning phases. The volume-to-capacity ratios of 0,84 and 0,86 suggest that the road will operate near capacity. The safety impact assessment, while limited by the absence of crash data, identified potential safety risks associated with increased heavy vehicle activity and gravel road conditions.

Environmental considerations, including dust, noise, and road surface degradation from increased truck movements, were highlighted as potential concerns. Mitigation measures were proposed to address capacity and safety risks, including selective paving, signage, and geometric improvements at the access point.

The project also considered community and stakeholder engagement, regulatory compliance with provincial and national road planning frameworks, and the need for ongoing monitoring and reporting throughout the project lifecycle.

13.2 RECOMMENDATIONS

Based on the findings of the assessment, the following recommendations are proposed to manage the traffic impact of the Makganyane Mine responsibly and sustainably:

- Routine maintenance of the R385 should be carried out throughout the lifecycle of the mine to ensure the continued safe and efficient operation of the road, particularly given the anticipated increase in heavy vehicle usage.

- Implement access road enhancements at the proposed mine access point, including:
  - Widening of the access road to at least 7,5 m to allow two 36-ton trucks to pass safely in opposing directions without encroaching onto road shoulders,
  - Designing bellmouth radii of a least 15 m to accommodate turning movements by large vehicles, ensuring smooth and safe entry/ exit at the mine,
  - Installing appropriate signage and road markings such as advance warning signs (e.g., "Trucks Turning", "Reduce Speed Ahead"), stop/ yield control signage at the access point, edge line markings and chevron signs for improved visibility, and
  - Ensuring adequate sight distance in both directions based on design speeds, with vegetation clearance and grading adjustments as needed.

- Establish a traffic monitoring programme, particularly during peak operational years, to evaluate performance against projected conditions.

- Engage with local stakeholders regularly to address community concerns and incorporate feedback into ongoing planning.

- Ensure compliance with regulatory requirements, including those set out in *TMH 16*, the *Highway Capacity Manual*, and provincial road agency guidelines.

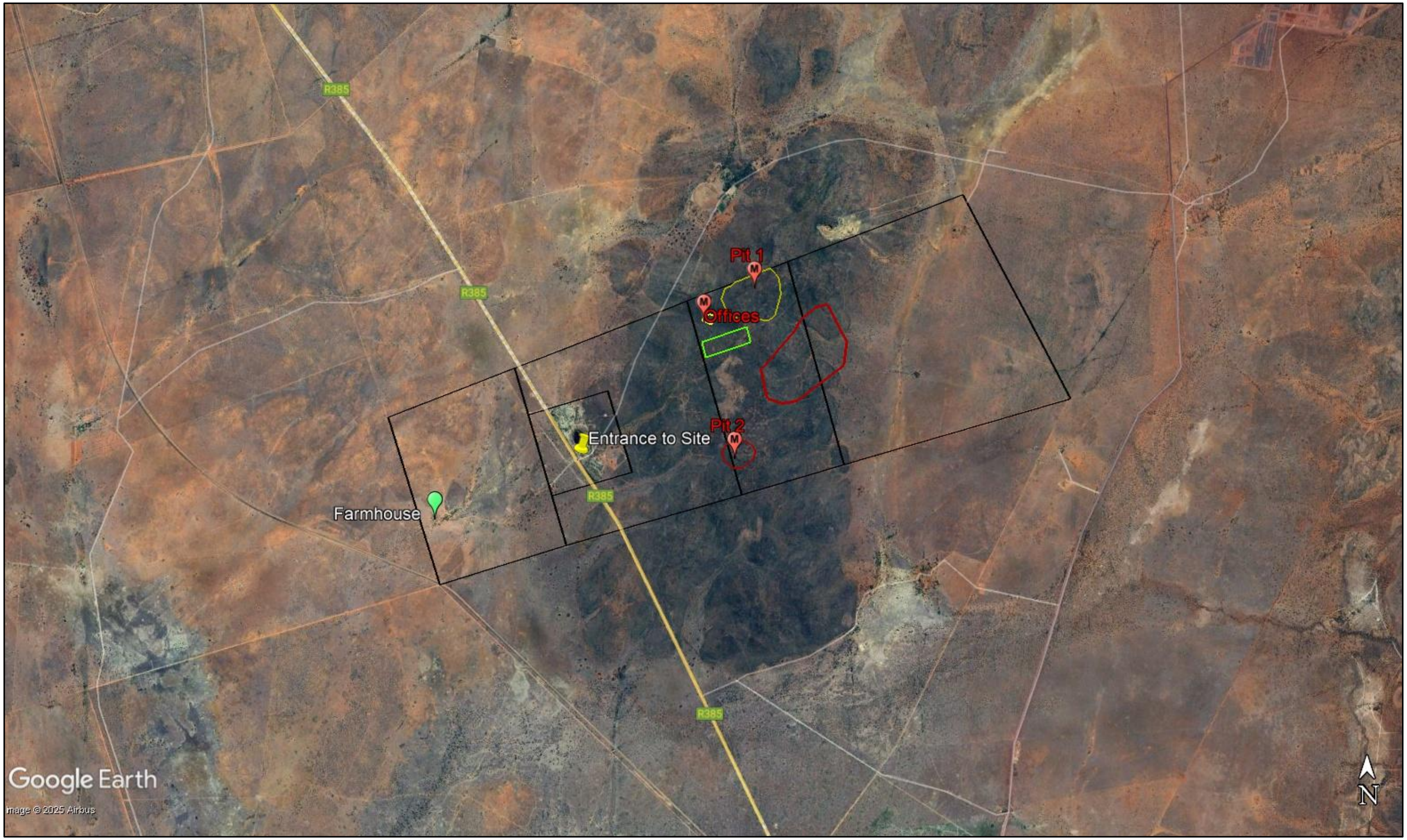
- Incorporate environmental controls, such as dust suppression and surface maintenance, to minimize the impact of mining traffic on surrounding areas.

