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Traffic Engineering
Transportation Planning
Transport Economy
Project Management
Project Financing & Viability

TRAFFIC IMPACT ASSESSMENT

TRONOX KZN SANDS (Pty) Ltd , Port Dunford, uMlalazi & uMhlathuze Local Municipality

February 2025

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Traffic Engineering
Transportation Planning
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director : PIETER KRUGER (PrEng)

Our Reference: REP01/TW1363/11Feb25

11 February 2025

UMLALAZI & UMHLATHUZE LOCAL MUNICIPALITY

uMlalazi Municipality

The Directorate Planning and Development

For Attention: Mr Sibusiso Mngoma

uMhlathuze Local Municipality

The Department of Infrastructure Services

For Attention: Mr E S Ngcobo

Dear Sir

TRAFFIC IMPACT ASSESSMENT: PROPOSED MINING DEVELOPMENT BY TRONOX, UMLALAZI & UMHLATHUZE LOCAL MUNICIPALITY

BACKGROUND

Tronox is applying for mining rights in the Port Dunford area. The Port Dunford area is rich in ilmenite, rutile, zircon, and leucoxene. Tronox plans to mine these heavy minerals from the starting year 2025 until closing in 2069. The Port Dunford mining area will include several farm portions; namely Sub 1 & Remainder of Lot 102 uMlalazi No. 13860, Sub 1,2 & Remainder of Lot 131 uMlalazi No. 14098, Sub 1 & Remainder of Lot 103 uMlalazi No. 13880, Sub 2,3 & Remainder of Lot 104 uMlalazi No. 13853 and Sub 1 & Remainder of Lot Hibbert No. 15714 measuring ±843.72 hectares in extent.

Planned new mining and downstream processing operations at Port Dunford will over time replace the existing mining and processing operations at Fairbreeze.

Run of Mine (ROM) will be transported from the mining area at Port Dunford to a Primary Wet Plant (PWP), whereafter Heavy Mineral Concentrate (HMC) will be transported to the Central Processing Complex (CPC) in Empangeni for further processing. All transport of ROM and HMC will be done by 34-tonne side-tipper highway trucks.

The pumping of ROM to the PWP via a pipeline crossing under Road P535 and Road P537 is also possible. The impact of this scenario was not investigated since the critical scenario from a capacity and operational point of view is based on ROM transported by highway truck.

During the lifetime of the new mining operations, a new Mine and new PWP will be established in phases at Port Dunford, the existing Fairbreeze Mine and Fairbreeze PWP will be decommissioned, however the existing CPC in Empangeni will remain operational.

FIRST PHASE OF OPERATIONS

During the first phase of operations, minerals from the Port Dunford mining area will supplement the existing ROM feed to the Fairbreeze PWP. Mineral output will be transported from the Port Dunford mining area utilising the R102, Helly Hutchinson Road, and the N2 to transport the ROM to the PWP at Fairbreeze. The purpose of this phase is to ensure that the Fairbreeze PWP does not fall short with mineral production.

From Fairbreeze, HMC is currently transported by utilising the N2 route via Ngwelezane Road, and the Western Bypass to transfer the HMC to the CPC in Empangeni.

This first phase entails the mining of 70,400 ROM tonnes per annum (tpa) that will be transported by ±35 heavy vehicles per day to the PWP, and after processing will form part of the HMC (tpa) that is currently transported to the CPC. The mining operations will commence in 2025, and will be operational 12 hours a day, 60 days a year (once a month for 5 days) and result in low / negligible additional peak hour traffic volumes on the external road network.

SECOND PHASE OF OPERATIONS

The second phase of operations will commence in 2036 and will increase the mining output, using the full capacity of the new PWP that will be established at the Port Dunford mining area (the Fairbreeze PWP will be decommissioned at this point). Mining operations will take place in seven stages, each active for a period of 5 years from 2036 to 2069 (stage 1 being mined 2036 – 2040, stage 2 being mined 2041 – 2045, etc.). These seven mining stages will be identical in every way except the mining area, with stages 4, 5, and 6 being the only stages that are separated from the PWP by a public road, i.e. during which external traffic will be generated.

Stage 5 is the critical stage as it requires the crossing of both Road P537 and Road P535 for transportation of ROM to the PWP (Stage 4 and Stage 6 will require the crossing of Road P537 and Road P535 respectively). The ROM during the peak hours for every stage of mining will be transported by ±473 heavy vehicles to the PWP and back, crossing none or one of Road P537 or Road P535, or both roads:

- Stage 1 to Stage 3, and Stage 7 – only internal traffic from the mine to the PWP,
- Stage 4 (west of Road P537) – ±236 vehicles/hour crossing Road P537 per direction,
- Stage 4 (east of Road P537) – only internal traffic,
- Stage 5 (west of Road P537 and east of Road P535) – ±236 vehicles/hour crossing Road P537 and Road P535 per direction respectively,

- Stage 6 (west of Road P535) – only internal traffic,
- Stage 6 (east of Road P535) – ±236 vehicles/hour crossing Road P535 per direction,

After processing at the new location of the PWP at Port Dunford, all minerals will be transported to the CPC in Empangeni (similar to the PWP at Fairbreeze during the First Phase). From the Port Dunford PWP, heavy vehicles will utilise a new interchange proposed on the N2 Route via Ngwelezane Road, and the Western Bypass to the CPC.

Fines residue will be pumped in slurry format from the PWP to a Residue Storage Facility (RSF) that will not generate any traffic.

The expected mining volumes during the Second Phase will comprise of the mining of ±26,280,000 ROM tpa (89% efficiency will translate into ±23,470,000 tpa) that will be transported by ±1,891 daily heavy vehicles (±473 peak hour trucks) to the PWP, and after processing ±574,900 HMC tpa that will be transported by ±46 daily heavy vehicles (±12 peak hour trucks) to the CPC. This phase will operate 24 hours a day, via separate shifts, 365 days per year.

The required mitigation measures for the project includes the reconstruction of the northern section of Road P537 to a design speed of 80km/h to comply with the standards of Kwa-Zulu Natal Roads Department (and realignment of the T-junction with R102) to support Phase 1 (2025), the construction of a partial interchange at the access on Road P535 and the signalization of the terminals at the P535 / N2 Interchange to support Phase 2 Stage 1 (2036), and the construction of a partial interchange at the access on Road P537, the reconstruction of the southern section of Road P537 to a design speed of 80km/h to comply with the standards of Kwa-Zulu Natal Roads Department, and the construction of the ramps between P537 and the N2 to support Phase 2 Stage 4 (2051).

The construction of Public Transport Stops (PTS) and paved sidewalks is to connect PTS to the development is recommended at the proposed partial interchanges on Roads P535 and P537 to support the development.

Although this project also entails site-establishment and site-closure phases, these phases are not critical from a traffic impact perspective as it will generate much less traffic than the operational phases.

Please do not hesitate to contact us for any discussions and/or clarifications.

Kind regards

Pieter Kruger

For TECHWORLD

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ABBREVIATIONS AND ACRONYMS

CPC	Central Processing Complex
HMC	Heavy Mineral Concentrate
PWP	Primary Wet Plant
ROM	Run of Mine
RSF	Residue Storage Facility
tpa	Tonnes per annum

1 INTRODUCTION

1.1 BACKGROUND

Tronox is applying for mining rights in the Port Dunford area. The Port Dunford area is rich in ilmenite, rutile, zircon, and leucoxene. Tronox plans to mine these heavy minerals from the starting year 2025 till closing in 2069.

Planned new mining and downstream processing operations at Port Dunford will over time replace the existing mining and processing operations at Fairbreeze.

Run of Mine (ROM) will be transported from the mining area at Port Dunford to a Primary Wet Plant (PWP), whereafter Heavy Mineral Concentrate (HMC) will be transported to the Central Processing Complex (CPC) in Empangeni for further processing. All transport of ROM and HMC will be done by 34-ton side-tipper highway trucks.

The pumping of ROM to the PWP via a pipeline crossing under Road P535 and Road P537 is also possible. The impact of this scenario was not investigated since the critical scenario from a capacity and operational point of view is based on ROM transported by highway truck.

During the lifetime of the new mining operations, a new Mine and new PWP will be established in phases at Port Dunford, the existing Fairbreeze Mine and Fairbreeze PWP will be decommissioned, however the existing CPC in Empangeni will remain operational.

Refer to *Figure 1: Locality Plan and Study Area*.

1.2 MINING RIGHTS APPLICATION

Tronox is applying for the following mining rights for the following farms in the Port Dunford area:

- Remainder of Richards 16802, Remainder of Birkett 16832, Portion 1 of Birkett 16832, and Ruth 16833.
- Rights on portions 1 and 2 of Lot 131 uMlalazi 14098, Remainder of Lot 131 uMlalazi 14098, Remainder of Lot 103 uMlalazi 13880, and Remainder of Lot 104 uMlalazi 13853 in the Waterloo area
- Remainder of Lot 132 uMlalazi 13602, and Portion 1 of Lot 132 uMlalazi 13602 in the Penarrow area.

1.3 OBJECTIVES OF TRAFFIC IMPACT ASSESSMENT

This TIA determines the expected traffic impact of the planned mining operations at Port Dunford as well as the required mitigation measures from a capacity, operational, and traffic safety perspective.

2 PLANNED MINING OPERATIONS

2.1 INTRODUCTION

The planned new mining and downstream mineral processing operations at Port Dunford will over time replace the existing mining and mineral processing operations at Fairbreeze.

The existing and phased mining operations are summarised in *Table 1:*

- Existing mining & mineral processing operations at Fairbreeze,
- Phase 1 mining operations at Port Dunford,
- Phase 2 mining & mineral processing operations are Port Dunford,

No change will occur in the operations of the CPC in Empangeni. Byproducts from the CPC, MSP Tails & Gypsum, which are currently transported to the Fairbreeze PWP, will in future, during the Phase 2 operations, be transported to the Port Dunford PWP. The coarse tails that result from the PWP process, which is currently transported from the Fairbreeze PWP to the Fairbreeze Mine, will in future, during Phase 2, be transported from the Port Dunford PWP to the Port Dunford Mining areas.

2.2 PHASE 1 MINING OPERATIONS

The Primary Wet Plant (PWP) at Fairbreeze will remain operational during Phase 1 (2025 – 2036) and will only be decommissioned and moved by a PWP at Port Dunford during Phase 2. Heavy Mineral Concentrate (HMC) will be transported from the Fairbreeze PWP to the Central Processing Complex (CPC) in Empangeni during the Phase 1 operations (similar to the existing operations) but from the Port Dunford PWP during the Phase 2 operations.

2.3 PHASE 2 MINING OPERATIONS

Mining operations during Phase 2 will take place in seven stages, each active for a period of 5 years from 2036 to 2069 (stage 1 being mined 2036 – 2040, stage 2 being mined 2041 – 2045, etc.). These seven mining stages will be identical in every way except the mining area, with stages 4, 5, and 6 being the only stages that are separated from the PWP by a public road, i.e. during which external traffic will be generated.

Table 2 summarises the seven (7) stages of the Phase 2 mining operations.

Table 1: Phasing of Planned Mining Operations

PHASING OF MINING OPERATIONS	PRODUCT	ROUTE	PROCESS FLOW	ESTIMATED ANNUAL OUT-PUT (tonnes)
EXISTING SITUATION: UP TO 2025: Mine & PWP at Fairbreeze	ROM	Fairbreeze Mine to PWP Fairbreeze	Mine – PWP	UNKNOWN (existing)
	HMC	PWP Fairbeeze to CPC Empangeni	PWP – CPC	574,856
	MSP Tails & Gypsum	CPC Empangeni to PWP Fairbreeze	CPC – PWP	201,550
	Coarse Tails	PWP Fairbreeze to Fairbreeze Mine	PWP - Mine	166,410
PHASE 1: 2025 – 2036: New Mine at Port Dunford (PWP remains at Fairbreeze)	ROM	Fairbreeze Mine to PWP Fairbreeze	Mine – PWP	UNKNOWN (existing)
	ROM	**Port Dunford Mine to PWP Fairbreeze**	**New Mine – PWP**	**70,400**
	HMC (based on ROM input from Fairbreeze Mine)	PWP Fairbeeze to CPC Empangeni	PWP – CPC	570,733
	HMC (based on ROM input Port Dunford Mine)	**PWP Fairbeeze to CPC Empangeni**	**PWP – CPC**	**4,123**
	MSP Tails & Gypsum (based on ROM input from Fairbreeze Mine)	CPC Empangeni to PWP Fairbreeze	CPC – PWP	200,027
	MSP Tails & Gypsum (based on ROM input from Port Dunford Mine)	**CPC Empangeni to PWP Fairbreeze**	**CPC – PWP**	**1,523**
	Coarse Tails	PWP Fairbreeze to Fairbreeze Mine	PWP - Mine	165,153
	Coarse Tails	**PWP Fairbreeze to Port Dunford Mine**	**PWP – New Mine**	**1,257**
PHASE 2: 2036 – 2069: New Mine AND PWP at Port Dunford	**ROM**	**Port Dunford Mine to PWP Port Dunford**	**New Mine – New PWP**	**23,470,000**
	HMC	**PWP Port Dunford to CPC Empangeni**	**New PWP – CPC**	**574,856**
	MSP Tails & Gypsum	**CPC Empangeni to PWP Port Dunford**	**CPC – New PWP**	**201,550**
	Coarse Tails	**PWP Port Dunford to Port Dunford Mine**	**New PWP – New Mine**	**166,410**

Note: Additional / Change in Production indicated in BOLD

Table 2: Stages in Phase 2 Mining Operations

STAGE	PERIOD	MINING AREA	TRAFFIC GENERATED
STAGE 1	2036 – 2040	Between Road P537 and Road P535	Only Internal Traffic
STAGE 2	2041 – 2045		
STAGE 3	2046 – 2050		
STAGE 4	2051 – 2055	West of Road P537	Traffic will cross Road P537
		East of Road P537	Only Internal Traffic
STAGE 5	2056 – 2060	West of Road P537	Traffic will cross Road P537
		East of Road P535	Traffic will cross Road P535
STAGE 6	2061 – 2065	West of Road P535	Only internal Traffic
		East of Road P535	Traffic will cross Road P535
STAGE 7	2066 - 2069	Between Road P537 and Road P535	Only Internal Traffic

Stage 5 is the critical stage as it requires the crossing of both Road P537 and Road P535 for transportation of ROM to the PWP (Stage 4 and Stage 6 will require the crossing of Road P537 and Road P535 respectively):

- Stage 1 to Stage 3, and Stage 7 – only internal traffic,
- Stage 4 (west of Road P537) – traffic will cross Road P537,
- Stage 4 (east of Road P537) – only internal traffic,
- Stage 5 (west of Road P537 and east of Road P535) – traffic will cross Road P537 and Road P535,
- Stage 6 (west of Road P535) – only internal traffic,
- Stage 6 (east of Road P535) – traffic will cross Road P535,

3 EXPECTED TRAFFIC GENERATION

3.1 HEAVY VEHICLE (HV) TRIP GENERATION

Delivery of minerals from Mine to PWP (ROM), PWP to CPC (HMC), CPC to PWP (MSP Tails & Gypsum), and PWP to Mine (Coarse Tails) will be done by 34-tonne 7-axle side-tipper heavy vehicles.

The expected daily and peak hour trips during Phase 1 and Phase 2 mining operations are based on the assumptions stated in the following paragraphs.

Heavy vehicle trips during Phase 1 were calculated based on the following assumptions:

- Planned mining output of 100 tonne/hour,
- Mining efficiency of 89%,
- Average payload of 34-tonne,
- Mining operations 12-hours per day,
- Mining operations of 60 days per annum,
- Maximum peak hour trips 25% of daily trips,
- Return traffic is mostly empty vehicles,

Heavy vehicle trips during Phase 2 were calculated based on the following assumptions:

- Planned mining output of 3,000 tonne/hour,
- Mining efficiency of 89%,
- Average payload of 34-tonne,
- Mining operations 24-hours per day,
- Mining operations of 365 days per annum,
- Maximum peak hour trips 25% of daily trips,
- Return traffic is mostly empty vehicles,

Inspection of *Table 3* shows that the existing peak hour heavy vehicle traffic (up to 2025), as well as the Phase 1 (2025 – 2036) and Phase 2 (2036 – 2069) peak hour heavy vehicle traffic is low, i.e. below 50 vehicle trips, with the exception of the ROM from the various Port Dunford Mining Areas (Stages) to the Port Dunford PWP.

Table 4 indicates the maximum peak hour heavy vehicle traffic that will transport ROM between the various Stages (Port Dunford Mining Areas) and the Port Dunford PWP. This traffic will have to cross one of two public roads, namely Road P537 and Road P535.

Table 3: Maximum Peak Hour Heavy Vehicle Trips per Phase (One-way Traffic)

PHASING OF MINING OPERATIONS	ROUTE	ESTIMATED ANNUAL OUT-PUT (tonnes)	ESTIMATED DAILY ONE-WAY TRUCKS	ESTIMATED PEAK HOUR ONE-WAY TRUCKS
EXISTING SITUATION: UP TO 2025: Mine & PWP at Fairbreeze	ROM from Fairbreeze Mine to PWP Fairbreeze	UNKNOWN	UNKNOWN	UNKNOWN
	HMC from PWP Fairbeeze to CPC Empangeni	574,856	±46	±12
	MSP Tails & Gypsum from CPC Empangeni to PWP Fairbreeze	201,550	±16	±4
	Coarse Tails from PWP Fairbreeze to Fairbreeze Mine	166,410	±13	±3
PHASE 1: 2025 – 2036: New Mine at Port Dunford (PWP remains at Fairbreeze)	ROM from Fairbreeze Mine to PWP Fairbreeze	UNKNOWN	UNKNOWN	UNKNOWN
	ROM from Port Dunford Mine to PWP Fairbreeze	**70,400**	**±35**	**±9**
	HCM (ROM from Fairbreeze Mine) from PWP Fairbeeze to CPC Empangeni	570,733	±44	±11
	HCM (ROM from port Dunford Mine) from PWP Fairbeeze to CPC Empangeni	**4,123**	**±2**	**<1**
	MSP Tails & Gypsum (ROM from Fairbreeze Mine) from CPC Empangeni to PWP Fairbreeze	200,027	±15	±4
	MSP Tails & Gypsum (ROM from Port Dunford Mine) from CPC Empangeni to PWP Fairbreeze	**1,523**	**±1**	**<1**
	Coarse Tails from PWP Fairbreeze to Fairbreeze Mine	165,153	±12	±3
	Coarse Tails from PWP Fairbreeze to Port Dunford Mine	**1,257**	**±1**	**<1**
PHASE 2: 2036 – 2069: New Mine AND PWP at Port Dunford	**ROM from Port Dunford Mine to PWP Port Dunford**	**23,470,000**	**±1,891**	**±473**
	HMC from PWP Port Dunford to CPC Empangeni	**574.856**	**±46**	**±12**
	MSP Tails & Gypsum from CPC Empangeni to PWP Port Dunford	**201,550**	**±16**	**±4**
	Coarse Tails from PWP Port Dunford to Port Dunford Mine	**166,410**	**±13**	**±3**

Note: New traffic / changed traffic indicated in BOLD

Table 4: Maximum Heavy Vehicle Traffic for Stages in Phase 2 Mining Operations

STAGE	PERIOD	MINING AREA	PEAK HOUR TRAFFIC GENERATED PER DIRECTION
STAGE 1	2036 – 2040	Between Road P537 and Road P535	Only Internal Traffic
STAGE 2	2041 – 2045		
STAGE 3	2046 – 2050		
STAGE 4	2051 – 2055	West of Road P537	±236 vehicles/hour crossing P537 (per direction)
		East of Road P537	Only Internal Traffic
STAGE 5	2056 – 2060	West of Road P537	±236 vehicles/hour crossing P537 (per direction)
		East of Road P535	±236 vehicles/hour crossing P535 (per direction)
STAGE 6	2061 – 2065	West of Road P535	Only internal Traffic
		East of Road P535	±236 vehicles/hour crossing P535 (per direction)
STAGE 7	2066 - 2069	Between Road P537 and Road P535	Only Internal Traffic

3.2 LIGHT VEHICLES (LV) TRIP GENERATION

Phase 1 requires ±38 staff members for operations. Allowance is made for 30% extra staff in the form of contractors to perform various tasks. Phase 2 requires ±43 staff members, with the added 30% for contractors. An average vehicle occupancy of 1.2 is assumed for both phases.

