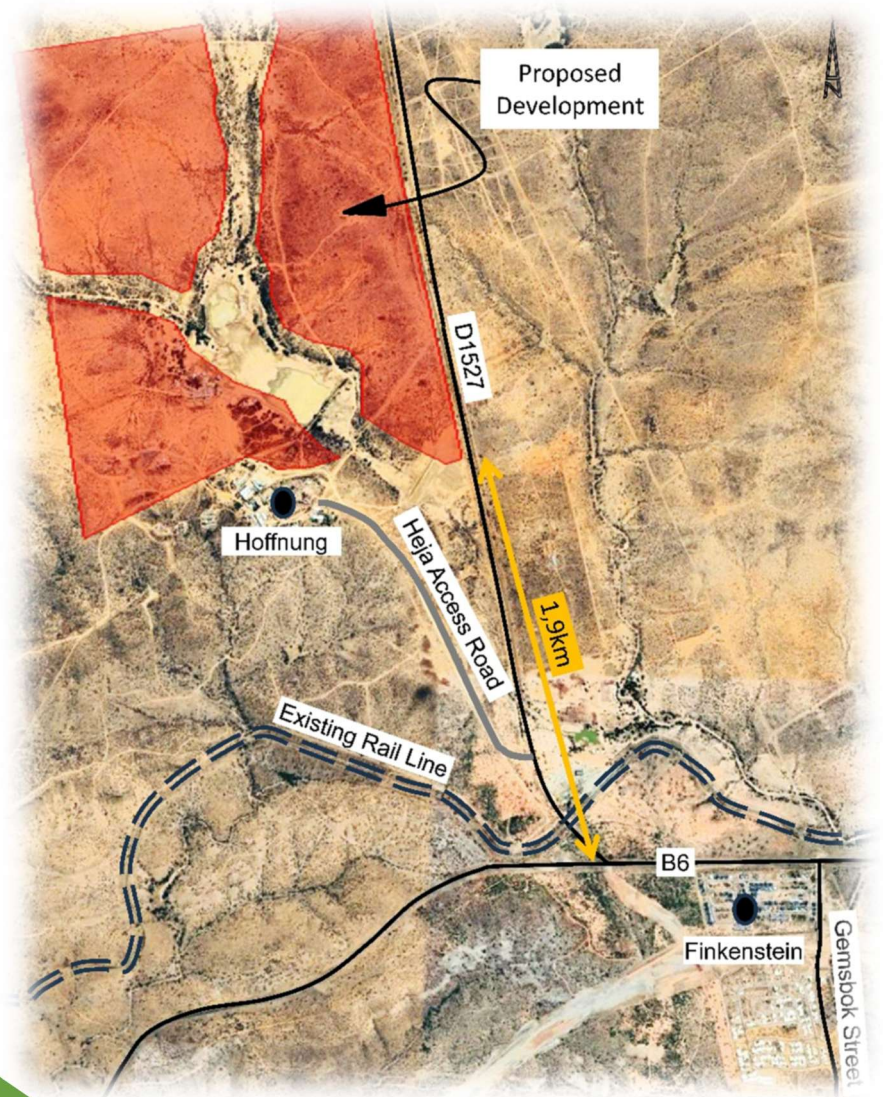


Transport Impact Assessment (TIA) Gondwana Lifestyle and Country Estate Hoffnung, Namibia

Date: May 2025
Report Status: Final



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SUMMARY SHEET

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Date	May 2025
Report Status	Final
File Name	G:\4789 Gondwana Lifestyle & Country Estate\12 Reports\Issue\4789_Gondwana FinalTIA TCN_2025 05 20.docx

It is herewith certified that this Traffic Impact Assessment has been prepared according to requirements of the South African Traffic Impact and Site Traffic Assessment Manual.

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REPORT - SUMMARY TABLE

This transport impact assessment is reported only in a summary table instead of a lengthy report to assist review and interpretation of the results. This summary table includes all the relevant information that is normally contained in a report. It should be sufficient for review and interpretation of the expected transport impacts as well as the comprehension of the required measures to mitigate the transport impact. If any more detail is required, please contact the authors.