- Review mitigation measures periodically, adjusting interventions as needed based on actual traffic volumes, safety performance, and road conditions.

These actions, if implemented in line with the phased development of the mine, will help to ensure safe, efficient, and sustainable transport outcomes for the broader Postmasburg region.

ANNEXURE A:

LAYOUT PLAN


R385
R385
Pit 1
Offices
Entrance to Site
Pit 2
R385
Farmhouse
R385
Google Earth
Image © 2025 Airbus
N

Layout plan

ANNEXURE B:

TRAFFIC DATA

STATION INFORMATION

Lane No	1	2
Rev.Lane	2	1
Position	1	1
Straddle Set	0/2	1/0
Direction	E	W
T.Stream	1	2
Rev.TStream	2	1
Vehicle Data		
Arrival Time	At	At
Speed	Sp	Sp
Length	Ln	Ln
Axle Data		
Weight Data		
Offscale		
S/D Tyre		
IN Lane		
Description	To Postmasburg	To Beeshoek

Site Identifier : 22062
Site Number : 22062
Site Name : Postmasburg New
Site Description : Between Beeshoek & Postmasburg
Owner : Northern Cape Roads
Site Type : Permanent
Physical Lanes : 2
Logical Lanes : 2
GPS Longitude : 23.011793E
GPS Latitude : -28.298867S
Installation Date :
Termination Date :
Speed Limit : 80.0km/hr
Companion Site :
Province : Northern Cape
Municipality : (NC) Tsantsabane LM
Responsibility : N/A
SANRAL Region : Western
Route : R385
Road : MR882
Section :
Distance : 0.000
Road Description : MR882 km

No	Direction Description	Direction
01	To Postmasburg	East
02	To Beeshoek	West

STATION INFORMATION

Site Identifier	: 22062	***Site Number***	: 22062
Site Name	: Postmasburg New		
Site Description	: Between Beeshoek & Postmasburg		
Owner	: Northern Cape Roads	***Site Type***	: Permanent
Physical Lanes	: 2	***Logical Lanes***	: 2
GPS Longitude	: 23.011793E	***GPS Latitude***	: -28.298867S
Installation Date	:	***Termination Date***	:
Speed Limit	: 80.0km/hr	***Companion Site***	:
Province	: Northern Cape	***Municipality***	: (NC) Tsantsabane LM
Responsibility	: N/A	***SANRAL Region***	: Western
Route	: R385	***Road***	: MR882
Section	:	***Distance***	: 0.000
Road Description	: MR882 km		