Table 5: Maximum Peak Hour Light Vehicle Trips per Phase

TRONOX	PEAK HOUR LIGHT VEHICLE TRIPS				
	STAFF	CONTRAC-TORS	TOTAL WORKERS	VEHICLE OCCUPANCY	TOTAL LIGHT VEHICLES
Phase 1	38	11 (30%)	49	1.2	41
Phase 2	43	13 (30%)	56	1.2	47

4 EXPECTED TRAFFIC ASSIGNMENT

4.1 SUPPORTING ROAD NETWORK

The Port Dunford Mining Area is located between the N2 in the south and the R102 in the north and is bisected by two public roads namely Road P537 in the west and Road P535 in the east.

The N2 is a Class 1 national road under the jurisdiction of SANRAL, while the R102 (Road P2-4) is a Class 2, and Roads P537 and P535 Class 3 provincial roads, respectively, under the jurisdiction of the Kwazulu-Natal Provincial Roads Department.

A diamond interchange is constructed between Road P535 and the N2, while Road P537 crosses the N2 with an Underpass.

Transport of HMC to the Empangeni CPC and MSP Tails & Gypsum from the Empangeni CPC, via the N2, requires the use of the R34 between the N2 and the CPC. However, since the R34 traverses the CBD of Empangeni, heavy vehicles are avoiding the section of the R34 through the CBD by using a circular route – R102 – Ngwelezane Road – Western Bypass – to travel to the CPC. The sections of the R34 between the N2 and the R102 (Road P496) and north of the Western Bypass (Road P230) are provincial Class 2 roads, while Ngwelezane Road (Road P456), and the Western Bypass (Road P166) are provincial Class 3 roads.

4.2 ACCESS TO MINING AREAS

Access to the supporting road network, from the Port Dunford Mining Areas, must be from the lower order Class 3 roads, namely Road P537 in the west, and Road P535 in the east. Since these roads bisect the mining areas, it will be necessary to cross these roads to transport ROM to the PWP during the Phase 2 mining operations. *Table 4* shows that this will only be required during Stages 4, 5, and 6.

4.3 HEAVY VEHICLE ROUTING (ASSIGNMENT)

Mining at Fairbreeze and Port Dunford has the following transportation requirements for Phase 1 and Phase 2 respectively:

4.3.1 PHASE 1 MINING OPERATIONS

The mining area for Phase 1 is located west of Road P537. Since there is no existing interchange between Road P537 and the N2, the ROM and Coarse Tails between the mining area in Port Dunford and the Fairbreeze PWP will have to be transported via the R102.

Transportation between the Fairbreeze PWP and the CPC Empangeni is already taking place via the N2.

The following routes will therefore be used for the Phase 1 mining operations:

- ROM: Port Dunford Mining Area to Fairbreeze PWP via the R102 and the N2,
- HMC: Fairbreeze PWP to Empangeni CPC via the N2 and the R34,
- MSP Tails & Gypsum: Empangeni CPC to Fairbreeze PWP via the N2 and the R34,
- Coarse Tails: Fairbreeze PWP to Port Dunford Mining Area via the R102 and the N2,

4.3.2 PHASE 2 MINING OPERATIONS

The Fairbreeze PWP and mining area will be decommissioned at the start of the Phase 2 mining operations. Since a new PWP will be constructed within the Port Dunford mining areas, most of the heavy vehicle traffic will occur internally (ROM and Coarse Tails to/from the PWP) except for heavy vehicle traffic that will have to cross either Road P537 or Road P535 or both. Heavy vehicle traffic between the PWP and the Empangeni CPC will divert from the Fairbreeze PWP (which will be decommissioned) to the Port Dunford PWP (via the N2).

- ROM: Port Dunford Mining Areas to Port Dunford PWP (only internal traffic or crossing of either Road P537 or Road P535 or both),
- HMC: Port Dunford PWP to Empangeni CPC via the N2 and the R34,
- MSP Tails & Gypsum: Empangeni CPC to Port Dunford PWP via the N2 and the R34,
- Coarse Tails: Port Dunford PWP to Port Dunford Mining Areas (only internal traffic or crossing of either Road P537 or Road P535 or both),

4.4 LIGHT VEHICLE ROUTING (ASSIGNMENT)

Section 3.2 shows that less than 50 light vehicle peak hour trips (±41 during Phase 1 and ±47 during Phase 2) are expected during the weekday peak hours (many of these light vehicle trips will actually occur outside the commuting peak hours given the operational hours of mining activities).

The origins of staff members (place of residence) and contractors (place of business) are distributed between Richards Bay, Empangeni, Mtunzini, KwaGingindlovu, and Eshowe. These trips are thus expected to distribute from Road P537 and Road P535 to the R102 in the north and the N2 in the south, and then along these roads towards the west and the east.

5 ASSESSMENT OF EXISTING TRAFFIC CONDITIONS

5.1 INTRODUCTION

Traffic surveys were conducted in the study area to determine the existing operational conditions on the road network.

5.2 TRAFFIC SURVEYS

Traffic surveys were done on Tuesday, 15 November 2022, between 06:00 and 18:00 at 16 intersections in the study area. These intersections cover the total operational area of the project, i.e. including the Fairbreeze Mine and PWP, and the Empangeni CPC.

The following intersections were surveyed:

1) Empangeni CPC Access / R34 (P230)
2) Western Bypass (P166) / R34 (P230)
3) R102 (P2-4) / R34 (P496)
4) N2 – 28 Western Terminal / R34 (P496)
5) N2 – 28 Eastern Terminal / R34 (P496)
6) Western Bypass (P166) / Ngwelezane Rd (P456)
7) R102 (P2-4) / Ngwelezane Rd (P456)
8) Hely Hutchinson Rd (P378) / R102 (P2-4)
9) Road P537 / R102 (P2-4)
10) Road P535 / R102 (P2-4)
11) Fairbreeze Mine Access Road / N2 – 28 Northern Terminal
12) Hely Hutchinson Rd (P378) / N2 – 28 Northern Terminal
13) Road P535 / N2 – 28 Northern Terminal
14) Fairbreeze Mine Access Road / N2 – 28 Southern Terminal
15) Hely Hutchinson Rd (P378) / N2 – 28 Southern Terminal
16) Road P535 / N2 – 28 Southern Terminal

The processed traffic data indicates that the weekday morning commuting peak hour is between 6:45 and 7:45, while the weekday afternoon commuting peak hour is between 16:00 and 17:00.

5.3 CAPACITY AND OPERATIONAL ANALYSES

Capacity and Operational analyses were subsequently done for three scenarios, namely the base year in 2025, as well as a future 5-year horizon (2030) and a future 10-year horizon (2035) with assumed growth rates in background traffic of 3% p.a. during the first 5-years and 2% p.a. during the following 5-years.

The summary results of the Capacity and Operational Analyses for the current and expected growth in background traffic is shown in *Table 6* below:

Table 6: Weekday Peak Hours: Summary Results of Capacity and Operational Analyses for Background Traffic

INTERSECTION	PEAK HOUR	MOE	2025 CURRENT TRAFFIC	2030 5 YEAR HORIZON	2035 10 YEAR HORIZON
INTERSECTION 1 Empangeni CPC Access / R34 (P230)	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.277	0.317	0.327
		Delay	1.0	1.1	1.3
		LOS	A	A	F
		Cycle Length	-	-	-
	Weekday PM	V/C	0.208	0.331	0.341
		Delay	1.4	1.6	1.8
		LOS	D	E	E
		Cycle Length	-	-	-
INTERSECTION 2 Western Bypass (P166) / R34 (P230)	Intersection	Control	TSC	TSC	TSC
	Weekday AM	V/C	1.406 (1.406)	1.358 (1.358)	1.397 (1.397)
		Delay	79.9 (224.9)	102.1 (208.4)	120.7 (218.8)
		LOS	E (F)	E (F)	F (F)
		Cycle Length	75	85	90
	Weekday PM	V/C	0.916 (0.916)	1.104 (1.104)	1.154 (1.154)
		Delay	41.3 (70.7)	55.4 (104.5)	65.3 (119.7)
		LOS	D (E)	E (F)	E (F)
		Cycle Length	120	85	85
INTERSECTION 3 R102 (P2-4) / R34 (P496)	Intersection	Control	TSC	TSC	TSC
	Weekday AM	V/C	0.864 (0.864)	0.939 (0.939)	0.806 (0.806)
		Delay	21.8 (35.4)	25.3 (39.8)	24.7 (48.4)
		LOS	C (D)	C (D)	C (D)
		Cycle Length	60	60	80
	Weekday PM	V/C	1.070 (1.070)	1.050 (1.050)	1.033 (1.033)
		Delay	32.7 (75.1)	33.3 (70.3)	28.4 (28.4)
		LOS	C (E)	C (E)	C (E)
		Cycle Length	80	65	70
INTERSECTION 4 N2 Western Terminal / R34 (P496)	Intersection	Control	TSC	TSC	TSC
	Weekday AM	V/C	0.766 (0.766)	0.815 (0.815)	0.814 (0.814)
		Delay	25.9 (41.3)	22.4 (49.8)	23.6 (55.4)
		LOS	B (D)	C (D)	C (E)
		Cycle Length	90	90	100
	Weekday PM	V/C	0.747 (0.747)	0.789 (0.789)	0.800 (0.800)
		Delay	15.3 (39.1)	17.2 (47.8)	18.0 (50.7)
		LOS	B (D)	B (D)	B (D)
		Cycle Length	70	85	90

INTERSECTION	PEAK HOUR	MOE	2025 CURRENT TRAFFIC	2030 5 YEAR HORIZON	2035 10 YEAR HORIZON
INTERSECTION 5 N2 Eastern Terminal / R34 (P496)	Intersection	Control	TSC	TSC	TSC
	Weekday AM	V/C	0.758 (0.758)	0.789 (0.789)	0.820 (0.820)
		Delay	19.7 (32.9.0)	22.7 (45.0)	24.4 (45.0)
		LOS	B (C)	C (D)	C (D)
		Cycle Length	80	110	110
	Weekday PM	V/C	0.815 (0.815)	0.933 (0.933)	0.963 (0.963)
		Delay	30.3 (44.6)	43.7 (57.0)	51.2 (64.3)
		LOS	C (D)	D (E)	D (E)
		Cycle Length	110	120	120
INTERSECTION 6 Western Bypass (P166) / Ngwelezane Rd (P456)	Intersection	Control	TSC	TSC	TSC
	Weekday AM	V/C	0.897 (0.897)	0.874 (0.874)	0.881 (0.881)
		Delay	25.9 (56.9)	19.6 (56.5)	21.2 (64.8)
		LOS	C (E)	B (E)	C (E)
		Cycle Length	90	90	100
	Weekday PM	V/C	0.814 (0.814)	0.859 (0.859)	0.817 (0.817)
		Delay	23.8 (47.6)	20.2 (41.9)	21.5 (50.9)
		LOS	C (D)	C (D)	C (D)
		Cycle Length	80	70	80
INTERSECTION 7 R102 (P2-4) / Ngwelezane Rd (P456)	Intersection	Control	RBT	RBT	RBT
	Weekday AM	V/C	0.378	0.444	0.475
		Delay	7.2	7.5	7.8
		LOS	A	A	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.319	0.443	0.475
		Delay	7.2	7.6	7.8
		LOS	A	A	A
		Cycle Length	-	-	-
INTERSECTION 8 Hely Hutchinson Road (P378) / R102 (P2-4)	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.413	0.486	0.510
		Delay	7.4	8.1	8.4
		LOS	C	C	C
		Cycle Length	-	-	-
	Weekday PM	V/C	0.257	0.304	0.319
		Delay	6.1	6.3	6.4
		LOS	B	B	B
		Cycle Length	-	-	-

INTERSECTION	PEAK HOUR	MOE	2025 CURRENT TRAFFIC	2030 5 YEAR HORIZON	2035 10 YEAR HORIZON
INTERSECTION 9 Road P537 / R102 (P2-4)	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.068	0.079	0.082
		Delay	2.3	2.0	2.0
		LOS	A	A	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.084	0.097	0.101
		Delay	1.6	1.5	1.6
		LOS	A	A	A
		Cycle Length	-	-	-
INTER-SECTION 10 Road P535 / R102 (P2-4)	Intersection	Control	RBT	RBT	RBT
	Weekday AM	V/C	0.250	0.297	0.307
		Delay	6.2	6.4	6.4
		LOS	B	B	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.264	0.315	0.327
		Delay	5.7	5.8	5.9
		LOS	A	A	A
		Cycle Length	-	-	-
INTERSECTION 13 Fairbreeze Access Road / N2 Northern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.059	0.033	0.034
		Delay	4.2	3.0	3.0
		LOS	A	A	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.077	0.033	0.048
		Delay	5.2	3.0	4.8
		LOS	A	A	A
		Cycle Length	-	-	-
INTERSECTION 14 Hely Hutchinson Rd (P378) / N2 Northern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.159	0.138	0.151
		Delay	3.1	2.3	2.7
		LOS	B	C	C
		Cycle Length	-	-	-
	Weekday PM	V/C	0.136	0.139	0.150
		Delay	2.6	2.5	2.5
		LOS	B	B	B
		Cycle Length	-	-	-

INTERSECTION	PEAK HOUR	MOE	2025 CURRENT TRAFFIC	2030 5 YEAR HORIZON	2035 10 YEAR HORIZON
INTERSECTION 16 Road P535 / N2 Northern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	1.308	1.308	1.646
		Delay	21.1	21.1	29.1
		LOS	F	F	F
		Cycle Length	-	-	-
	Weekday PM	V/C	0.515	0.484	0.539
		Delay	5.2	26.3	6.7
		LOS	D	E	E
		Cycle Length	-	-	-
INTERSECTION 17 Fairbreeze Access Road / N2 Southern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.109	0.087	0.091
		Delay	4.6	5.0	5.0
		LOS	A	A	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.074	0.049	0.050
		Delay	3.0	1.7	1.7
		LOS	A	A	A
		Cycle Length	-	-	-
INTERSECTION 18 Hely Hutchinson Rd (P378) / N2 Southern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.202	0.222	0.257
		Delay	2.7	2.7	2.7
		LOS	C	C	C
		Cycle Length	-	-	-
	Weekday PM	V/C	0.172	0.196	0.248
		Delay	3.0	3.0	3.5
		LOS	B	B	B
		Cycle Length	-	-	-
INTERSECTION 20 Road P535 / N2 Southern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.703	2.111	2.495
		Delay	8.9	29.8	38.1
		LOS	F	F	F
		Cycle Length	-	-	-
	Weekday PM	V/C	0.324	0.326	0.362
		Delay	5.0	4.0	4.2
		LOS	D	D	E
		Cycle Length	-	-	-

NOTE:

The MOE's in brackets show the worst / critical movement (OWSC and TWSC) or the worst / critical approach (TSC, AWSC and RBT).

TSC = Traffic Signal Control

AWSC = All-way Stop Control

TWSC = Two-way Stop Control

OWSC = One-way Stop Control

RBT = Roundabout

5.4 ASSESSMENT

Inspection of *Table 6* shows that the following intersections will be operating under constrained conditions during the various scenarios:

- Base year in 2025: Intersections 2, 16, and 20

The mitigation of these intersections is not the responsibility of the applicant, although the poor operating conditions at Intersections 16 and 20 (terminals of N2 / R535 Interchange) is of particular importance since access will be obtained from Road P535 in future.

6 ASSESSMENT AND MITIGATION OF FUTURE TRAFFIC CONDITIONS

6.1 ROUTE PWP TO EMPANGENI CPC

The transport of HMC (firstly from Fairbreeze PWP and secondly from Port Dunford PWP) to the Empangeni CPC, and the return products MSP Tails & Gypsum to the respective PWP's comprises of very low peak hour traffic volumes which are mostly already on the network. These volumes are estimated as ±24 two-way heavy vehicle trips which is not significant from a capacity and operational analyses point of view.

No further analyses of these trips are required.

6.2 ROUTE PORT DUNFORD MINING AREA TO FAIRBREEZE PWP (PHASE 1)

Phase 1 of the mining operations will be located on the remainder of Richards 16802, and Portion 1 of the same. ROM will be transported to the PWP at Fairbreeze via the R102 and the N2 and will comprises of very low peak hour traffic volumes namely ±18 two-way heavy vehicle trips which is not significant from a capacity and operational analyses point of view.

No further analyses of these trips are required.