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Transport Impact Assessment

Gondwana Lifestyle and Country Estate, Hoffnung, Namibia

1 Purpose of Study

This report summarises an investigation of the transport related impacts, expected as part of the Gondwana Lifestyle and Country Estate development, in Hoffnung, Namibia.

The purpose of this investigation is to evaluate the surrounding road network, and to recommend appropriate mitigation measures that would ensure acceptable future traffic operations.

2 Locality

Location – Hoffnung Farm 66

This development is planned about 9.9km east of Windhoek, 1.9km north of the B1, directly west of the D1527, on the Farm Hoffnung 66. See **Figure 1**, Annexure A for the Locality Plan.

3 Land Use

Existing Use: The site is currently mostly vacant. However, the Heja Game Lodge is located southwest of the Hoffnung Dam.

Future Use: The following land uses / extents are proposed:

Land Use	Units	Units	GLA (m ²)
Single Residential	641		
Townhouses	510		
Retirement Village	159		
Apartments	347		
Primary School (Learners)		280	22 000
High School (Learners)		200	
Hotel (Rooms)		34	844
Conference (Seats)		100	844
Leisure - Health and Fitness			2171
Leisure - Community Facility			2171
Restaurant			836
Commercial - Business			2991
Office			1994
Medical (Private Hospital)			1495

A detailed Site Development Plan (SDP) was not available at the time of this Transport Impact Assessment (TIA). Hence, these land uses / extents should be confirmed, as part of the formal SDP submission process. Based on the above summary table, 1 657 residential units are planned on this property. See **Figure 2** for the Development Framework Plan.

4 Existing Roadways	The following study roads were included in this investigation: B6 – A typical rural Principal Arterial (Class 1/2) with one lane per direction, narrow shoulders, no sidewalks and a 120km/h posted speed limit. DR1527 – A typical Rural Arterial (Class 3/4) road with one lane per direction, no shoulders, no sidewalks and a 60km/h posted speed limit. Heja Game Lodge Access Road - Typical Class 5 residential access roads.
5 Future Roadways	The following future roads are planned in the site vicinity: <u>Dr Hage G Geingob Freeway (Trans-Kalahari Corridor)</u> – will function as a typical rural Principal Arterial (Class 1/2), with two lanes per direction, narrow shoulders, no sidewalks, and a 120 km/h speed limit. This road is currently under construction and will connect Hosea Kutako International Airport to Robert Mugabe Avenue, in Windhoek. <i>Note: Based on discussions with the Roads Authority, the current B6 will be reclassified from a Trunk Road to a District Road once the Trans-Kalahari Corridor is completed. An interchange is also currently under construction south of the Gondwana development, at the D1527 extension.</i>
6 Study Intersections & Existing Control	The following study intersections, are included in this investigation: Int.1. D1527 / Development North Access.....[Future Intersection] Int.2. D1527 / School Access.....[Future Intersection] Int.3: D1527 / Heja Game Lodge Access Road.....[Side Road Stop Control] Int.4: D1527 Railway Crossing.....[Yield Control] Int.5: B6 / D1527.....[Side Road Stop Control] Int.6: B6 / Gemsbok Street.....[Side Road Stop Control] See Figure 3 for the Lane Configuration and Intersection Controls of these study intersections.
7 Analyses Hours	The planned development will include a mix of residential, educational, and commercial land uses, which typically generate peak-hour trips during the morning, midday, and afternoon periods. Hence, the following peak periods were evaluated as part of this investigation: Weekday a.m. peak period (Surveyed peak period 06:00 – 09:00) Weekday midday peak period (Surveyed peak period 12:00 – 14:00) Weekday p.m. peak period (Surveyed peak period 16:00 – 18:00) The peak hours within each of these peak periods were identified and used in the capacity analyses calculations.