Ln	Lane Description	Direction	Pos	Log Info	RLn	Rev.Log Lane Desc.
01	To Postmasburg	East	1	AT,Sp,Ln	02	
02	To Beeshoek	West	1	AT,Sp,Ln	01	

TRAFFIC HIGHLIGHTS OF SITE 22062				
1.1	Site Identifier			22062
1.2	Site Name			Postmasburg New
1.3	Site Description			Between Beeshoek & Postmasburg
1.4	Road Description	Route : R385	Road : MR882 Section :	Distance : 0.0km
1.5	GPS Position			23.011793E -28.298867S
1.6	Number of Lanes			2
1.7	Station Type			Permanent
1.8	Requested Period			2023/01/01 - 2023/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2023/03/29 - 2023/12/31
1.11	Actual available good data (hours)			6641
1.12	Percentage good data available for requested period			75.8
		To Postmasburg	To Beeshoek	Total
2.1a	Total number of vehicles (counted)	506205	519186	1025391
2.1b	Total number of vehicles (projected for period)	667663	684784	1352447
2.2	Average daily traffic (ADT)	1829	1876	3705
2.3	Average daily truck traffic (ADTT)	263	283	546
2.4	Percentage of trucks	14.4	15.1	14.7
2.5	Truck split % (short:medium:long)	43 : 13 : 44	40 : 13 : 47	41 : 13 : 46
2.6	Percentage of night traffic (20:00 - 06:00)	8.7	13.2	11.0
3.1	Speed limit (km/hr)			80
3.2	Average speed (km/hr)	89.1	90.1	89.6
3.3	Average speed - light vehicles (km/hr)	90.8	92.0	91.4
3.4	Average speed - heavy vehicles (km/hr)	79.1	79.6	79.4
3.5	Average night speed (km/hr)	86.9	93.7	91.0
3.6	15th centile speed (km/hr)	73.6	73.6	73.6
3.7	85th centile speed (km/hr)	105.9	110.0	108.0
3.8	Percentage vehicles in excess of speed limit	70.0	67.8	68.9
4.1	Percentage vehicles in flows over 600 vehicles/hr	9.0	27.6	22.5
4.2	Highest volume on the road (vehicles/hr)		2023/06/14 07:00:00	1023
4.3	Highest volume in the To Postmasburg (vehs/hr)		2023/09/11 17:00:00	692
4.4	Highest volume in the To Beeshoek (vehs/hr)		2023/06/14 07:00:00	940
4.5	Highest volume in a lane (vehicles/hr)		2023/06/14 07:00:00	940
4.6	15th highest volume on the road (vehicles/hr)		2023/08/30 07:00:00	951
4.7	15th highest volume in the To Postmasburg direction (vehs/hr)		2023/06/27 17:00:00	660
4.8	15th highest volume in the To Beeshoek direction (vehs/hr)		2023/04/14 07:00:00	876
4.9	30th highest volume on the road (vehicles/hr)		2023/05/16 07:00:00	933
4.10	30th highest volume in the To Postmasburg direction (vehs/hr)		2023/09/13 17:00:00	637
4.11	30th highest volume in the To Beeshoek direction (vehs/hr)		2023/05/09 07:00:00	857
5.1	Percentage of vehicles less than 2s behind vehicle ahead	19.9	23.9	21.9
6.1	Total number of heavy vehicles (projected for period)	96006	103294	199300
6.2	Estimated average number of axles per truck	4.6	4.7	4.7
6.3	Estimated truck mass (Ton/truck)	26.4	27.1	26.8
6.4	Estimated average E80/truck	2.2	2.3	2.3
6.5	Estimated daily E80 on the road			1237
6.6	Estimated daily E80 in the To Postmasburg direction			585
6.7	Estimated daily E80 in the To Beeshoek direction			652
6.8	Estimated daily E80 in the worst To Postmasburg lane			585
6.9	Estimated daily E80 in the worst To Beeshoek lane			652
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.5 : 2.1 : 3.9)