6.3 ROUTE PORT DUNFORD MINING AREAS TO PORT DUNFORD PWP (PHASE 2)

The Phase 2 mining operations will take place in Stages, i.e. different mining areas. *Table 4* summarises the traffic requirements of these Stages in terms of external traffic:

- Stage 4 (2051 – 2055) – West of Road P537 – 236 heavy vehicles/hour will have to cross Road P537,
- Stage 5 (2056 – 2060) – West of Road P537 – 236 heavy vehicles/hour will have to cross Road P537,
- Stage 5 (2056 – 2060) – East of Road P535 – 236 heavy vehicles/hour will have to cross Road P535,
- Stage 6 (2061 – 2065) – East of Road P535 – 236 heavy vehicles/hour will have to cross Road P535,

6.4 ACCESS TO PORT DUNFORD MINING AREAS

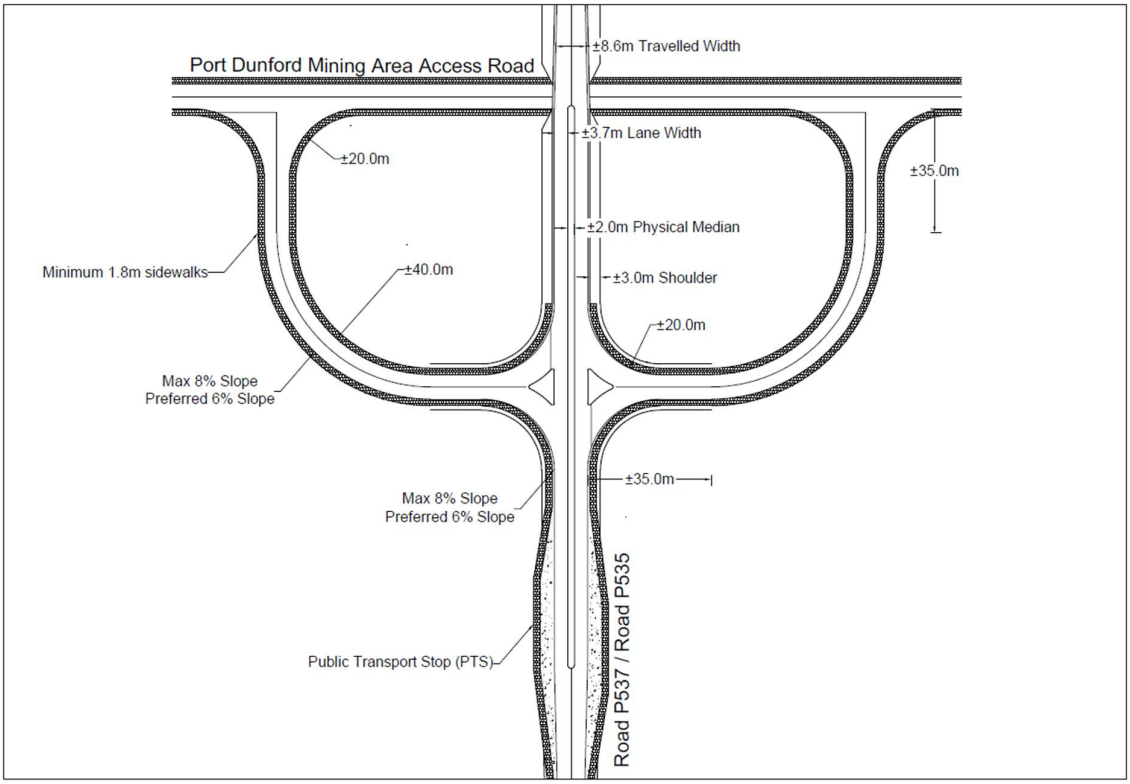
6.4.1 ACCESS FROM ROAD P537 AND ROAD P535

The at-grade crossing of Road P537 and Road P535 by high peak hour heavy vehicle volumes given mining operations on both sides of these roads is not acceptable from an operational

and traffic safety point of view and must be prevented through the construction of either an underpass or an overpass of these roads.

The construction of a partial interchange is recommended given that access is also required at these locations. The construction of a physical median will prohibit at-grade crossings at the access position. Refer to *Illustration 1*.

Illustration 1: Proposed Access Layout on Road P535 / Road P537



6.4.2 ACCESS FROM N2 NATIONAL ROAD

A diamond interchange is constructed between Road P535 and the N2, while Road P537 crosses the N2 with an Underpass. Since access to the N2 national road is currently not possible from Road P537, the construction of the required on- and off-ramps at the existing underpass is recommended.

This new interchange will also alleviate the expected future congestion at the existing interchange between Road P535 and the N2 (Intersections 16 and 20), which in future will increase due to additional traffic that will be generated by the Port Dunford mining operations.

6.5 EXPECTED HEAVY VEHICLE TRIPS

The expected heavy vehicle trips, for both phases, in the various traffic corridors are summarised in Table 7 that also shows the routes and affected intersections.

Table 7: Heavy Vehicle Trips per Route

PHASE	TRAFFIC CORRIDORS	HV IN PEAK HOUR	ROUTE	AFFECTED INTERSECTIONS
Phase 1	Between Mine and PWP Fairbreeze	9	P537, R102, Hely Hutchinson Rd, N2.	8, 9, 11, 13, 14, 17, 18
	Between PWP Fairbreeze – CPC Empangeni	1	N2, R34, R102, Ngwelezane Rd, Western Bypass.	1, 2, 3, 4, 5, 6, 7, 13, 17
Phase 2	Between Mine and PWP Port Dunford	473	Internal Roadways	11, 12
	Between PWP Port Dunford and CPC Empangeni	12	P537, P535, N2, R34, R102, Ngwelezane Rd, Western Bypass.	1, 2, 3, 4, 5, 6, 7, 11, 12, 15, 16, 19, 20

Inspection of this table shows the following potential traffic issues (Refer to *Figure 1*):

- High volumes of heavy vehicles crossing Road P535 at Intersection 12 and Road P537 at Intersection 11,
- The use of the terminals of the N2 / P535 interchange (Intersections 16 and 20) which are already congested with the existing traffic volumes,
- No interchange is currently provided at the underpass of Road P537 with the N2 (Intersections 15 and 19),

6.6 EXPECTED IMPACT OF ADDITIONAL LIGHT VEHICLE TRAFFIC

Plant operators, labourers, and supervisors all must commute to work, as there is no housing on site.

Section 3.2 shows that less than 50 light vehicle peak hour trips (±41 during Phase 1 and ±47 during Phase 2) are expected during the weekday peak hours (many of these light vehicle trips will occur outside the commuting peak hours given the operational hours of mining activities on the site).

The light vehicle trips are expected to distribute from Road P537 and Road P535 to the R102 in the north and the N2 in the south, and then along these roads towards the west and the east. The relative impact of these expected trips from a capacity and operational point of view will thus be low and does not require any further consideration from a capacity and operational point of view.

No further analyses of these trips are required.

Table 8: Peak Hour Light Vehicle Trips per Phase

TRONOX	PEAK HOUR LIGHT VEHICLE TRIPS		
	TOTAL LV	ROUTE	AFFECTED INTERSECTIONS
Phase 1	41	Hely Hutchinson Rd, R102, P537, N2	9, 10, 11, 8, 14, 18
Phase 2	47	Hely Hutchinson Rd, R102, P537, P535, N2	9, 10, 11, 12, 15, 16, 19, 20

Inspection of this table shows the following potential traffic issues:

- The light vehicles during Phase 1 will not warrant the construction of the interchange between Road P537 and the N2, although the interchange will be required during Phase 2 (Stage 5),
- The use of the terminals of the N2 / P535 interchange (Intersections 16 and 20) which are already congested with the existing traffic volumes,

6.7 CAPACITY & OPERATIONAL ANALYSES

Capacity and operational analyses were subsequently done for the immediate study area of the mining operations that includes the surrounding road network and intersections (Intersections 9, 10, 11, 12, 15, 16, 19, 20).

Capacity and operational analyses are required for separate periods. Phase 1 will commence in 2025 and will continue until 2036 when Phase 2 will commence with the establishment of a new PWP at Port Dunford. The PWP will operate until 2069. During this period different areas (Stages) will be mined at Port Dunford. The external traffic distribution of Phase 2 however will not change given that different areas (Stages) will be mined on the site with the same output. For this reason, and from a practical perspective only future years 2025, 2030, and 2036 was analysed. It was thus assumed that Phase 2 will be fully operational by 2036 since it is not reasonable to analyse further future years (2037 – 2069) given the relatively small trip generation of the mining operations.

The capacity and operational analyses that follow in *Table 9* is based on the required access arrangements at Intersection 11 and Intersection 12 (to support Phase 2) and includes the construction of the interchange terminals (on- and off-ramps) between Road P537 and the N2 (Intersections 15 and 19) (to support Phase 2).

The following mitigation measures are included / required:

- Intersection 9: The realignment of the southern approach of the intersection is required to ensure a minimum 10-degree angle on this approach from a sight distance / safety perspective. No other mitigation measures are required at this intersection.
- Intersection 10: No mitigation measures are required.

- Intersection 11: The construction of a partial interchange, i.e. an Underpass / Overpass crossing P537 with marginal access on both sides of P537 which is separated by a physical median is required.
- Intersection 12: The construction of a partial interchange, i.e. an Underpass / Overpass crossing P535 with marginal access on both sides of P535 which is separated by a physical median is required.
- Intersection 15: The construction of the ramps and northern terminal with an additional right-turn lane on the south approach of P537 is required.
- Intersection 16: The implementation of traffic signal control is required at the northern terminal of the P535 / N2 interchange.
- Intersection 19: The construction of the ramps and southern terminal with an additional right-turn lane on the north approach of P537 is required.
- Intersection 20: The implementation of traffic signal control is required at the southern terminal of the P535 / N2 interchange.

Also required from an operational and traffic safety point of view is the reconstruction of Road P537 – in phases - to a design speed of 80km/h to comply with the standards of Kwa-Zulu Natal Road Department, which includes the realignment, widening and strengthening of the road :

- *Between the access (Intersection 11) and the T-junction with R102 (Intersection 9) before 2025 (start of Phase 1),*
- *Between the access (Intersection 11) and the propsoed interchaneg with the N2 before 2051 (start of Stage 4 of Phase 2),*

Table 9: Weekday Peak Hours: Summary Results of Capacity and Operational Analyses

INTERSECTION	PEAK HOUR	MOE	PHASE 1 Year 2025	PHASE 1 Year 2030	PHASE 2 Year 2036
INTERSECTION 9 Road P537 / R102 (P2-4)	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.079	0.079	0.086
		Delay	2.0	2.0	2.0
		LOS	A	A	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.097	0.097	0.106
		Delay	1.5	1.5	1.8
		LOS	A	A	A
		Cycle Length	-	-	-
INTERSECTION 10 Road P535 / R102 (P2-4)	Intersection	Control	RBT	RBT	RBT
	Weekday AM	V/C	0.250	0.297	0.329
		Delay	6.2	6.4	6.5
		LOS	B	B	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.264	0.315	0.351
		Delay	5.7	5.8	6.0
		LOS	A	A	A
		Cycle Length	-	-	-
INTERSECTION 11 Road P537 / Mine Access	Intersection	Control	TWSC	TWSC	TWSC
	Weekday AM	V/C	0.047	0.047	0.021
		Delay	2.8	2.8	1.3
		LOS	A	A	A
		Cycle Length	-	-	-
	Weekday PM	V/C	0.039	0.039	0.012
		Delay	3.7	3.7	1.6
		LOS	A	A	A
		Cycle Length	-	-	-
INTERSECTION 12 Road P535 / Mine Access	Intersection	Control	-	-	TSC
	Weekday AM	V/C	-	-	0.133
		Delay	-	-	0.2
		LOS	-	-	A
		Cycle Length	-	-	-
	Weekday PM	V/C	-	-	0.144
		Delay	-	-	0.3
		LOS	-	-	A
		Cycle Length	-	-	-

INTERSECTION	PEAK HOUR	MOE	PHASE 1 Year 2025	PHASE 1 Year 2030	PHASE 2 Year 2036
INTERSECTION 15 Road P537 / N2 Northern Terminal	Intersection	Control	-	-	OWSC
	Weekday AM	V/C	-	-	0.039
		Delay	-	-	3.1
		LOS	-	-	A
		Cycle Length	-	-	-
	Weekday PM	V/C	-	-	0.059
		Delay	-	-	0.8
		LOS	-	-	A
		Cycle Length	-	-	-
INTERSECTION 16 Road P535 / N2 Northern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	1.308	1.308	0.764 (0.764)
		Delay	21.1	21.1	17.2 (47.1)
		LOS	F	F	B (D)
		Cycle Length	-	-	80
	Weekday PM	V/C	0.515	0.484	0.540 (0.540)
		Delay	5.2	26.3	14.1 (34.2)
		LOS	D	E	B (C)
		Cycle Length	-	-	60
INTERSECTION 19 Road P537 / N2 Southern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	-	-	0.030
		Delay	-	-	1.7
		LOS	-	-	B
		Cycle Length	-	-	-
	Weekday PM	V/C	-	-	0.053
		Delay	-	-	3.3
		LOS	-	-	B
		Cycle Length	-	-	-
INTERSECTION 20 Road P535 / N2 Southern Terminal	Intersection	Control	OWSC	OWSC	OWSC
	Weekday AM	V/C	0.703	2.111	0.645 (0.645)
		Delay	8.9	29.8	7.8 (23.4)
		LOS	F	F	A (C)
		Cycle Length	-	-	80
	Weekday PM	V/C	0.324	0.326	0.601 (0.601)
		Delay	5.0	4.0	8.3 (17.0)
		LOS	D	D	A (B)
		Cycle Length	-	-	80

NOTE:

The MOE's in brackets show the worst / critical movement (OWSC and TWSC) or the worst / critical approach (TSC, AWSC and RBT).

TSC = Traffic Signal Control

AWSC = All-way Stop Control

TWSC = Two-way Stop Control

OWSC = One-way Stop Control

RBT = Roundabout

6.8 SUMMARY OF MITIGATION REQUIREMENTS

The required mitigation measures for the application are summarised in *Table 10.*

Table 10: Matrix of Required Mitigation Measures

NETWORK	PHASE 1	PHASE 2	
	YEAR 2025	STAGE 1 - YEAR 2036	STAGE 4 - YEAR 2051
Intersection 9: T-Junction between P537 and R102	Realign the southern approach to a maximum angle of 10-degrees from a safety perspective.	NA	NA
Road P537 Between Intersections 9 & 11	Reconstruction the road to a design speed of 80km/h to comply with the KZN Roads Department Standard.	NA	NA
Intersection 12	NA	Construct partial interchange i.e. Underpass / Overpass crossing of Road P535 with marginal access on both sides of P535 separated by a physical median.	NA
Intersection 16 & Intersection 20	NA	Implement Traffic Signal Control	NA
Intersection 11	NA	NA	Construct partial interchange i.e. Underpass / Overpass crossing of Road P537 with marginal access on both sides of P537 separated by a physical median.
Road P537 Between Intersections 11 & 15	NA	NA	Reconstruction the road to a design speed of 80km/h to comply with the KZN Roads Department Standard.
Intersection 15 & Intersection 19	NA	NA	Construct the interchange between the P537 and the N2 with exclusive right-turn lanes on Road P537

7 TRAFFIC IMPACT ON ROAD SAFETY

7.1 SAFETY CONSIDERATIONS

The mining operations will generate 7-axle side tipper trucks with 34-tonne payloads. These trucks are not compatible with light vehicle traffic and must be separated from the general light vehicle fleet as far as possible.

7.2 ROAD SAFETY MITIGATION MEASURES

The following mitigation measures are recommended to improve road safety given the planned mining operations:

1. Rerouting of heavy vehicles to the higher order road network namely the N2 Route (Class 1) for traffic to/from the Fairbreeze PWP and the Empangeni CPC. The signalization of the terminals of the P535 / N2 Interchange and the construction of the P537 / N2 Interchange will encourage mining related traffic to use the N2 Freeway.

2. The crossing of public roads by high volumes of heavy vehicle traffic is a large safety risk. The construction of partial interchanges (grade separation) is recommended at Intersections 11 and 12 (the accesses to the mining areas) to mitigate these risks.

3. The reconstruction of Road P537 to a design speed of 80km/h to comply with the standards of Kwa-Zulu Natal Roads Department is required to accommodate heavy vehicles from a safety perspective.

The implementation of the road safety mitigation measures that will trigger construction works will require the compilation and approval of Basic Assessment Reports (BAR). These individual processes will take at least 6 months.

7.3 RESIDUE STORAGE FACILITY (RSF) REPAIRS

Failure of the RSF can potentially result in the temporary closure and damage to Road R102 and the N2-28 National freeway. During this period, traffic will have to be rerouted to other routes or temporary diversion routes will have to be constructed in the same road reserve. These diversion routes can only be determined based on the facts. The design of the required construction works, and the rerouting of traffic, is managed through a wayleave process that includes a Traffic Accommodation Plan.

The required rerouting of traffic and construction works will only be of a short-term nature, i.e. approximately 3 to 6 months, during which time traffic can be redirected based on a Disaster Management Plan and subsequent Traffic Accommodation Plans will have to be compiled.

The temporary closure and rerouting of traffic is common with flooding, stability issues on slopes, and other natural disasters.

7.4 PUBLIC TRANSPORT STOPS (PTS)

The construction of Public Transport Stops (PTS) is recommended on both sides, south of the partial interchange intersections on Road P535 and Road P537 as shown on *Illustration 1* and *Figure 7* to support the development.

7.5 NON-MOTORISED TRANSPORT (NMT)

The construction of paved sidewalks is recommended only at the accesses on Road P535 and Road P537 to link these accesses with the proposed Public Transport Stops (PTS) at these accesses as shown on *Illustration 1* and *Figure 7*.

7.6 IMPACT ASSESSMENT RATING

The impact assessment rating below is based on the results of the Traffic Impact Assessment in terms of expected traffic generation, expected impact on the road network, expected road safety implications and the required mitigation measures.

The impacts considered in the traffic engineering discipline stretch over the entire phase, as the impact is generated by activities during the life of the project. The traffic impacts are expected; therefore, the probability is high. Most traffic related impacts are however simple matters to mitigate.

The impact rating methodology is based on the impact scores from *Table 11*, *Table 12*, *Table 13, Table 14*, *Table 15*, and *Table 16* below. The Severity is calculated based on the product of the Probability and the sum of the Extent, Duration, Reversibility, and Magnitude (*Significance = (Extent + Duration + Reversibility + Magnitude) x Probability*).

Table 11: Magnitude of Impact

SCORE	DESCRIPTION
0	Small and will have no effect on the environment.
1	Minor and will not result in an impact on processes (to be defined by individual specialist fields).
2	Low and will cause a slight impact on processes.
3	Moderate and will result in processes continuing but in a modified way.
4	High (processes are altered to the extent that they temporarily cease).
5	Very high and results in complete destruction of patterns and permanent cessation of processes.

Table 12: Extent of Impact

SCORE	DESCRIPTION
1	The impact will be limited to the site.
2	The impact will be limited to the local area (local study area).
3	The impact will be limited to the region.
4	The impact will be national.
5	The impact will be international.

Table 13: Reversibility of Impact

SCORE	DESCRIPTION
1	The impact is immediately reversible.
3	The impact is reversible within 2 years after the cause or stress is removed.
5	The activity will lead to an impact that is in all practical terms permanent.

Table 14: Duration of Impact

SCORE	DESCRIPTION
1	Of a very short duration (0 to 1 years).
2	Of a short duration (2 to 5 years).
3	Medium term (5–15 years).
4	Long term (> 15 years).
5	Permanent (this is considered permanent if the impact will be experienced post mine closure).

Table 15: Probability of Impact

SCORE	DESCRIPTION
1	Very improbable (probably will not happen).
2	Improbable (some possibility, but low likelihood).
3	Probable (distinct possibility).
4	Highly probable (most likely).
5	Definite (impact will occur regardless of any prevention measures).

Table 16: Significance Weightings

OVERALL SCORE	SIGNIFICANCE RATING	DESCRIPTION
<30 points	Low	Where this impact would not have a direct influence on the decision to develop in the area.
31 - 60 points	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.
> 60 points	High	Where the impact must have an influence on the decision process to develop in the area.