8 Scenarios Analysed	The following scenarios were analysed: Scenario 1: 2025 Existing Traffic conditions, based on current counted traffic volumes. Scenario 2: 2030 Background Traffic conditions, based on <i>Scenario 1</i> traffic volumes, escalated with a 3% growth rate per year, over five years. Scenario 3: 2030 Total Traffic conditions, based on Scenario 2 traffic volumes, plus the expected Gondwana development trips that could be accommodated with the current B6 / D1527 intersection geometry. Scenario 4: 2030 Total Traffic conditions, based on Scenario 2 traffic volumes, plus the expected Gondwana development trips that could be accommodated with the upgrades that are currently being implemented at the B6 / D1527 intersection. Scenario 5: 2030 Total Traffic conditions, based on Scenario 2 traffic volumes, plus the <i>FULL</i> Gondwana development trips. <i>Note: A five-year horizon was used to evaluate the future impacts of this development, since the new Trans-Kalahari Corridor, the B6/D1527 intersection and Trans-Kalahari/D1527 Interchange upgrades are expected to be completed as that stage. However, considering the scale of this development, the full Gondwana development would likely only be completed within the next 10 years or more.</i> Refer to Table 1, Annexure A for detailed land uses / extents of each phase and Table 2 for the expected development trips of each phase.
9 2025 Existing Traffic Conditions – Scenario 1	The 2025 Existing traffic conditions are based on existing intersection geometries, controls and counted traffic volumes. Traffic counts were done on Tuesday, 19 November 2024 at all study intersections. Based on the capacity analysis of this traffic scenario, as well as on-site observations, it is evident that all study intersections currently operate at acceptable Levels-Of-Service (<i>LOS A and B</i>), acceptable delays and with sufficient spare capacity. Hence, no intersection upgrades are required or proposed, <i>from an operational point of view</i>. See Figure 4 for the 2025 Existing Traffic volumes and operations. Also refer to Annexure D for the detailed SANS 3000 Risk Assessment analyses of the current at-grade Road over Rail Hoffnung level crossing.

10 2030 Background Traffic Conditions – Scenario 2	The 2030 Background Traffic volumes were calculated by escalating the existing counted traffic volumes with a 3 percent growth rate per year, over a five-year period. Note that a 2,5% historic growth rate was calculated along the B6, between Windhoek and the development. Hence, a 3 percent growth rate is expected to result in a slight over estimation of traffic growth on the surrounding road network. Since no upgrades are proposed in the Existing Traffic conditions, the existing geometries / controls were used to evaluate the Background Traffic conditions. Based on the capacity analysis results, it is expected that all study intersections will continue to operate at acceptable Levels-Of-Service (LOS A and B), acceptable delays and with sufficient spare capacity. Hence, no intersection upgrades are required or proposed, <i>from an operational point of view</i>. Refer Figure 5 for the 2030 Background Traffic volumes and operations.
11 Site Access	Existing Access: Access to this site and the Heja Game Lodge is currently possible via a gravel access road that intersect with the D1527, approximately 550 metres north of the B6 intersection, or 330 metres north of the at-grade road over rail level crossing. This existing intersection will be formalised as part of the proposed Gondwana development. Proposed Access: The following three (3x) site accesses are proposed: • <u>Access A (Int. 1) – North Access:</u> to serve Phase 1 of the development, which will mainly include residential uses. • <u>Access B (Int. 2) – School Access:</u> to serve Phase 2A of the development, which will mainly include the school. • <u>Access C (Int. 3) – Heja Access Road:</u> to serve Phase 2B and Phase 3 of the development, which will include a mix of land uses. Note that these accesses will be linked with an internal access road. D1527 can be classified as a typical Class 3 Road within a semi-rural roadside environment. Based on the Road Access Guidelines (RAG 2002), a minimum of 270 meters spacing is recommended between equivalent side road accesses / intersections, for the above criteria. Intersections 1 and 2 will be spaced more that 520 meters apart and intersections 2 and 3 will be spaced more that 1 800 meters apart. Hence, the proposed spacings of intersections 1 and 2 should be acceptable.