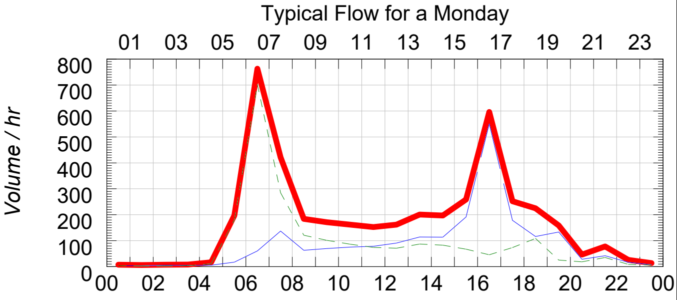
Typical Week Volume Report

Site : 22062 - Postmasburg New
Province & District : Northern Cape - (NC) Tsantsabane L
Actual Period : 2023/03/29 to 2023/12/31
Classification : RSA Lgt/Hvy
Day Type : Normal Day&Fixed Public Holiday+

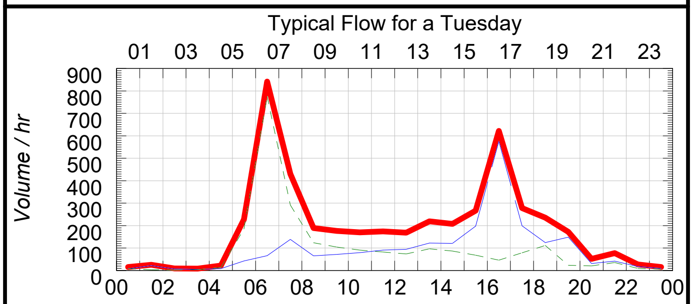
Total
To Postmasburg
To Beeshoek

Total
Light
Heavy

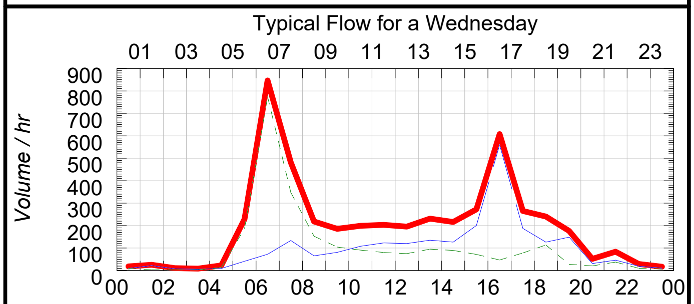
Typical Flow for a Monday