Note: Significance = (Extent + Duration + Reversibility + Magnitude) x Probability

Table 17: Impact Assessment Rating

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	SIZE AND SCALE OF DISTUR-BANCE	MAGNITUDE	EXTENT	REVERSIBILITY	DURATION	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MAGNITUDE	EXTENT	REVERSIBILITY	DURATION	PROBABILITY	SIGNIFICANCE WITH MITIGATION	DETAILED MITIGATION MEASURES	MITIGATIO N TYPE	STANDARDS TO BE ACHIEVED
Site-Establishment	Additional traffic generated	Operations and Traffic Safety	Internal to site ±5 Peak Hour Trips	**1**	**1**	**1**	**1**	**5**	**20**	**1**	**1**	**1**	**1**	**5**	**20**	No external mitigation required.	NA	Compliance with COTO Standards, Standards for KZN Provincial Roads, and Standards for SANRAL National Roads.
Phase 1			Fairbreeze PWP to Mine west of P537 ±9 Peak Hour Trips	**1**	**2**	**1**	**2**	**5**	**30**	**1**	**2**	**1**	**2**	**5**	**30**	Reconstruction of P537 between Mine Access and R102	Construction works	
Phase 2 Stage 1 (From 2036)			PWP Port Dunford to CPC Empangeni ±12 Peak Hour Trips	**3**	**3**	**1**	**3**	**5**	**50**	**2**	**3**	**1**	**3**	**5**	**45**	Construction of grade-separated access from/to P535	Construction works	
Phase 2 Stage 4 (From 2051)			ROM crossing P537 ±473 Peak Hour Trips	**5**	**3**	**1**	**4**	**5**	**65**	**3**	**3**	**1**	**4**	**5**	**55**	Construction of grade-separated access from/to P537	Construction works	
			PWP Port Dunford to CPC Empangeni ±12 Peak Hour Trips	**4**	**3**	**1**	**4**	**5**	**60**	**2**	**3**	**1**	**4**	**5**	**50**	Reconstruction of P537 between Mine Access and N2	Construction works	
				4	**3**	**1**	**4**	**5**	**60**	**2**	**3**	**1**	**4**	**5**	**50**	Construct the interchange between P537 and N2	Construction works	
Site Closure (2069)			Internal to site ±5 Peak Hour Trips	**1**	**1**	**1**	**1**	**5**	**20**	**1**	**1**	**1**	**1**	**5**	**20**	No external mitigation required.	NA	

8 TRAFFIC IMPACT ON PAVEMENT

8.1 INTRODUCTION

The Tronox Mine will not cause pavement damage to the road network since the loading of heavy vehicles will be strictly controlled through the weighing of loads with static weighbridges which will be provided on site. Tronox Mine will comply with the permissible maximum vehicle mass in terms of the National Road Traffic Act.

However, all heavy vehicles have an impact on road pavements, i.e. they gradually, over time, use a proportion of the pavement design strength which requires ongoing maintenance and rehabilitation during the design life of a road. It is not standard practice to hold developers / mines accountable for the use of pavement design strength since they pay taxes to central government which allocates the funding required for roads (new construction works, maintenance, and rehabilitation) to provincial and national road authorities. The only instances where developers and mines are held accountable for the use of pavement design strength is when they overload, which results in pavement damage, and when traffic generated by them utilise local roads which are not appropriate, i.e. not planned and designed to serve the specific function. This is not the case with the provincial and national roads that will be affected by the Tronox Mine.

8.2 EXPECTED INCREMENTAL LOADING ON PAVEMENT

Access to the supporting road network, from the Port Dunford Mining Areas, will be from Road P537 in the west and Road P535 in the east since these roads bisect the mining areas. The largest impact, in terms of loading, is thus expected on these provincial roads.

The expected impact of heavy vehicles on these roads, in terms of equivalent standard axle loads (ESALS) or E80kN axles, was thus determined for three (3) consecutive 15-year periods which corresponds with the typical design life of a road pavement. Please note that the design ESALS for a medium strength pavement is 0.1 – 3.0 million E80kN loads while the design ESALS for a heavy pavement is 3.0 – 100.0 million E80kN loads.

Average Truck Factors (E80kN loading per truck) of 4.0 was assumed for all loaded trucks while 0.6 was assumed for all empty trucks.

Table 18: Expected Million ESALS

PHASE	ROUTE	ROAD SECTIONS	MILLION ESALS IN FIRST 15 YEAR DESIGN-PERIOD	MILLION ESALS IN SECOND 15 YEAR DESIGN-PERIOD	MILLION ESALS IN THIRD 15 YEAR DESIGN-PERIOD
PHASE 1: 2025 – 2036: New Mine at Port Dunford (PWP remains at Fairbreeze)	From Port Dunford Mine to PWP Fairbreeze	Road P537, R102, N2	**0,008**	**-**	**-**
	From PWP Fairbeeze to CPC Empangeni	R102, N2, R34	**0,0005**	**-**	**-**
	From CPC Empangeni to PWP Fairbreeze	R102, N2, R34	**0,0014**	**-**	**-**
	From PWP Fairbreeze to Port Dunford Mine	Road P537, R102, N2	**0,0002**	**-**	**-**
PHASE 2: 2036 – 2069: New Mine AND PWP at Port Dunford	From Port Dunford Mine to PWP Port Dunford	Mine Access Road on P537	**-**	**1,381**	**1,381**
		Mine Access Road on P535	**-**	**-**	**2,761**
		Internal Circulation Road	**2,761**	**8,284**	**8,284**
	From PWP Port Dunford to CPC Empangeni	Road P537, Road P535, R102, N2, R34	**0,068**	**0,203**	**0,203**
	From CPC Empangeni to PWP Port Dunford	Road P537, Road P535, R102, N2, R34	**0,030**	**0,091**	**0,091**
	From PWP Port Dunford to Port Dunford Mine	Mine Access Road on P537	**-**	**0,215**	**0,215**
		Mine Access Road on P535	**-**	**-**	**0,431**
		Internal Circulation Road	**-**	**1,292**	**1,292**

8.3 ASSESSMENT OF LOADING IMPACT

Inspection of the expected incremental loading, in terms of ESALS, is summarised in Table 18 which shows the following:

- Significant loading, in terms of ESALS, is expected on the Internal Circulation Road(s) during all three 15-year periods,
- Significant loading, in terms of ESALS, is only expected on the Mine Access Roads during the second and third 15-year periods from/to Road P537 and only the third period from/to Road P535,

- Significant loading, in terms of ESALS, is not expected on the external provincial or national roads during any of the operational periods,

Table 19: Summary of Expected Million ESALS in Critical Direction

ROAD SECTIONS	MIL. STD. AXLES IN FIRST 15 YEAR DESIGN-PERIOD	MIL. STD. AXLES IN SECOND 15 YEAR DESIGN-PERIOD	MIL. STD. AXLES IN THIRD 15 YEAR DESIGN-PERIOD
Internal Circulation Road(s)	**2,761**	**8,284**	**8,284**
Mine Access Road on P535	**0,068**	**0,203**	**2,964**
Mine Access Road on P537	**0,008**	**1,381**	**1,381**

The TIA has concluded that Road P537 must be reconstructed to comply with the minimum geometric standards for a Class 3 provincial road. This road must be designed, and constructed, to accommodate the expected design ESALS for the design life of this road. The rehabilitation of Road P535 will likely be required only during the third 15-year design period.

All the Mine Access Roads and the Internal Circulation Road(s) must be designed and constructed to accommodate the expected design ESALS for the design life of these roads.

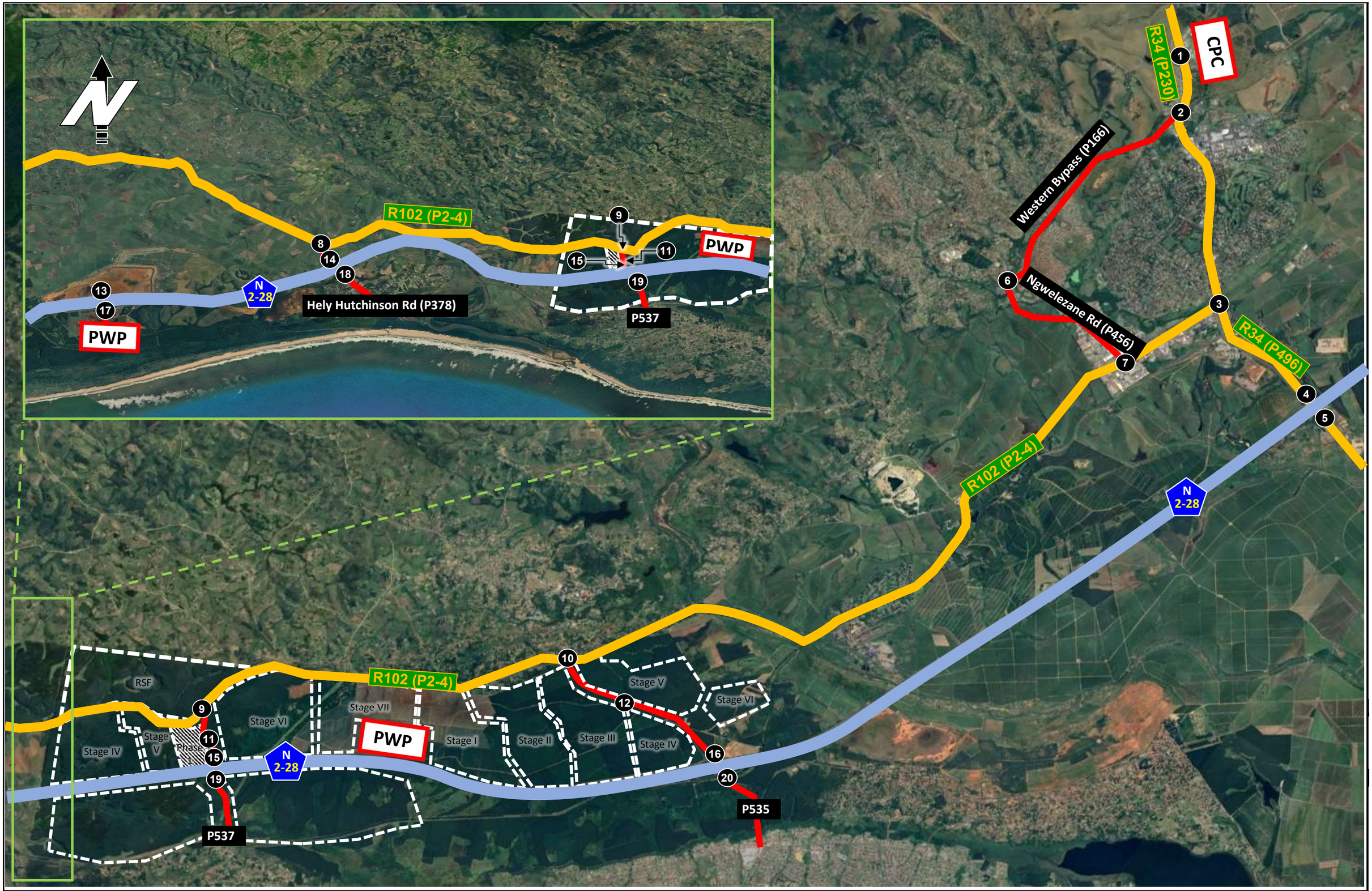
9 CONCLUSIONS AND RECOMMENDATIONS

The following is concluded and recommended:

1. The mining operations at Port Dunford is planned between 2025 and 2069. Phase 1 (2025 – 2036) will entail the transport of ROM between Port Dunford and the PWP at Fairbreeze, while the HMC produced at the Fairbreeze PWP will still be transported by road to the Empangeni CPC (and will therefore not generate any new traffic).
2. The ROM during Phase 1 will be transported by ±18 heavy vehicles (two-way traffic) and will only require the reconstruction of the northern section of Road P537 to a design speed of 80km/h to comply with the standards of Kwa-Zulu Natal Roads Department and the realignment of the southern approach at the T-junction with the R102 (from a safety perspective).
3. Phase 2 Stage 1 operations will be based on a new PWP at Port Dunford in 2036 and will require the construction of a partial interchange at the access on Road P535 given the high volume of heavy vehicles that will cross P535 during Stage 5 (473 veh/hr two-way traffic), as well as the signalization of the terminals of the P535 / N2 interchange which are already experiencing capacity problems.
4. Phase 2 Stage 4 operations in 2051 will require the construction of a partial interchange at the access on Road P537 given the high volume of heavy vehicles that will cross P537 during Stage 4 (473 veh/hr two-way traffic), as well as the reconstruction of the southern section of P537 to a design speed of 80km/h to comply with the standards of Kwa-Zulu Natal Roads Department and the construction of an interchange between P537 and the N2.
5. The reconstruction of the Internal Mining Area Access Road, Road P535, and Road P535 in three sections of 15-year design lives is required.

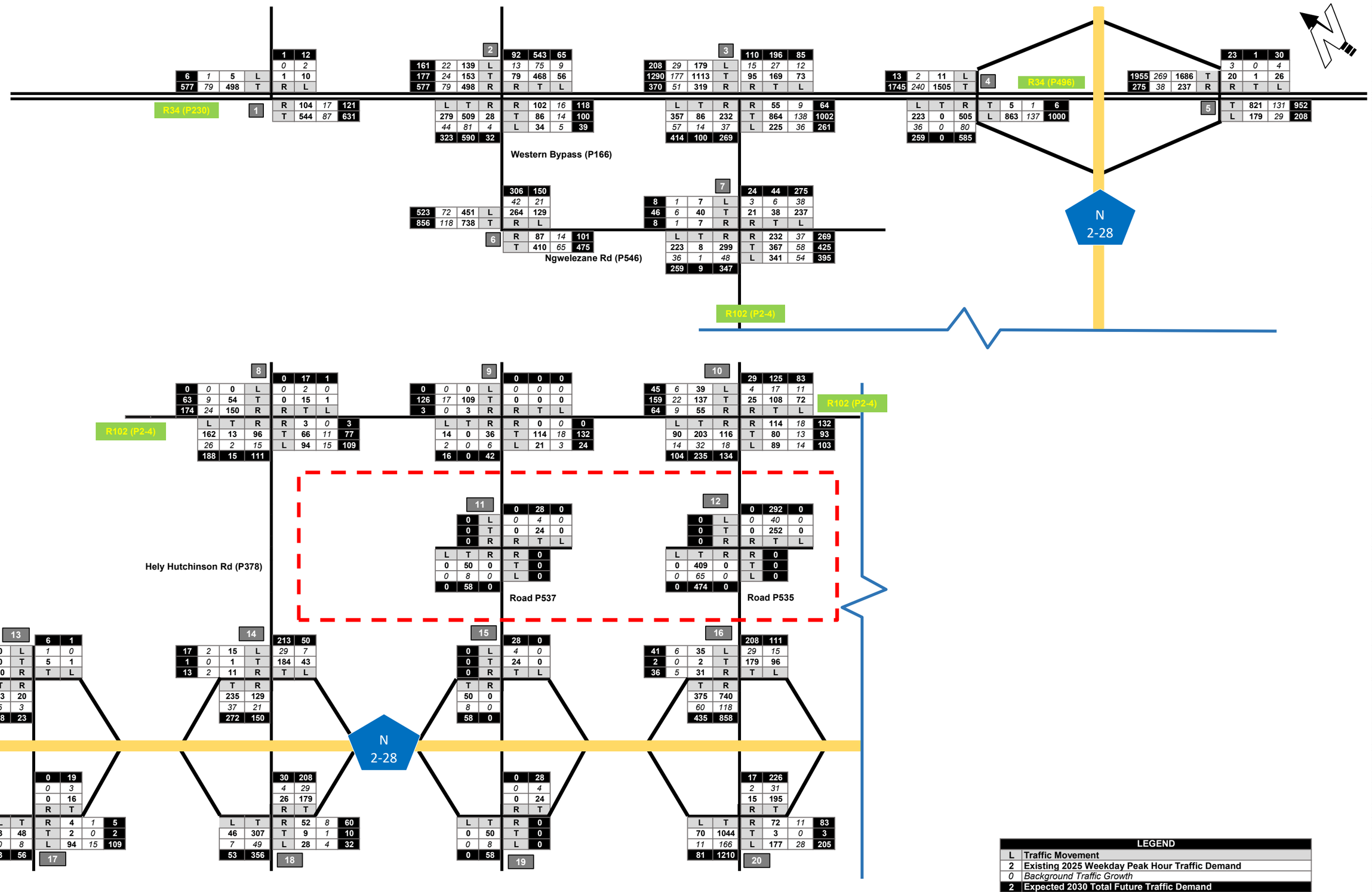
FIGURES

Figure 1: Locality Plan and Study Area



TECHWORLD	TRONOX, PORT DUNFORD	Locality Plan and Study Area	FIGURE 1

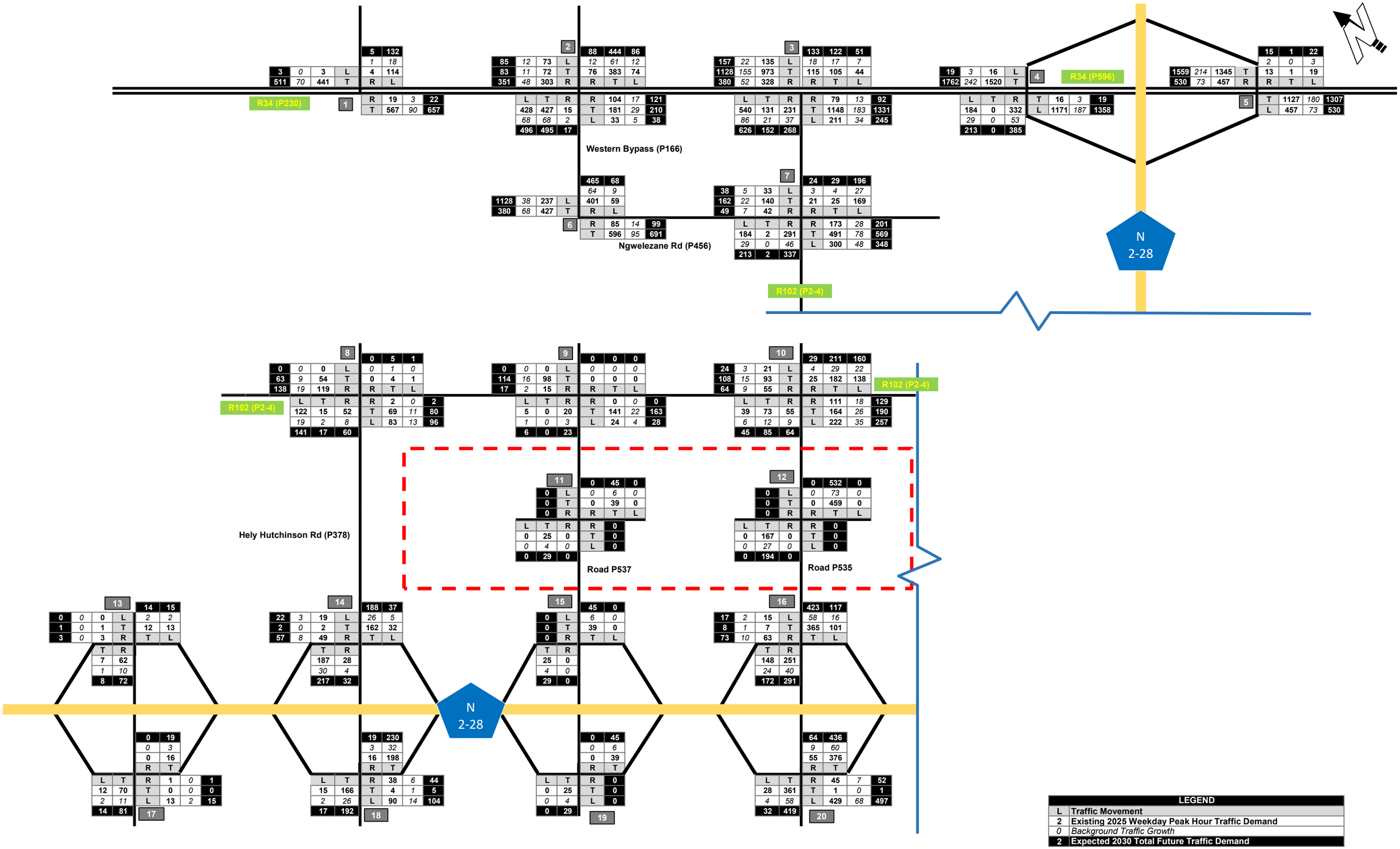
Figure 2: 2030 Background Weekday AM Peak Hour Traffic Demand