12

Trip Generation & Development Trips

The trip generation rates for the land uses proposed as part of this development, were obtained from The Committee of Transport Officials Trip Data Manual (TMH17 - CoTO 2013) as well as the Institute of Transport Engineers Trip Generation Manual (ITE, Edition 7). *Note, in cases where trips rates for the midday peak period were un-available, trips rates for the pm or Saturday peak hours were applied. This is expected to result in a slight over estimation of peak period development trips.*

The following trip rates were applied:

Land Use	A.M. Rate	Midday Rate	P.M. Rate
Single Residential	1.0 / Unit	0.5 / Unit	1.0 / Unit
Townhouses	0.85 / Unit	0.45 / Unit	0.85 / Unit
Retirement Village	0.35 / Unit	0.40 / Unit	0.35 / Unit
Apartments	0.65 / Unit	0.35 / Unit	0.65 / Unit
Primary School	0.85 / Student	0.35 / Student	0.30 / Student
High School	0.75 / Student	0.35 / Student	0.25 / Student
Hotel	0.5 / Room	0.25 / Room	0.5 / Room
Conference	0.5 / Delegate	0.5 / Delegate	0.5 / Delegate
Health and Fitness	5.0 / 100m ²	7.25 / 100m ²	9.50 / 100m ²
Community Centre	1.62 / 100m ²	1.28 / 100m ²	1.64 / 100m ²
Restaurant	0.75 / 100m ²	9.80 / 100m ²	11.80 / 100m ²
Commercial	1.50 / 100m ²	1.50 / 100m ²	1.50 / 100m ²
Office	2.10 / 100m ²	0.45 / 100m ²	2.10 / 100m ²
Medical (Hospital)	1.65 / 100m ²	1.6 / 100m ²	1.50 / 100m ²

Refer to **Table 1**, Annexure B for trip generation calculation details.

Based on the trip generation rates above, the *FULL* development is expected to generate the following Nett-New peak-hour vehicle trips:

Peak Hour	In	Out	Total
AM peak hour	402	827	1 229
Midday peak hour	401	399	800
PM peak hour	810	472	1 281

Refer to **Table 2** in Annexure B for a breakdown of the full development trips. Also refer to **Table 3** and **Table 4** for a breakdown of the Scenario 3 and Scenario 4 Total Traffic development trips respectively. *See Section 8 of this report, for an description of these traffic scenarios.*

13 Trip Distribution	The trips generated by the proposed development are expected to follow the existing traffic splits / patterns along on the D1527 via the B6. Based on the counted traffic volumes, the following trip distribution was applied: • 85% of the trips to / from the west along the B6 toward Windhoek • 15% of trips to / from east along the B6 toward Finkenstein / Neeudamn / Hosea Kuteka Airport.
14 Trip Assignment	Before the Trans-Kalahari Corridor and new interchange is completed, all the trips from this development are expected to distribute along the B6 to the east and west. However, once the Trans-Kalahari Corridor and new interchange is completed, some trips are expected to re-route along this new road. For analyses purposes, approximately 50% of the development trips were re-routed to this new road. Refer to Figure 6 and Figure 9, Figure 14 for the different Trip Assignments used as part of each traffic scenario.
15 2030 Total Traffic Conditions – Scenario 3	The 2030 Total (Scenario 3) Traffic volumes were calculated by adding a portion of the development trips to the 2030 Background Traffic volumes. The number of development trips in this scenario were limited to ensure that the current B6 / D1527 intersection geometry / control continue to operate acceptably. Based on the capacity analyses results, approximately 300 weekday peak hour development trips, or $(300/1200=)$ 25 percent of the full development, could be approved / implemented, while acceptable operations would be maintained at the <i>current</i> B6 / D1527 intersection geometry / control. However, <i>note that this intersection is currently being upgraded, as mentioned in Section 16 of this report. This upgrade would ensure that an even higher percentage of development trips could be approved / implemented.</i> As a guideline, the approximately 300 weekday peak hour trips, or $(300/1200=)$ 25 percent of the full development could potentially include the following development phases: • The full Phase 1A to 1C residential components, • The full Phase 2A educational component, and • A maximum 15% of Phase 3, the commercial/business park components.