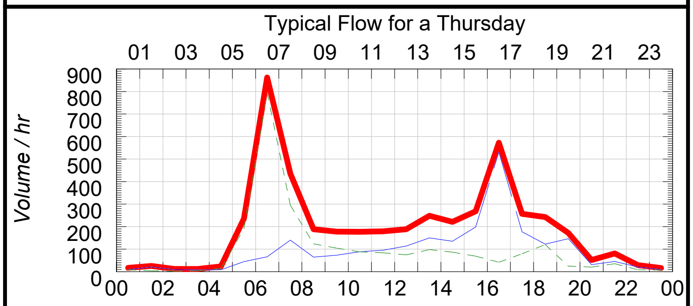
Typical Flow for a Tuesday



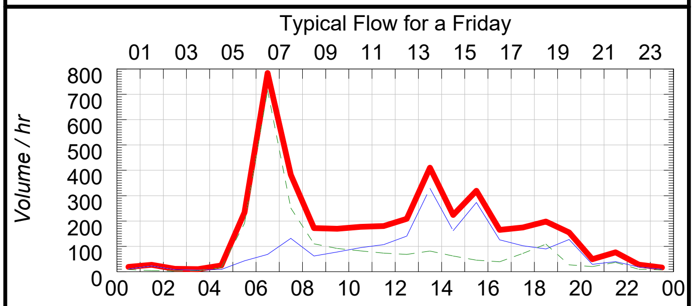
Typical Flow for a Wednesday



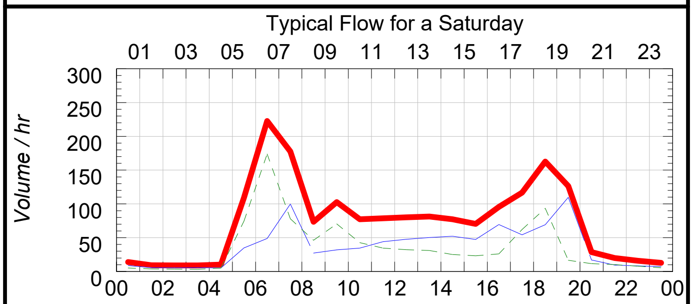
Typical Flow for a Thursday



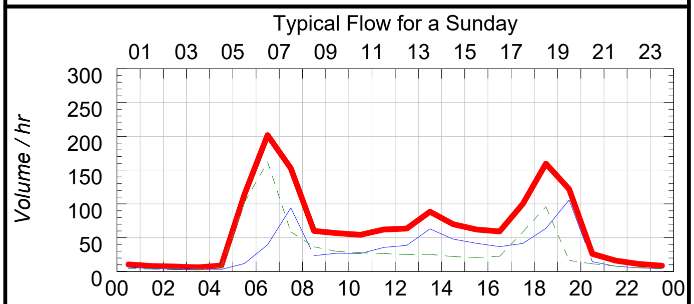
Typical Flow for a Friday



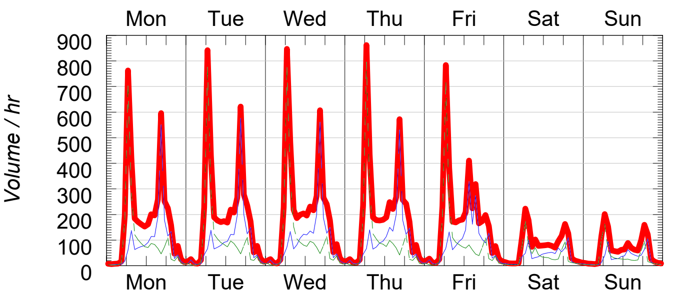
Typical Flow for a Saturday



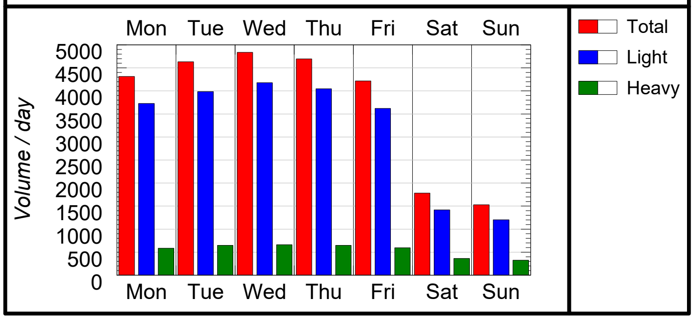
Typical Flow for a Sunday