LEGEND	
L	Traffic Movement
2	Existing 2025 Weekday Peak Hour Traffic Demand
0	Background Traffic Growth
2	Expected 2030 Total Future Traffic Demand

TECHWORLD consulting ENGINEERS	TRONOX, PORT DUNFORD	2030 Background Weekday AM Peak Hour Traffic Demand	FIGURE 2

Figure 3: 2030 Background Weekday PM Peak Hour Traffic Demand



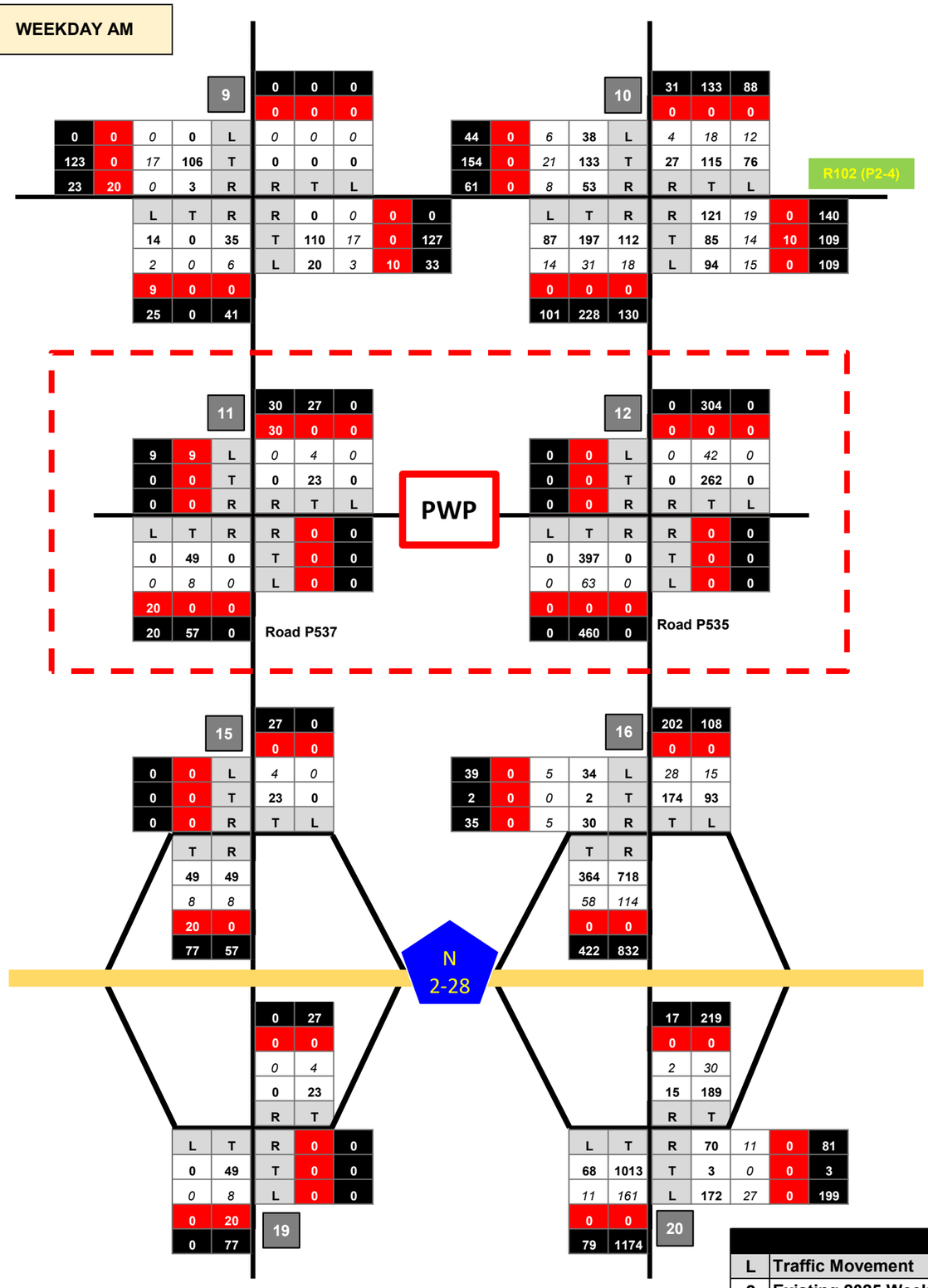
LEGEND	
L	Traffic Movement
2	Existing 2025 Weekday Peak Hour Traffic Demand
0	*Background Traffic Growth*
2	**Expected 2030 Total Future Traffic Demand**

TECHWORLD consulting ENGINEERS	TRONOX, PORT DUNFORD	2030 Background Weekday PM Peak Hour Traffic Demand

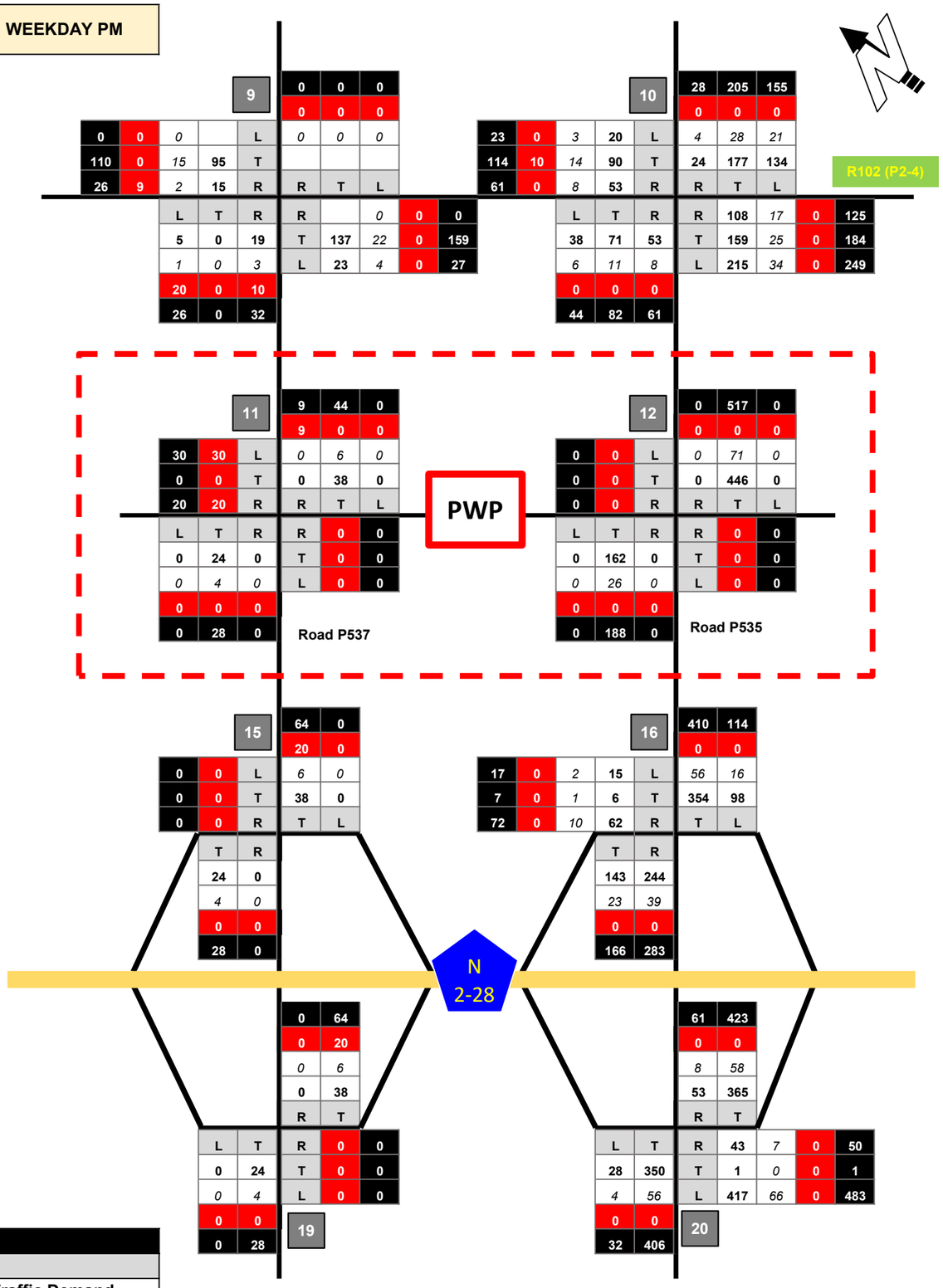
FIGURE 3

Figure 4: Phase 1 - 2030 Weekday Peak Hour Traffic Demand

WEEKDAY AM



WEEKDAY PM

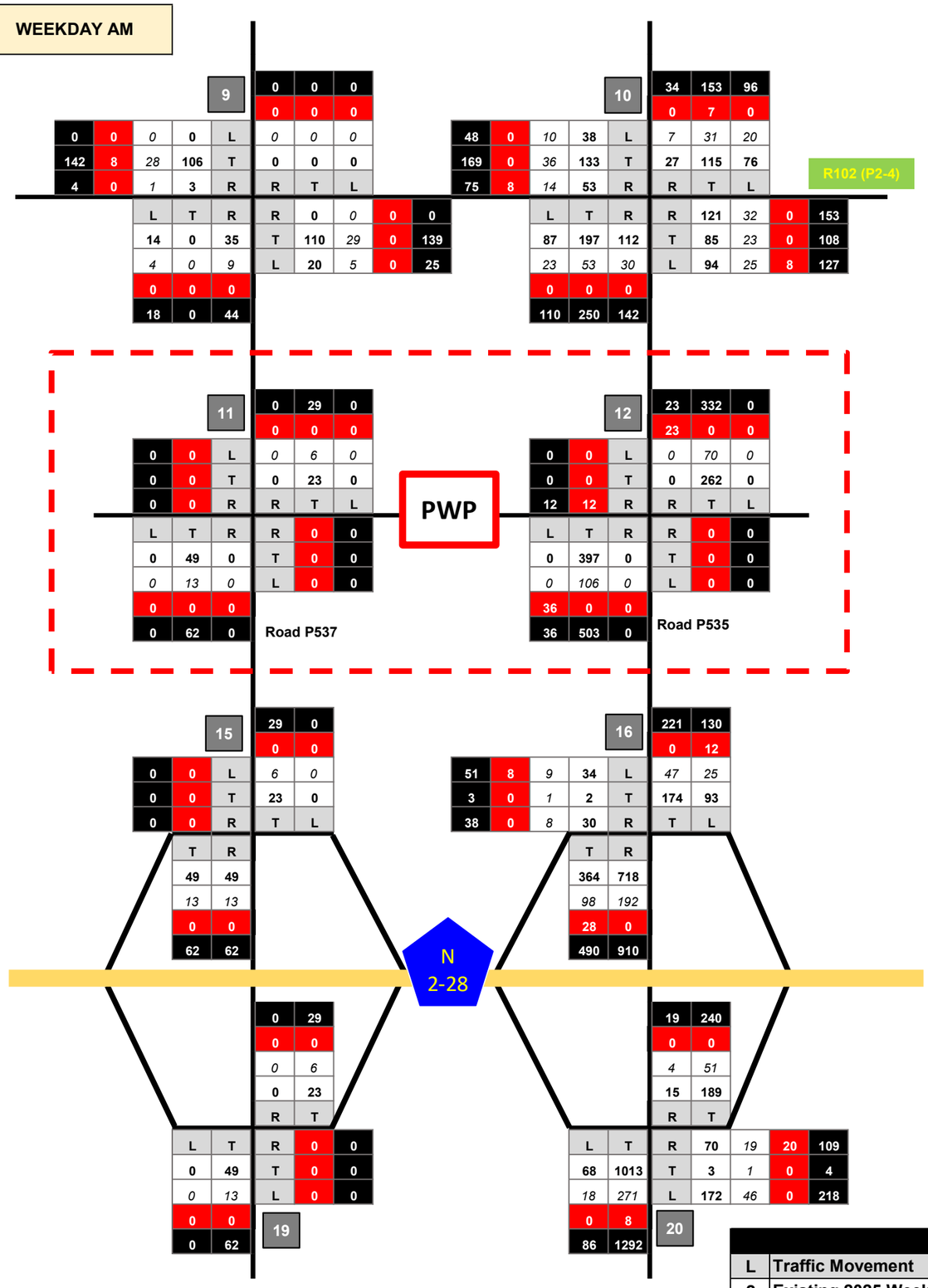


LEGEND	
L	Traffic Movement
2	Existing 2025 Weekday Peak Hour Traffic Demand
0	*Background Traffic Growth*
5	Added Application Traffic
7	Expected 2030 Total Future Traffic Demand

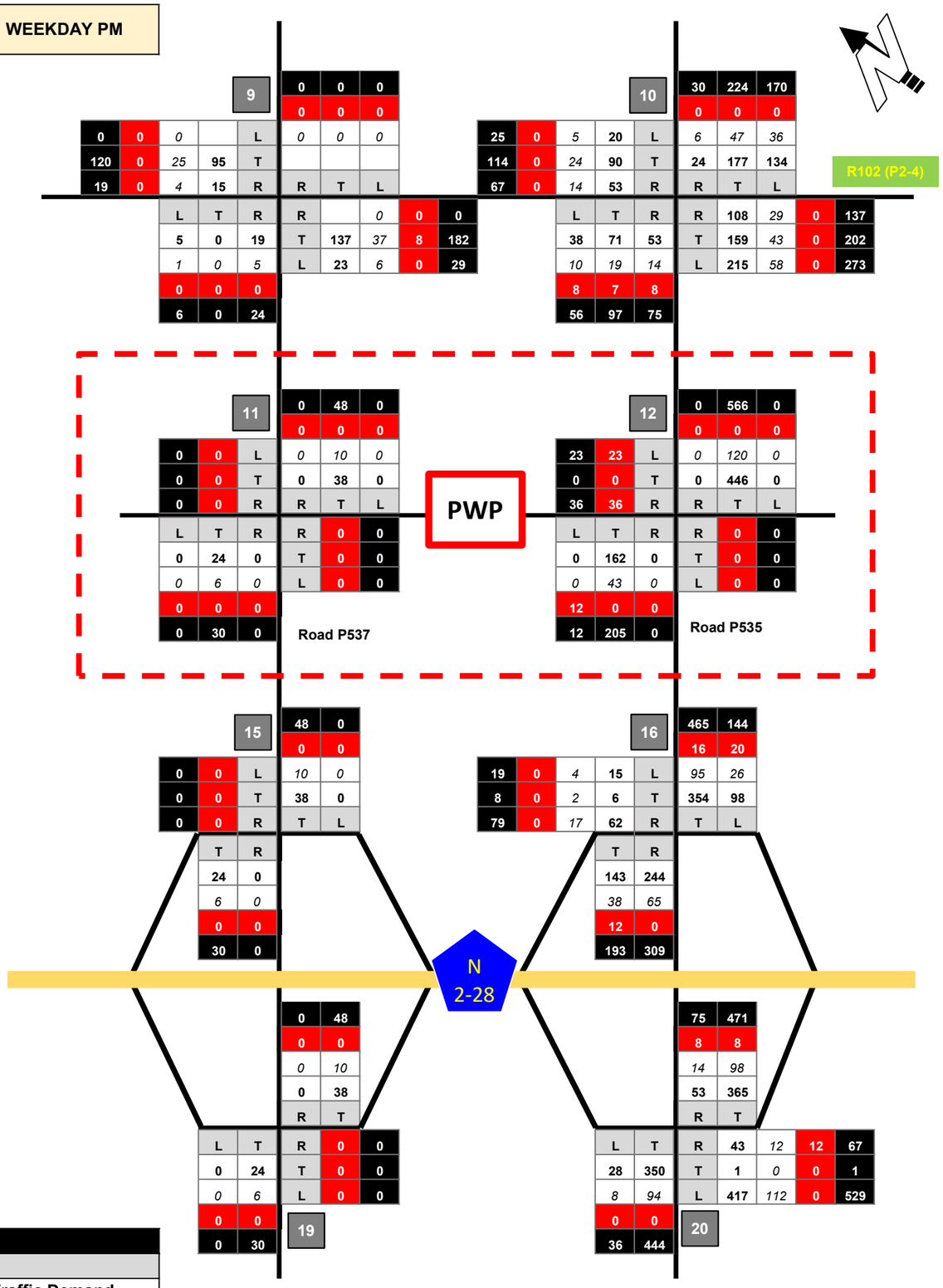
TECHWORLD consulting ENGINEERS	TRONOX, PORT DUNFORD	Phase 1 - 2030 Weekday Peak Hour Traffic Demand	FIGURE4

Figure 5: Phase 2 Stage 1 - 2036 Weekday Peak Hour Traffic Demand

WEEKDAY AM



WEEKDAY PM

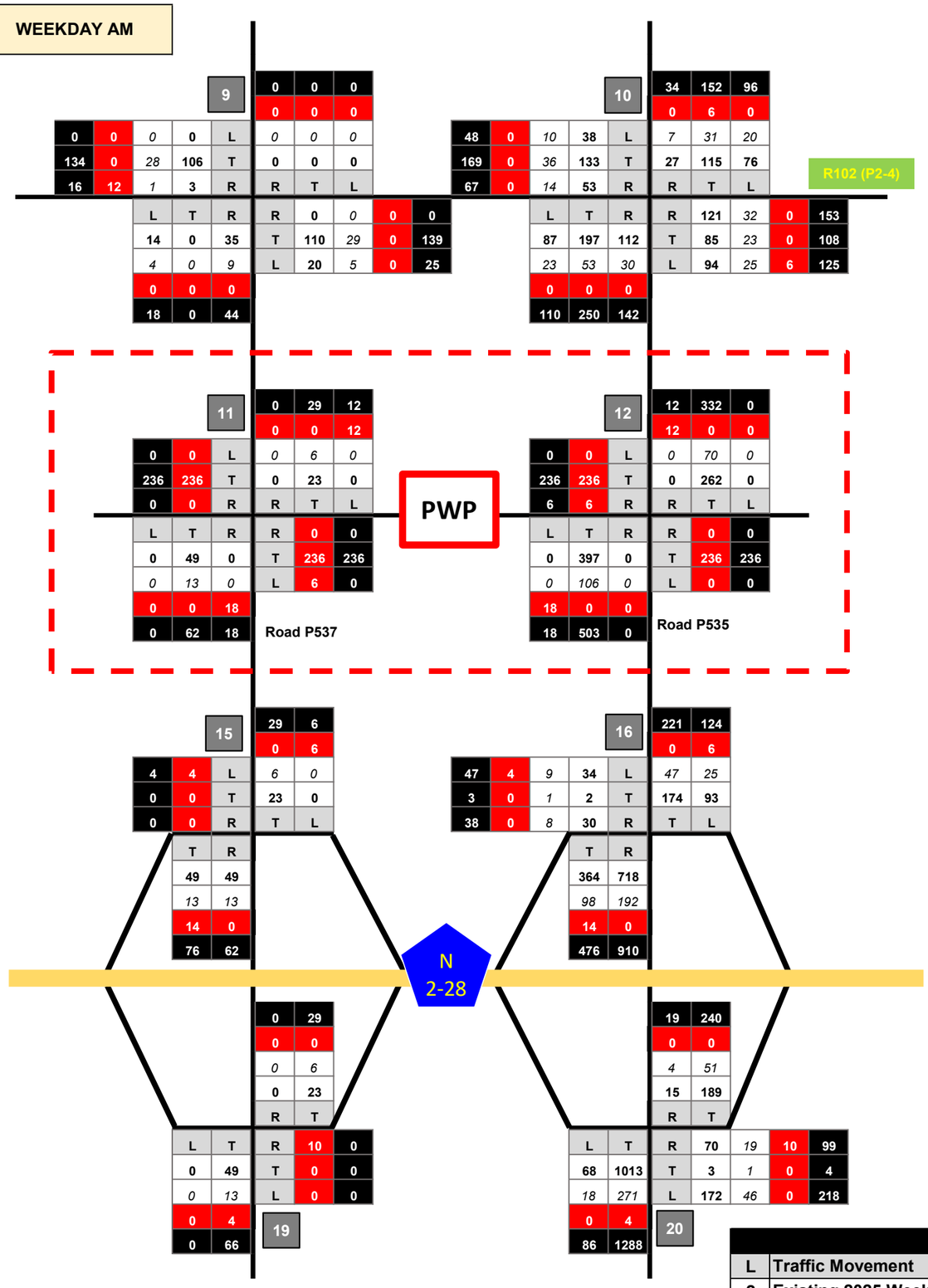


LEGEND	
L	Traffic Movement
2	Existing 2025 Weekday Peak Hour Traffic Demand
0	*Background Traffic Growth*
5	Added Application Traffic
7	Expected 2036 Total Future Traffic Demand