	To unlock these development phases, the following intersection and link upgrades are recommended for the Total (Scenario 3) Traffic scenario: Intersection upgrades: • Int 1. D1527 / Nort Access: Formalise this T-intersection, with one lane per direction on each approach. • Int. 2. D1527 / School Access: Formalise this T-intersection, with one lane per direction on each approach. • Int. 3. D1527 / Existing Heja Access: Formalise this T-intersection, with one lane per direction on each approach. Link upgrades: • Re-construct D1527 from the B6 to the North Access, including the at-grade road over rail crossing. Refer to Section 19 and Annexure D for more details. • Re-construct the Heja Access Road from the D1527, at least to the development site boundary. Refer to Table 3 for the expected trips associated with this Scenario 3 development trips, Figure 7 for the recommended geometry required to accommodate these development trips and Figure 8 for the expected 2030 Total (Scenario 3) Traffic volumes and operations.
16 2030 Total Traffic Conditions – Scenario 4	The 2030 Total (Scenario 4) Traffic volumes were calculated by adding an even higher portion of the development trips to the 2030 Background Traffic volumes. The number of development trips in this scenario were limited to ensure that the upgrades that are currently being implemented (by SMEC) at the B6 / D1527 intersection would continue to operate acceptably. Based on the capacity analyses results, approximately 550 weekday peak hour development trips, or $(550/1200=)$ 45 percent of the full development, could be approved / implemented, with the upgrades that are currently being implemented by SMEC. Refer to Figure 10 for a layout of the proposed upgrades at the B6 / D1527 intersection, which includes separate left-turn slip lanes and right-turn lanes from the B6, as well as single lanes on the D1527 approaches to accommodate all movements. <i>Note that further upgrades will be required at this intersection, to enable the release of the full development trips. Refer to Section 17 of this report, for a discussion on the alternative upgrades at the B6 / D1527 intersection, to unlock the remaining / full Gondwana development trips.</i>

	As a guideline, the approximately 550 weekday peak hour trips, or $(550/1200=)$ 45 percent of the full development could potentially include the following development phases: • The full Phase 1 residential components, • The full Phase 2 educational component, and • A maximum 30% of Phase 3, the commercial/business park components. Refer to Table 4 for the expected trips associated with phase Scenario 4 development trips, Figure 12 for the recommended geometry required to accommodate these expected development trips and Figure 13 for the expected 2030 Total (Scenario 4) Traffic volumes and operations.
17 2030 Total Traffic Conditions – Scenario 5	The 2030 Total (Scenario 5) Traffic volumes for were calculated by adding the Full Gondwana development trips to the 2030 Background Traffic volumes. The intersection geometries / controls used in this scenario, is based on the upgrades discussed / recommended in the previous sections of this report. Based on the capacity analyses results, the following upgrades are recommended to accommodate the Full Gondwana development trips: <u>Int. 1 – D1527 / North Access:</u> No upgrades are required or proposed. The intersection is expected to operate at acceptable LOS A / B with one lane per direction on all approaches. <u>Int. 2 – D1527 / School Access:</u> A southbound right-turn lane is recommended along D1527, based on the (Hammerlink) right-turn safety warrants. <u>Int. 3 – D1527 / Heja Access Road:</u> the following upgrades are proposed: • Eastbound – construct a separate left turn lane • Northbound – construct a separate left-turn lane • Southbound – construct a separate right-turn lane (based on right-turn lane safety warrants) <u>Int. 4 - D1527 / At-grade Road over Rail crossing:</u> Refer to Section 19 of this report as well as Annexure D for a detailed SANS 3000 Risk Assessment. The upgrades recommended at this existing road over rail level crossing would ensure a safer environment for all road users.