TYPICAL FLOW FOR A WEEK



TYPICAL DAILY Light/Heavy/Total VARIATIONS

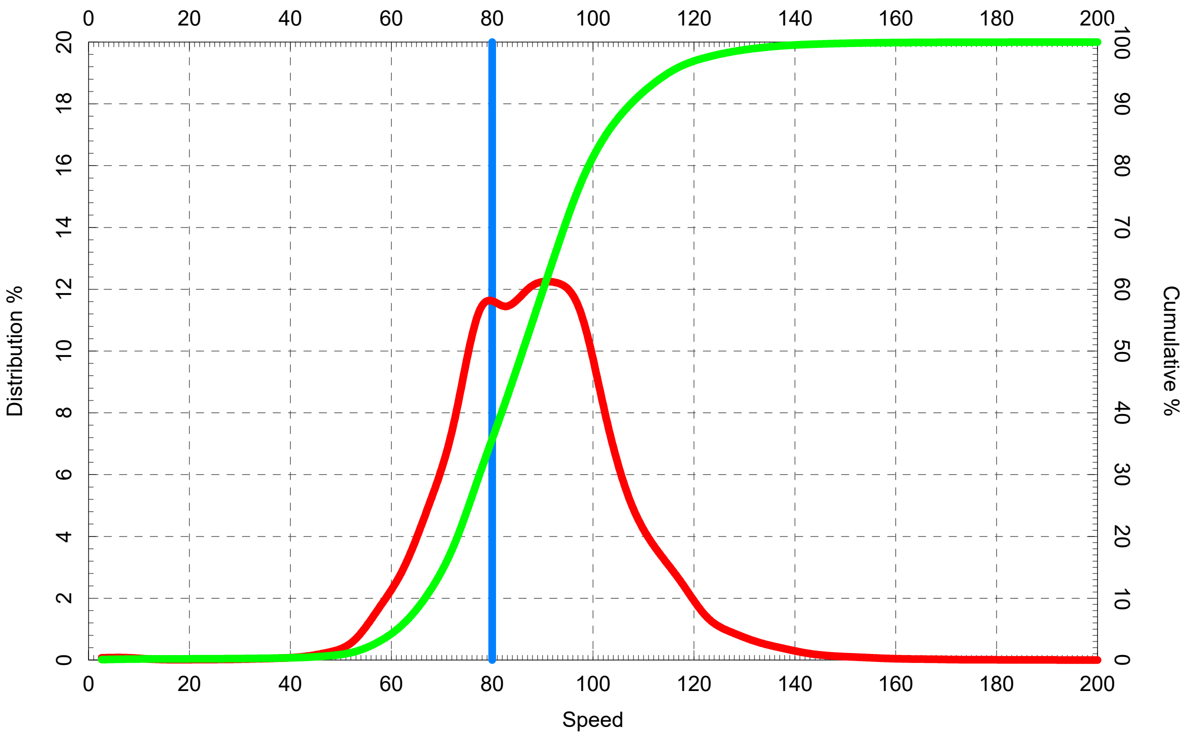


MIKROS TRAFFIC MONITORING

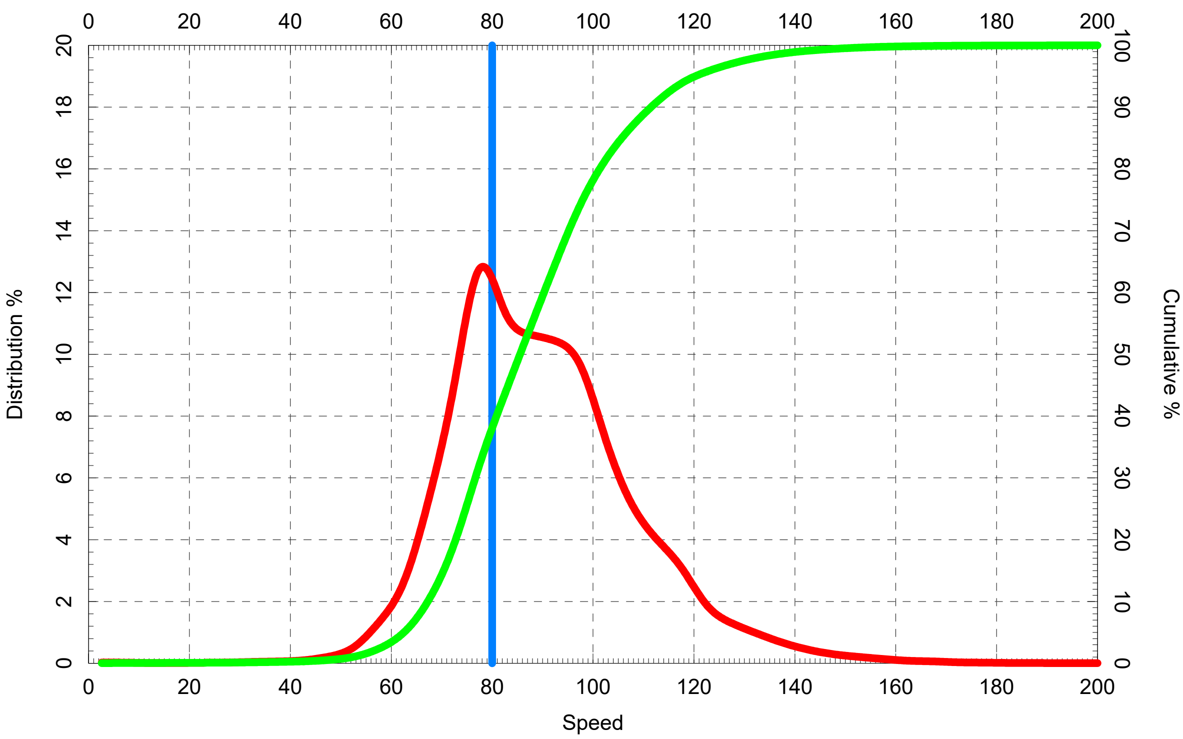
Speed Distribution Plot

Date : 2023/03/29 to 2023/12/31
Site : 22062 - Postmasburg New
Description : Between Beeshoek & Postmasburg

Direction - 1 - To Postmasburg



Direction - 2 - To Beeshoek



Distribution
Cumulative
Speed Limit