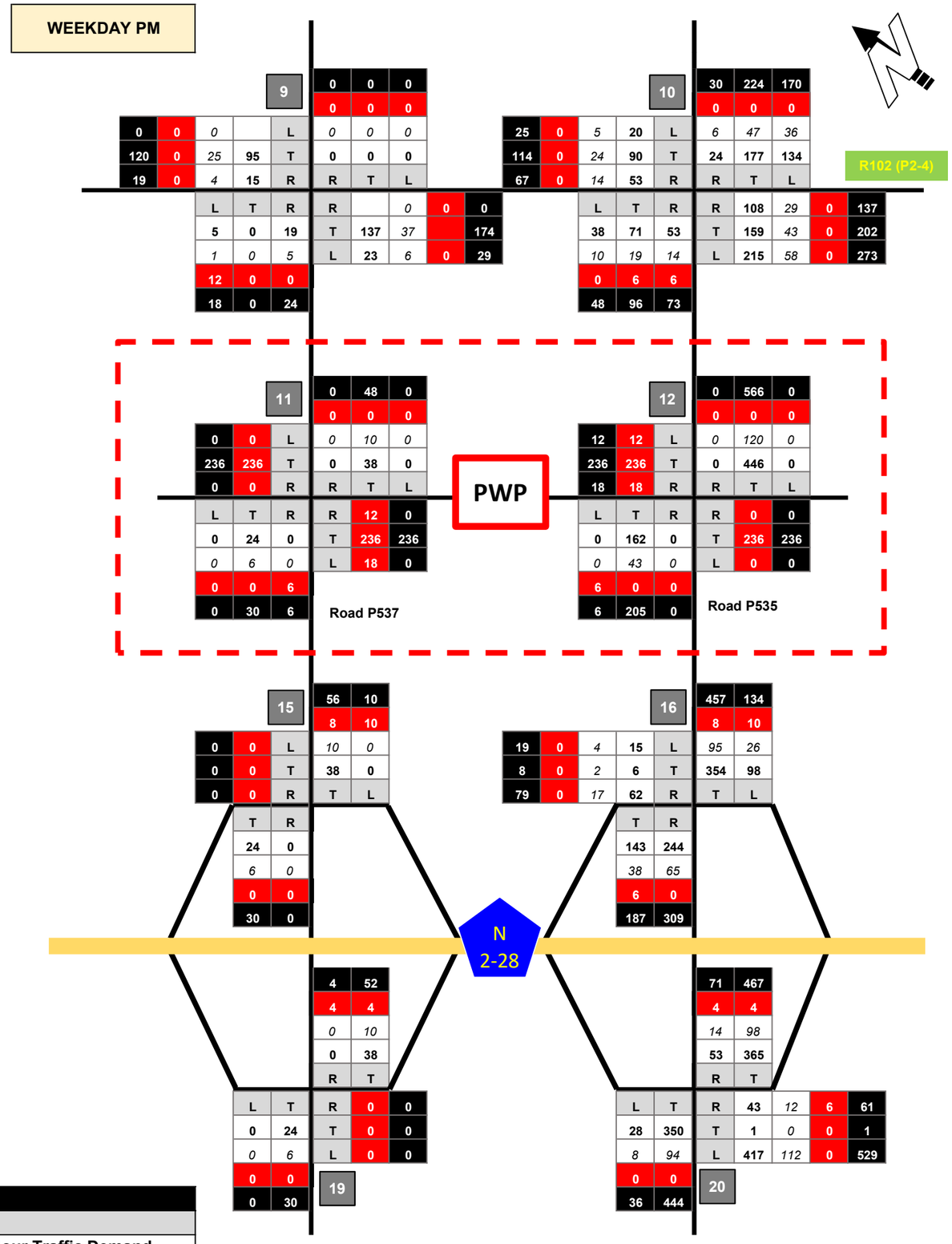
TECHWORLD consulting ENGINEERS	TRONOX, PORT DUNFORD	Phase 2 Stage 1 - 2036 Weekday Peak Hour Traffic Demand	FIGURE 5

Figure 6: Phase 2 Stage 5 – 2036 Weekday Peak Hour Traffic Demand

WEEKDAY AM



WEEKDAY PM

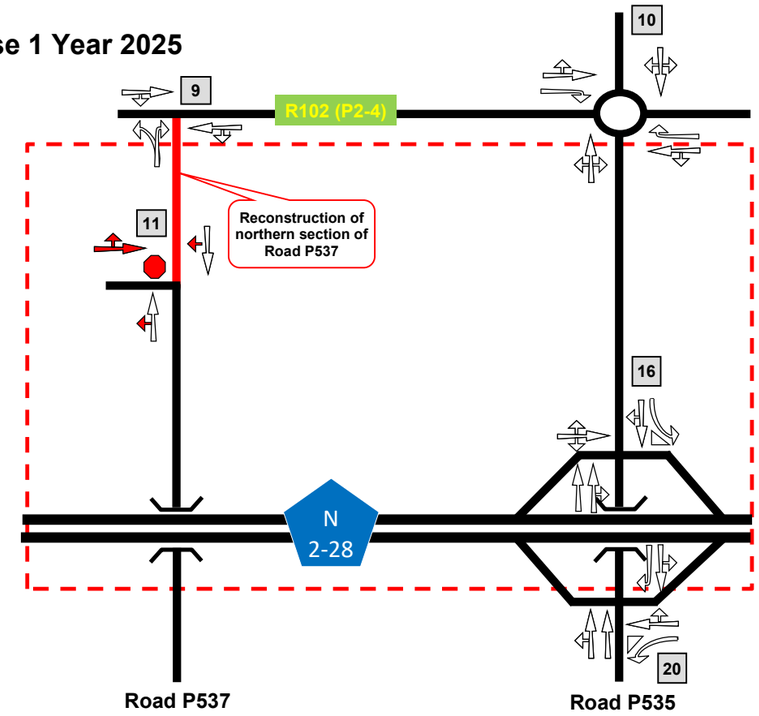


LEGEND	
L	Traffic Movement
2	Existing 2025 Weekday Peak Hour Traffic Demand
0	*Background Traffic Growth*
5	Added Application Traffic
7	Expected 2036 Total Future Traffic Demand

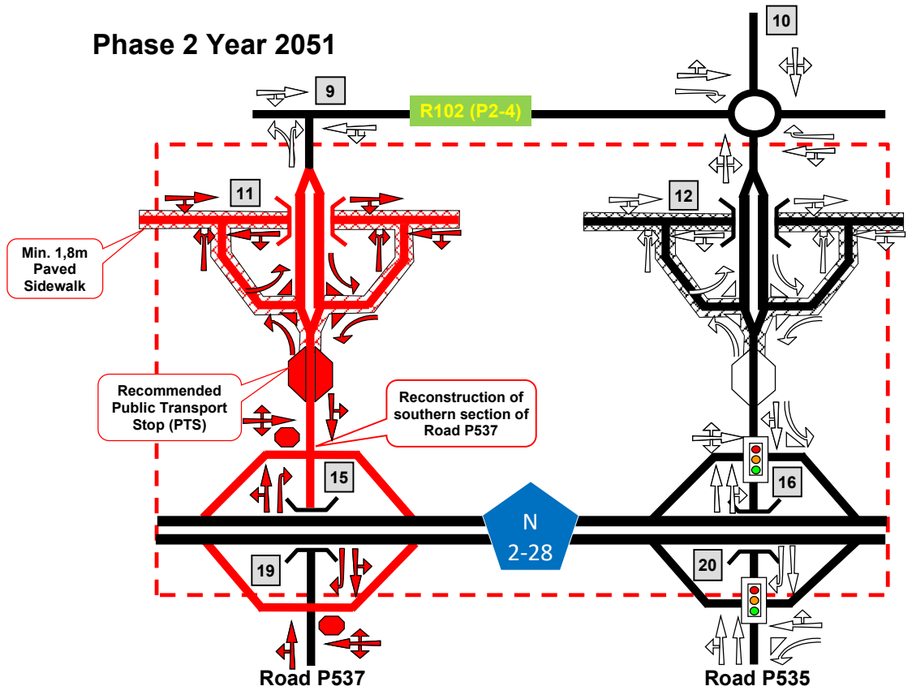
TECHWORLD consulting ENGINEERS	TRONOX, PORT DUNFORD	Phase 2 Stage 5 - 2036 Weekday Peak Hour Traffic Demand	FIGURE 6

Figure 7: Required Road Network Improvements

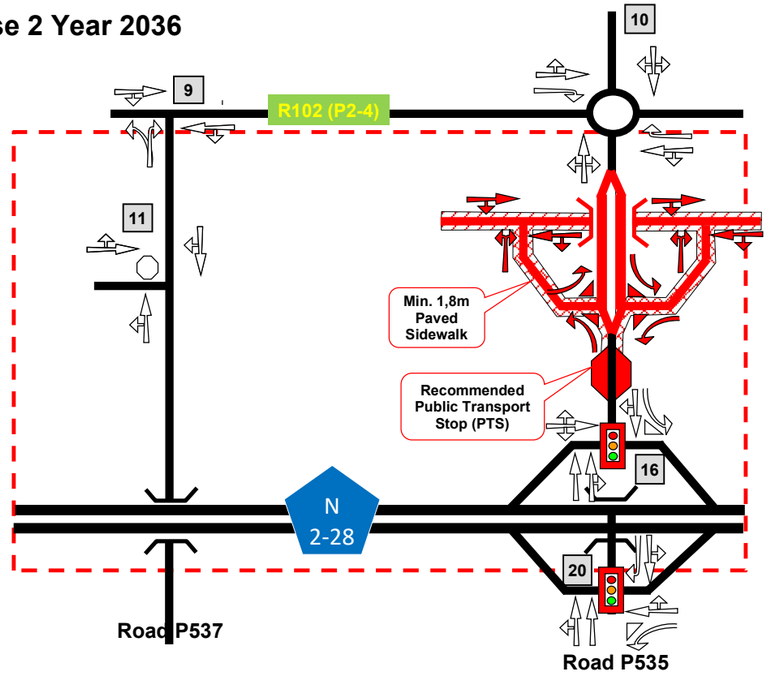
Phase 1 Year 2025



Phase 2 Year 2051



Phase 2 Year 2036



LEGEND
Existing Road Layout in Study Area
Committed Road Improvements by TRONOX

TECHWORLD consulting ENGINEERS	TRONOX, PORT DUNFORD	Required Road Network Improvements	FIGURE 7

APPENDICES

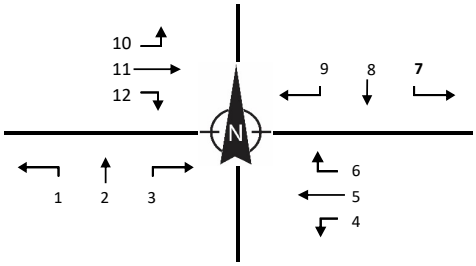
Appendix A: Traffic Counts

LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	R34 & ACCESS TO TRONOX KZN SANDS				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT 3	DATA:	D.L	TYPE:	4W-12H-6-18-C

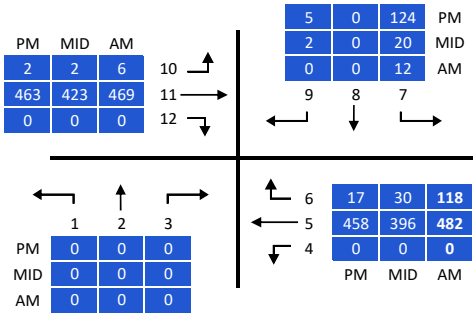
OVERVIEW MAP & VIDEO FRAME

JUNCTION DIAGRAM

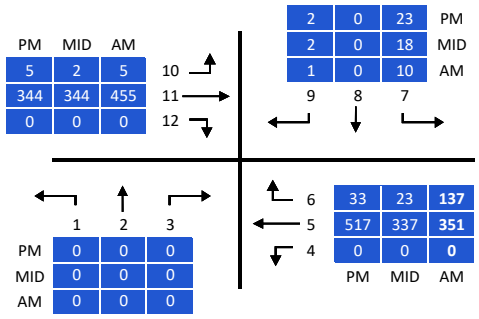
WESTERN APPROACH / EASTBOUND	NORTHERN APPROACH / SOUTHBOUND
R34	ACCESS TO TRONOX KZN SANDS
SOUTHERN APPROACH / NORTHBOUND	**EASTERN APPROACH / WESTBOUND**
	R34



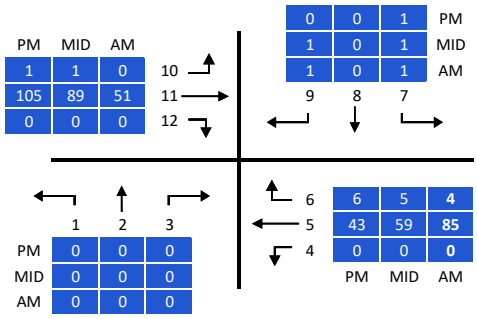
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLE

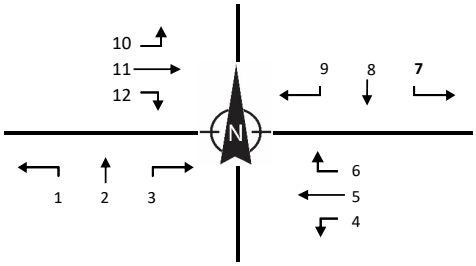


LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	WESTERN BYPASS & R34(NKWANAZI ST)				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT 2	DATA:	D.L	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

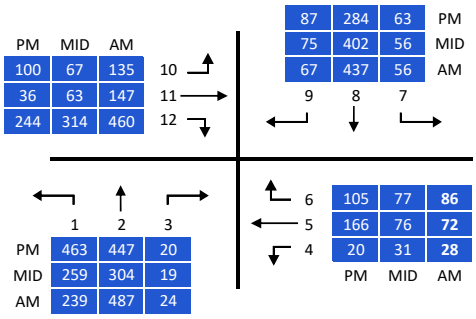
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND	NORTHERN APPROACH / SOUTHBOUND
R34(NKWANAZI ST)	WESTERN BYPASS

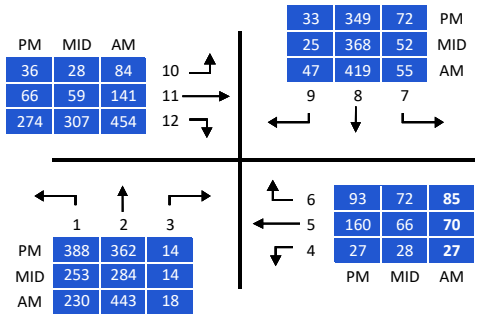


SOUTHERN APPROACH / NORTHBOUND	EASTERN APPROACH / WESTBOUND
WESTERN BYPASS	R34(NKWANAZI ST)

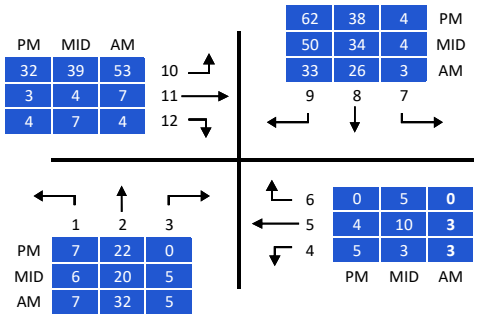
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLE

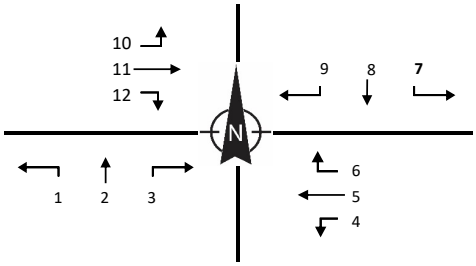


LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	R102 & R34				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT 1	DATA:	D.L	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

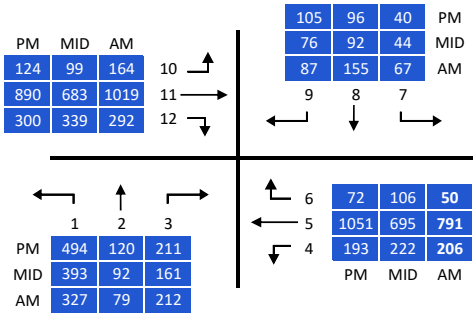
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND	NORTHERN APPROACH / SOUTHBOUND
R34	R102

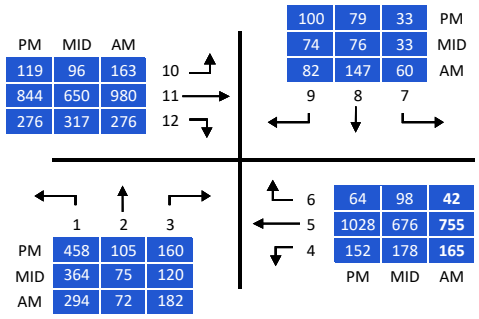


SOUTHERN APPROACH / NORTHBOUND	EASTERN APPROACH / WESTBOUND
R102	R34

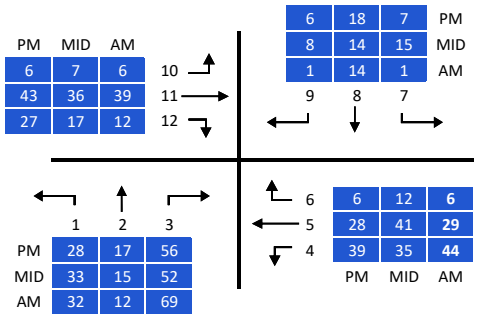
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



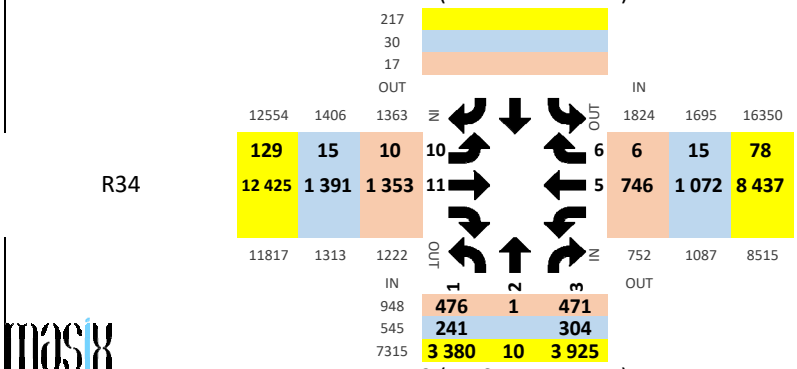
HEAVY VEHICLE



RICHARDS BAY

LOCATION	1	R34 AND N2 (WEST TERMINAL)	24.03.2022
12 HOUR COUNT		TOTAL VEHICLES	THURSDAY
AM PEAK	06:30 – 07:30	TOTAL 12 HR	PM PEAK 16:00 – 17:00

N2 (WEST TERMINAL)



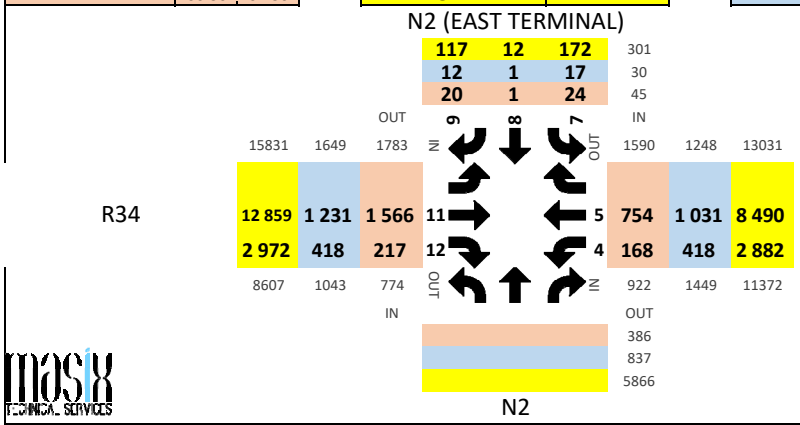
N2 (WEST TERMINAL)

v3.0

Time	Southern Leg			Eastern Leg		Northern Leg			Western Leg			Hourly	
	1	2	3	5	6				10	11			
AM PEAK	476	1	471	746	6				10	1 353		3063	
PM PEAK	241		304	1 072	15				15	1 391		3038	
TOTAL	3 380	10	3 925	8 437	78				129	12 425		28384	
06:00	46	1	79	125	1				3	84			
06:15	101		110	166	2				2	159			
06:30	131	1	110	170	1				2	289			
06:45	106		115	184	2				6	313		2309	06:00
07:00	121		128	200	1				1	336		2757	06:15
07:15	118		118	192	2				1	415		3063	06:30
07:30	99		101	214					2	313		3088	06:45
07:45	101		98	200	2				5	311		3079	07:00
08:00	86		97	187	2				4	228		2896	07:15
08:15	77		88	155	1				5	230		2606	07:30
08:30	64		82	149					6	217		2395	07:45
08:45	75		73	139	1				2	202		2170	08:00
09:00	74		127	139	1				2	209		2118	08:15
09:15	70		105	153	2				4	224		2120	08:30
09:30	51		81	142	2				1	244		2123	08:45
09:45	81		79	144	2				2	185		2124	09:00
10:00	65		63	134	6				1	221		2062	09:15
10:15	77	1	79	160	1				5	213		2040	09:30
10:30	83		83	146					2	209		2042	09:45
10:45	69		85	141					2	221		2067	10:00
11:00	62	1	81	145	5				2	188		2061	10:15
11:15	58		79	153	1				6	200		2022	10:30
11:30	57		68	152	1				1	214		1992	10:45
11:45	70		61	171	1				1	244		2022	11:00
12:00	53		79	147	2				1	243		2063	11:15
12:15	41		62	170	3				2	229		2073	11:30
12:30	75	2	92	175						214		2138	11:45
12:45	55	1	78	137					1	236		2098	12:00
13:00	56		58	161					2	276		2126	12:15
13:15	67		76	160					3	248		2173	12:30
13:30	50	1	72	150					2	264		2154	12:45
13:45	67	1	82	158	2				1	292		2249	13:00
14:00	67		71	172	3				6	229		2244	13:15
14:15	67		56	171	1				4	229		2218	13:30
14:30	73		72	189					3	225		2241	13:45
14:45	66		66	158	3				1	316		2248	14:00
15:00	68		65	195	2					252		2282	14:15
15:15	85		73	153	1				3	271		2340	14:30
15:30	54		78	210	2					250		2372	14:45
15:45	54		70	185	1				1	268		2341	15:00
16:00	65		91	279	3				2	330		2529	15:15
16:15	56		63	212	3				7	384		2668	15:30
16:30	54		86	289	3				4	320		2830	15:45
16:45	66		64	292	6				2	357		3038	16:00
17:00	50		75	243	3				1	363		3003	16:15
17:15	50		60	234	2				4	361		2989	16:30
17:30	50	1	96	195	1				4	282		2862	16:45
17:45	49		50	141					7	317		2639	17:00
18:00												1904	17:15
18:15												1193	17:30
18:30												564	17:45
18:45													18:00
19:00													18:15
19:15													18:30
19:30													18:45
19:45													19:00
20:00													19:15
20:15													19:30
20:30													19:45
20:45													20:00

RICHARDS BAY

LOCATION	2	R34 AND N2 (EAST TERMINAL)	24.03.2022
12 HOUR COUNT		TOTAL VEHICLES	THURSDAY
AM PEAK	06:30 – 07:30	TOTAL 12 HR	PM PEAK 16:00 – 17:00

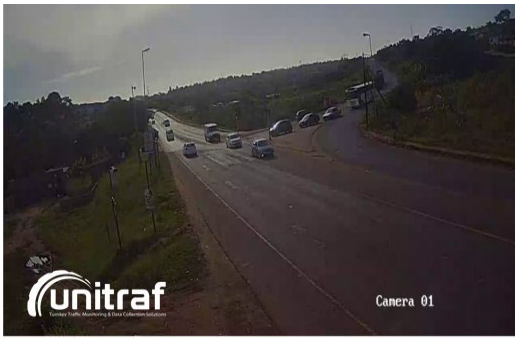


v3.0

Time	Southern Leg			Eastern Leg			Northern Leg			Western Leg			Hourly	
				4	5		7	8	9		11	12		
AM PEAK				168	754		24	1	20		1 566	217	2750	
PM PEAK				418	1 031		17	1	12		1 231	418	3128	
TOTAL				2 882	8 490		172	12	117		12 859	2 972	27504	
06:00				34	144		3		1		307	28		
06:15				38	165		5	1	1		356	37		
06:30				41	168		4		5		398	44		
06:45				45	206		6		3		427	65	2532	06:00
07:00				45	197		4		8		342	52	2663	06:15
07:15				37	183		10	1	4		399	56	2750	06:30
07:30				37	165		4		3		375	44	2718	06:45
07:45				36	181		4	1	4		361	33	2586	07:00
08:00				42	171		5		3		317	35	2511	07:15
08:15				45	178		4		3		301	34	2386	07:30
08:30				33	165		6		1		279	39	2281	07:45
08:45				34	125		2		6		256	41	2125	08:00
09:00				31	130		4		3		249	48	2017	08:15
09:15				32	135		2		2		245	15	1883	08:30
09:30				36	147		2				236	30	1811	08:45
09:45				48	129		2		4		219	40	1789	09:00
10:00				49	157		1		1		239	42	1813	09:15
10:15				50	162		4				209	45	1852	09:30
10:30				50	143		4	1			184	34	1817	09:45
10:45				44	141		2		2		216	42	1822	10:00
11:00				45	162		2				226	61	1829	10:15
11:15				49	166		4		5		208	61	1852	10:30
11:30				50	161		6	2	3		221	47	1926	10:45
11:45				51	149		3	1			215	56	1954	11:00
12:00				54	168		1		2		246	54	1983	11:15
12:15				40	161		1				258	59	2009	11:30
12:30				49	172		5		1		228	51	2025	11:45
12:45				63	149		5		4		208	53	2032	12:00
13:00				68	167		3				238	62	2045	12:15
13:15				70	165		4		4		229	54	2052	12:30
13:30				54	145		2		1		188	68	2004	12:45
13:45				61	176		2	1	2		219	74	2057	13:00
14:00				83	177		3		3		226	67	2078	13:15
14:15				76	155		4		2		226	52	2067	13:30
14:30				62	175		6	1	2		231	94	2180	13:45
14:45				84	176		4		2		245	104	2260	14:00
15:00				86	191		3	1	3		251	89	2325	14:15
15:15				85	169		2	1	3		267	85	2422	14:30
15:30				100	200				6		282	109	2548	14:45
15:45				101	209		4		2		291	94	2634	15:00
16:00				104	243		3	1	4		296	92	2753	15:15
16:15				114	270		6		3		317	121	2972	15:30
16:30				100	257		6		5		330	121	3094	15:45
16:45				100	261		2				288	84	3128	16:00
17:00				94	246		4		1		282	114	3126	16:15
17:15				88	269		4		1		256	99	3012	16:30
17:30				57	192		4		3		247	63	2759	16:45
17:45				87	167		1		1		225	80	2585	17:00
18:00													1844	17:15
18:15													1127	17:30
18:30													561	17:45
18:45														18:00
19:00														18:15
19:15														18:30
19:30														18:45
19:45														19:00
20:00														19:15
20:15														19:30
20:30														19:45
20:45														20:00

LOCATION:	RICHARDS BAY ADD	PROJECT TITLE:	RICHARDS BAY ADD-TRAFFIC COUNT				
PROJECT NR:	UT2022-2202	INTERSECTION:	NGWELEZANE RD & WESTERN BYPASS				
SURVEY DATE:	Wednesday, 24 May 2023						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	P20	DATA:	J.A.V	TYPE:	TN-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME



JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

NGWELWZANE RD

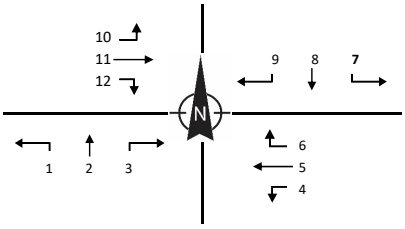
NORTHERN APPROACH / SOUTHBOUND

WESTERN BYPASS

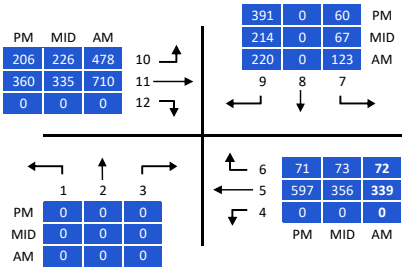
SOUTHERN APPROACH / NORTHBOUND

EASTERN APPROACH / WESTBOUND

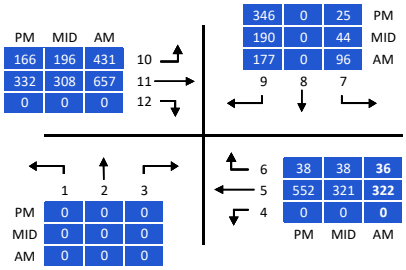
NGWELWZANE RD



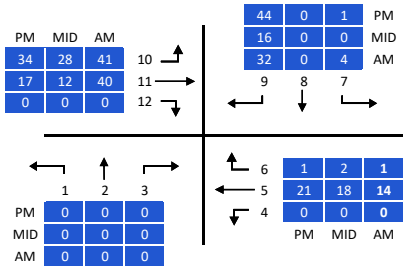
TOTAL VEHICLES SUMMARY



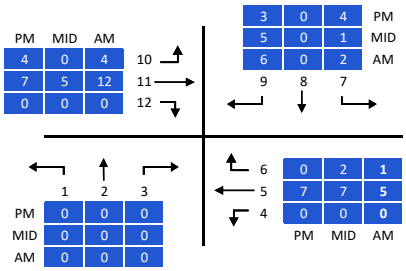
LIGHT VEHICLES



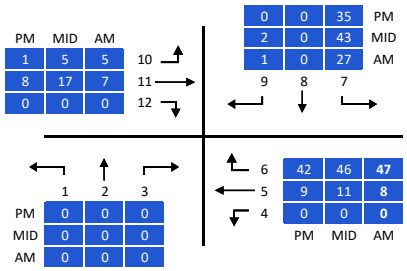
MINI BUS TAXI



BUSSES



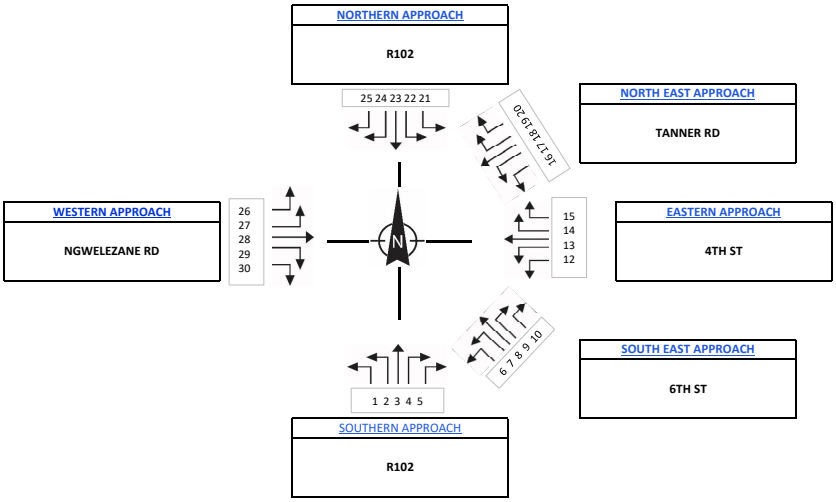
HEAVY VEHICLES



LOCATION:	RICHARDS BAY ADD	PROJECT TITLE:	UT2022-2202-RICHARDS BAY ADD					
PROJECT NR:	UT2022-2202	INTERSECTION:	NGWELEZANE RD & R102					
SURVEY DATE:	Wednesday, 24 May 2023							
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	P19	DATA:	J.A.V	TYPE:	6W-12H-6-18-C	

OVERVIEW MAP & VIDEO FRAME

JUNCTION DIAGRAM



TOTAL VEHICLE SUMMARY

	PM	MID	AM
26	30	19	6
27	48	31	10
28	76	52	24
29	4	3	3
30	38	24	6

	25	24	23	22	21
PM	19	23	89	23	43
MID	23	20	89	11	59
AM	19	35	129	11	59

	PM	MID	AM
20	5	6	10
19	29	16	22
18	17	26	6
17	28	31	9
16	7	6	2

	1	2	3	4	5
PM	168	2	175	7	4
MID	118	6	147	10	12
AM	204	7	165	13	3

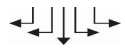
	PM	MID	AM
15	72	65	80
14	112	99	192
13	285	250	262
12	222	131	249
11	10	23	29

	PM	MID	AM
10	29	38	14
9	29	38	14
8	136	110	65
7	303	212	99
6	4	12	3

LIGHT VEHICLES SUMMARY

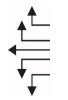
	PM	MID	AM
26	29	18	5
27	44	25	8
28	71	47	20
29	4	3	1
30	34	22	5

	25	24	23	22	21
PM	16	19	76	14	22
MID	18	16	65	10	27
AM	19	34	107	9	30



	PM	MID	AM
20	5	5	8
19	26	12	17
18	12	21	4
17	26	26	7
16	6	5	2

	1	2	3	4	5
PM	154	2	154	5	4
MID	104	4	125	7	9
AM	182	6	148	10	0



	PM	MID	AM
15	68	62	77
14	91	71	167
13	247	212	217
12	208	112	241
11	10	18	28

	PM	MID	AM
10	29	36	13
9	118	87	55
8	41	59	55
7	257	181	63
6	4	9	0

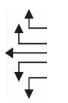
MINIBUS TAXI SUMMARY

	PM	MID	AM
26	0	1	0
27	1	4	0
28	0	2	3
29	0	0	0
30	0	1	1

	25	24	23	22	21
PM	0	0	12	1	3
MID	0	0	13	0	0
AM	0	0	7	0	4

	PM	MID	AM
20	0	0	0
19	0	0	0
18	1	1	2
17	0	0	0
16	0	0	0

	1	2	3	4	5
PM	3	1	12	0	0
MID	4	0	5	0	2
AM	5	0	10	1	1



	PM	MID	AM
15	0	0	2
14	5	2	8
13	23	15	37
12	4	6	1
11	0	0	0

	PM	MID	AM
10	0	2	0
9	18	8	2
8	1	0	0
7	14	12	5
6	0	2	1

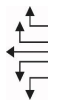
BUS SUMMARY

	PM	MID	AM
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	1
30	0	0	0

	25	24	23	22	21
PM	1	1	1	10	0
MID	3	0	2	0	1
AM	0	0	1	0	0

	PM	MID	AM
20	0	1	0
19	0	1	0
18	1	1	0
17	0	0	0
16	0	0	0

	1	2	3	4	5
PM	1	0	4	0	0
MID	0	1	3	1	0
AM	2	0	0	0	0



	PM	MID	AM
15	1	0	0
14	0	3	1
13	14	6	5
12	0	5	1
11	0	0	0

	PM	MID	AM
10	0	0	0
9	7	7	2
8	3	4	3
7	9	5	16
6	0	0	0

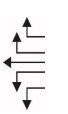
HEAVY VEHICLE SUMMAY

	PM	MID	AM
26	1	3	2
27	0	1	0
28	1	8	8
29	0	1	3
30	2	4	0

	25	24	23	22	21
PM	5	1	10	0	32
MID	1	2	14	1	34
AM	1	2	8	3	36

	PM	MID	AM
20	0	0	1
19	0	0	6
18	1	1	0
17	1	2	4
16	0	1	1

	1	2	3	4	5
PM	9	2	7	1	0
MID	9	1	10	1	2
AM	10	0	8	0	0



	PM	MID	AM
15	5	6	5
14	23	38	15
13	15	13	16
12	12	19	15
11	4	3	5

	PM	MID	AM
10	1	8	0
9	6	10	6
8	9	0	7
7	9	12	16
6	0	2	0

LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	R102 & UNKNOWN RD				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT11	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

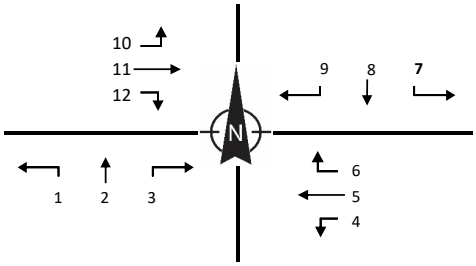
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

UNKNOWN RD

NORTHERN APPROACH / SOUTHBOUND

R102



SOUTHERN APPROACH / NORTHBOUND

R102

EASTERN APPROACH / WESTBOUND

UNKNOWN RD

TOTAL VEHICLES SUMMARY

	PM	MID	AM
10	2	3	1
11	4	10	14
12	1	0	0

	9	8	7
PM	3	59	75
MID	0	50	55
AM	3	60	86

	1	2	3
PM	0	55	113
MID	0	49	97
AM	0	49	137

	PM	MID	AM
6	44	26	**88**
5	12	11	**12**
4	114	90	**148**

LIGHT VEHICLES

	PM	MID	AM
10	2	3	1
11	4	9	13
12	1	0	0

	9	8	7
PM	3	54	72
MID	0	43	51
AM	3	52	84

	1	2	3
PM	0	52	108
MID	0	42	90
AM	0	42	134

	PM	MID	AM
6	41	25	**86**
5	12	10	**11**
4	109	85	**143**

HEAVY VEHICLES

	PM	MID	AM
10	1	0	0
11	1	2	1
12	0	0	0

	9	8	7
PM	0	6	1
MID	0	15	2
AM	0	8	2

	1	2	3
PM	1	10	9
MID	0	10	3
AM	0	7	3

	PM	MID	AM
6	7	2	**2**
5	0	1	**1**
4	7	4	**5**

LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	R102 & UNKNOWN RD				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT9	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

UNKNOWN RD

NORTHERN APPROACH / SOUTHBOUND

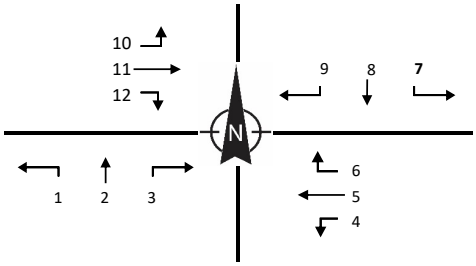
R102

SOUTHERN APPROACH / NORTHBOUND

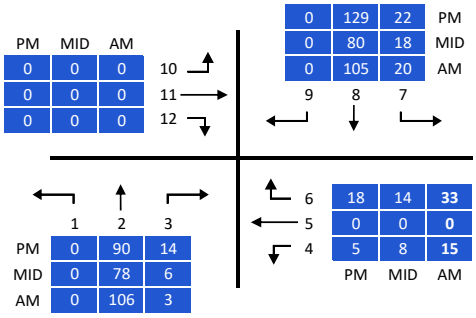
R102

EASTERN APPROACH / WESTBOUND

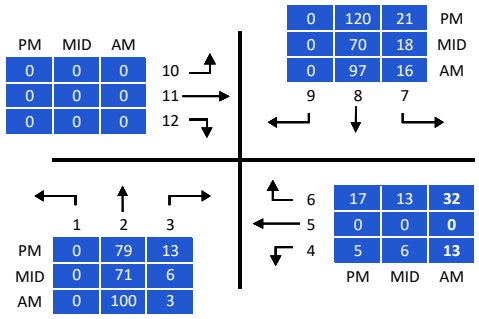
UNKNOWN RD



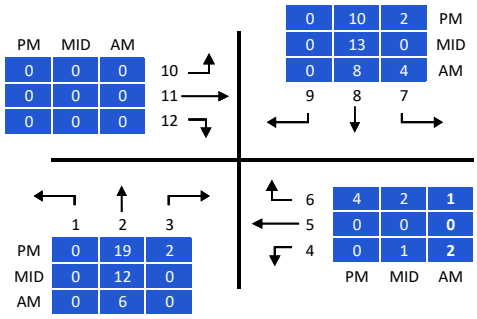
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLES



LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	R102 & P535				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT7	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

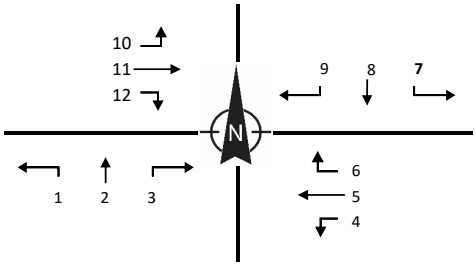
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

P743

NORTHERN APPROACH / SOUTHBOUND

R102



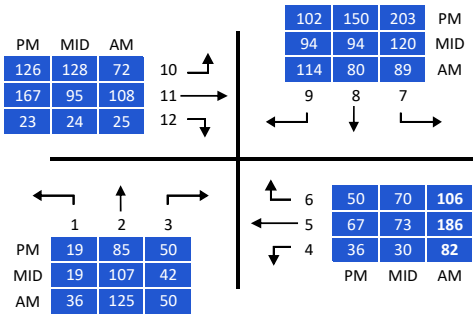
SOUTHERN APPROACH / NORTHBOUND

R102

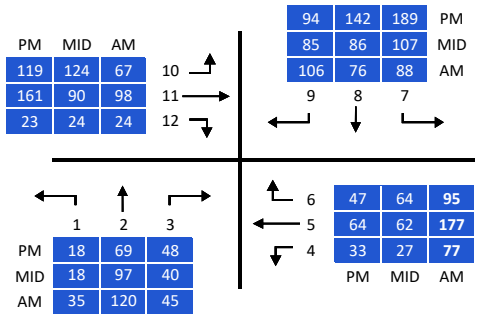
EASTERN APPROACH / WESTBOUND

P535

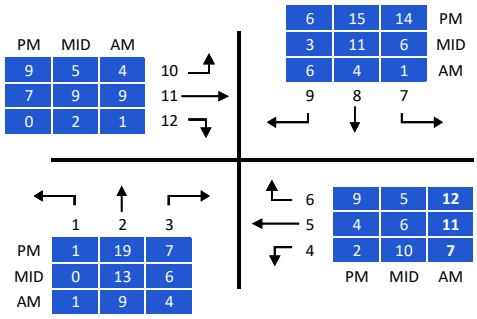
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLES



LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	N2 ON/OFF-RAMP & FAIRBREEZE MINE				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT15	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

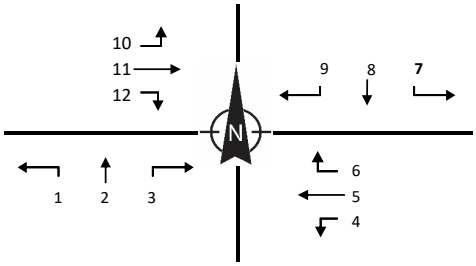
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

FAIRBREEZE MINE

NORTHERN APPROACH / SOUTHBOUND

N2 ON-RAMP



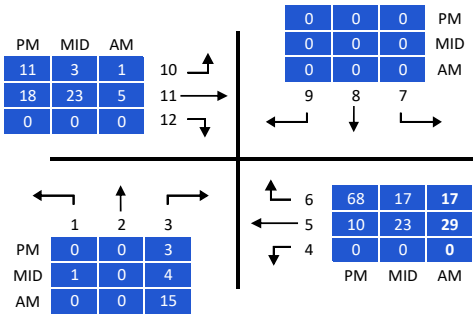
SOUTHERN APPROACH / NORTHBOUND

N2 OFF-RAMP

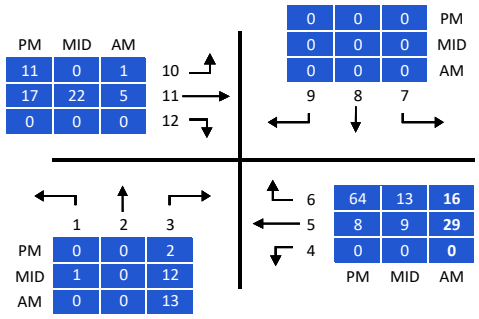
EASTERN APPROACH / WESTBOUND

FAIRBREEZE MINE

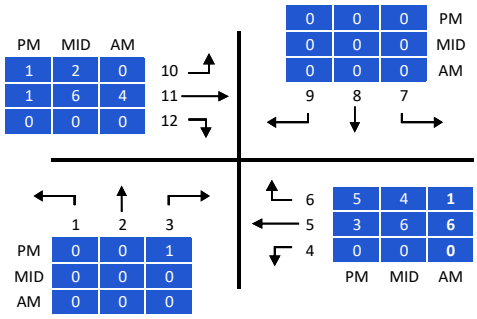
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLE



LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	N2 ON/OFF-RAMP & UNKNOWN RD				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT12	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

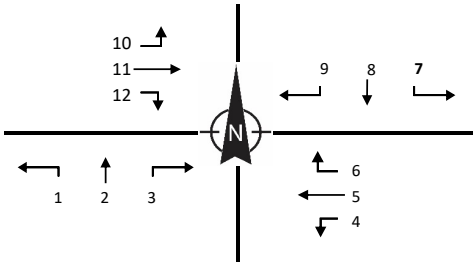
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

UNKNOWN RD

NORTHERN APPROACH / SOUTHBOUND

N2 ON-RAMP



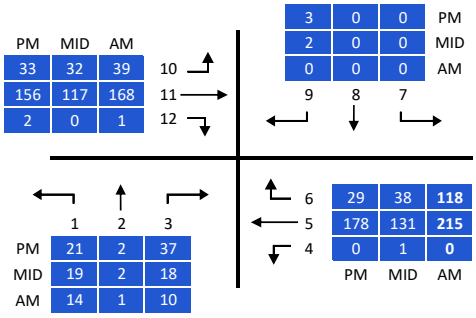
SOUTHERN APPROACH / NORTHBOUND

N2 OFF-RAMP

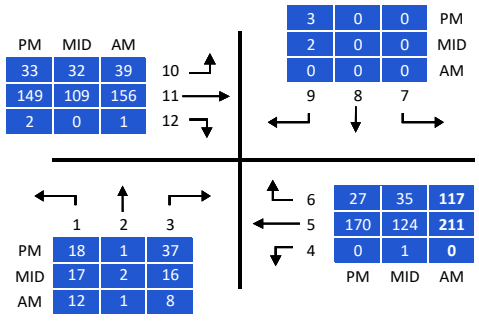
EASTERN APPROACH / WESTBOUND

UNKNOWN RD

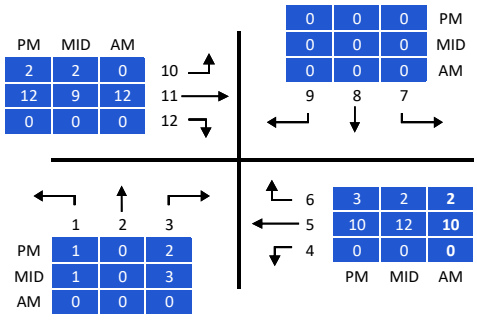
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLES



LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	P535 & N2 ON/OFF-RAMP				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT6	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

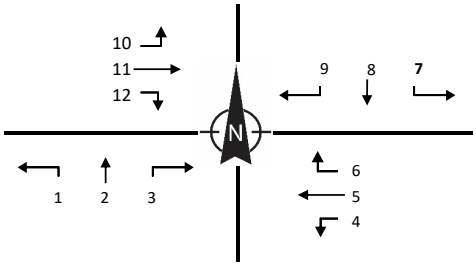
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

P535

NORTHERN APPROACH / SOUTHBOUND

N2 ON-RAMP



SOUTHERN APPROACH / NORTHBOUND

N2 OFF-RAMP

EASTERN APPROACH / WESTBOUND

P535

TOTAL VEHICLES SUMMARY

	PM	MID	AM
10	92	54	85
11	334	202	154
12	0	0	0

	9	8	7
PM	0	0	0
MID	0	0	0
AM	0	0	0

	1	2	3
PM	14	6	58
MID	17	1	25
AM	29	1	30

	PM	MID	AM
6	230	296	**774**
5	135	173	**319**
4	0	0	**0**

LIGHT VEHICLES

	PM	MID	AM
10	84	52	78
11	317	183	150
12	0	0	0

	9	8	7
PM	0	0	0
MID	0	0	0
AM	0	0	0

	1	2	3
PM	12	6	57
MID	16	1	25
AM	24	1	27

	PM	MID	AM
6	212	283	**760**
5	129	158	**303**
4	0	0	**0**

HEAVY VEHICLES

	PM	MID	AM
10	7	6	9
11	19	13	6
12	0	0	0

	9	8	7
PM	0	0	0
MID	0	0	0
AM	0	0	0

	1	2	3
PM	3	0	1
MID	6	0	5
AM	7	0	1

	PM	MID	AM
6	33	11	**17**
5	10	16	**21**
4	0	0	**0**

LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	N2 ON/OFF-RAMP & FAIRBREEZE MINE				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT16	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

FAIRBREEZE MINE

NORTHERN APPROACH / SOUTHBOUND

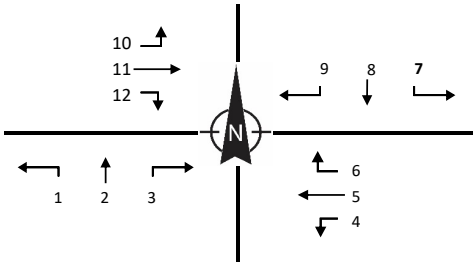
N2 OFF-RAMP

SOUTHERN APPROACH / NORTHBOUND

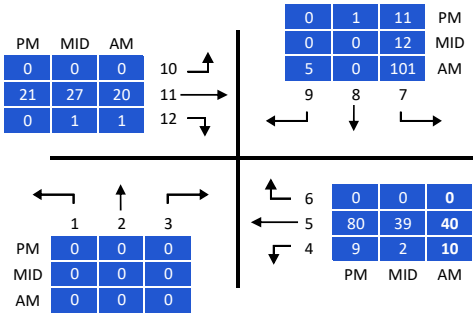
N2 ON-RAMP

EASTERN APPROACH / WESTBOUND

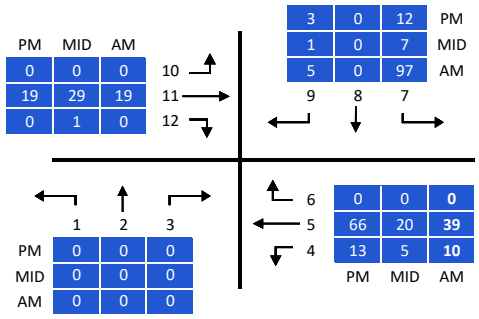
FAIRBREEZE MINE



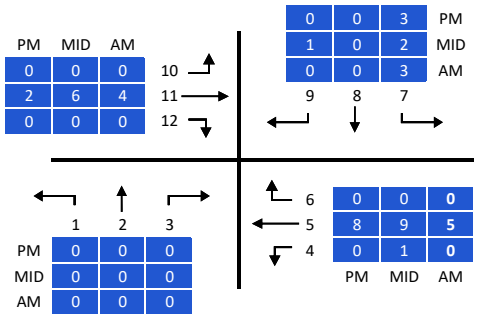
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLES



LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	N2 ON/OFF-RAMP & HELY HUTCHINSON RD				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT13	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND

UNKNOWN RD

NORTHERN APPROACH / SOUTHBOUND

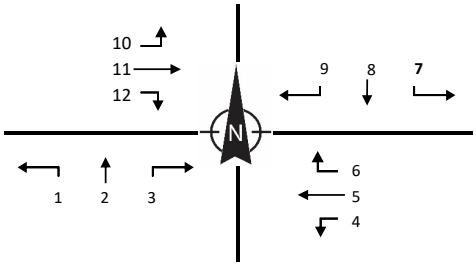
N2 OFF-RAMP

SOUTHERN APPROACH / NORTHBOUND

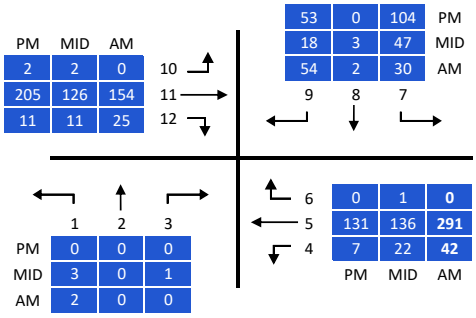
N2 ON-RAMP

EASTERN APPROACH / WESTBOUND

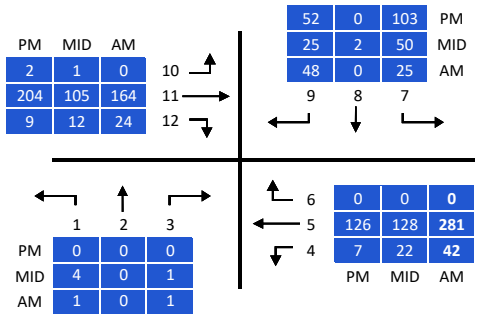
HELY HUTCHINSON RD



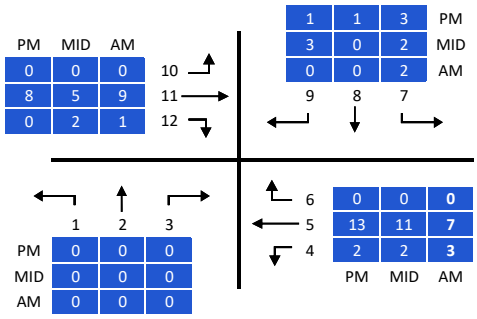
TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLES



LOCATION:	RICHARDS BAY	PROJECT TITLE:	RICHARDS BAY-TRAFFIC COUNT				
PROJECT NR:	UT2022-2219	INTERSECTION:	P535 & N2 ON/OFF-RAMP				
SURVEY DATE:	Tuesday, 15 November 2022						
SURVEY TIMES:	06H00-18H00	KMZ FILE NR:	INT5	DATA:	J.A.V	TYPE:	4W-12H-6-18-C

OVERVIEW MAP & VIDEO FRAME

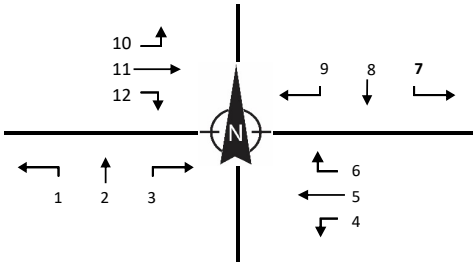
JUNCTION DIAGRAM

WESTERN APPROACH / EASTBOUND
P535

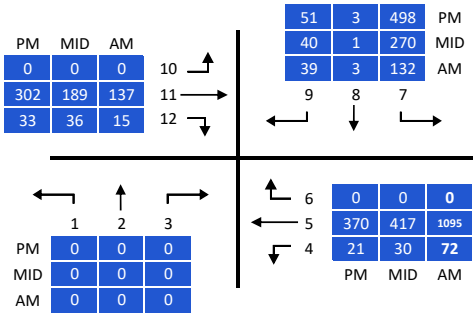
NORTHERN APPROACH / SOUTHBOUND
N2 OFF-RAMP

SOUTHERN APPROACH / NORTHBOUND
N2 ON-RAMP

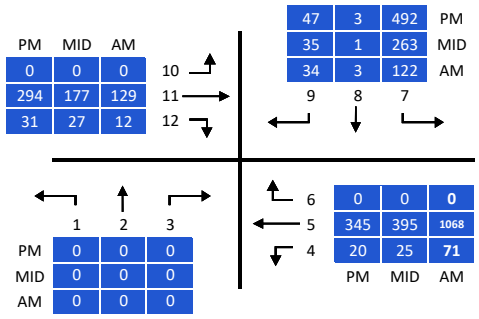
EASTERN APPROACH / WESTBOUND
P535



TOTAL VEHICLES SUMMARY



LIGHT VEHICLES



HEAVY VEHICLES