	<u>Int. 5 – B6 / D1527</u>: Two upgrade alternatives were evaluated: • Traffic Signal – will operate at LOS B during the peak hours • Roundabout – will operate at LOS A during the peak hours. The roundabout is recommended due to the following reasons: • Better overall operations, • Lower maintenance costs, • Longer expected lifespan, and • Safer conditions for all road users. The following safety measures are recommended at this roundabout: • Design both B6 approaches with chicane geometries to reduce vehicle entry speeds. Refer to Figure 17B: • Provide street lighting to enhance visibility and safety at night. • Provide R101 speed limit signs on both approaches, reducing the speed in 20 km/h increments from 120 km/h to 60 km/h. • Install high-visibility Type WB signs on the B6 approaches, including: ○ W201 – Roundabout Ahead Warning Signs ○ “Slow Down” text on the background underneath the warning sign. • Provide road studs on the approaches and along the chicane geometry to increase visibility at night. • Provide splitter islands marked with RM8 kerb road markings. Refer to Table 2 for the expected full development trips, Figure 15 for the geometry required to accommodate the full development trips, Figure 16 for the 2030 Total (Scenario 5) Traffic volumes and operations and Figure 17 for schematic illustrations of the recommended upgrade alternatives.
18 At Grade Road over Rail Level Crossing	The capacity of the Hoffnung road-over-rail level crossing was evaluated using the Highway Capacity Manual (HCM) methodology for two-lane roads. This approach assesses road capacity based on Level of Service (LOS) and was applied to each of the traffic scenarios using the corresponding traffic volumes. Table 5 summarises the results of the capacity analysis. Under full development conditions, the D1527 link is expected to operate at an acceptable LOS D during the AM peak period, LOS C during midday peak period and LOS D during the PM peak period. While the level crossing will operate near its capacity, its performance will remain within acceptable limits.

	It is important to note that this analysis is based on the land uses and development extents considered in this study. Any future increases in land use and extent will require a re-evaluation to determine whether the level crossing will continue to operate effectively or if a grade-separated solution (such as a bridge) would be required.
19 SANS 3000 Risk Assessment	The road over rail level crossings at the Hoffnung Siding were evaluated as part of this investigation. This evaluation is based on the SANS 3000 level crossing risk assessment methodology. Based on the investigation and also considering the expected increase in traffic in the future it is recommended to implement the following upgrades at this level crossing: The minimum recommended road markings / signage includes: • Install / replace the following road markings / signage: ○ Replace the existing W318 signs with Type WD high-visibility background signs on both approaches, including: ▪ W318 – Railway Crossing Advance Warning Sign; ▪ W302 – Stop Control Ahead Advance Warning Sign; ▪ IN11.3 – Distance supplementary plate ○ WM1 – Railway Crossing Ahead Symbol road marking; ○ R1 - Stop Sign / RTM1 – Stop Line Road Markings / GM7-Stop Markings Text ○ W403 – Railway Crossing Hazard Marker Sign. ○ Replace whistle boards on the eastern approach with new boards. ○ Provide whistle boards on the western approach. • The rail and concrete slab section at this level crossing must be re-constructed to acceptable SANS 3000 standards. • The vegetation must be cleared to ensure acceptable lines of sight are maintained, for both the train- and vehicle drivers. • The following additional advance warning measures should be considered, after consultation with the road authority and rail network operator: ○ Flashing Red Disk Signals ○ Whistle boards / Bells ○ Illumination (street lighting) at the crossing • The implementation and maintenance of these safety measures must be discussed and agreed between the road authority / rail network operator, to ensure continued and safe use of these level crossings. See Annexure D for details of the SANS 3000 level crossing assessments.

20 Pedestrians and Cyclists	Existing Facilities: No dedicated pedestrian or cyclist facilities are currently available within the site vicinity, or at the study intersections. Site Observations: • At the B6 / D1527 intersection, fewer than 5 cyclists and 10 pedestrians were recorded during the survey period. • At the B6 / Gemsbok Street intersection, approximately 10 cyclists and 20 pedestrians were observed during the survey periods. Recommended Facilities: The following facilities are recommended as part of the Gondwana development: • A minimum 1.5-meter-wide sidewalks along all internal residential roads and a minimum 2,0-meter-wide sidewalks along streets within the business node. • A minimum 1,5 meters wide surfaced shoulder along D1527, to accommodate cyclist movements. • Although the pedestrian / cyclist demands along the D1527 is expected to be relatively low, it is recommended to provide gravel shoulders along D1527, across the B6 as well as across the Trans Kalahari Corridor highway. • Streetlights should be installed at all intersections along D1527 to enhance visibility and safety for all road users.																																	
21 Public Transport	Existing Facilities: No formal public transport facilities currently exist within the within the site vicinity, or at the study intersections. Counted Volumes and Observations: <i>Table: Existing Public Transport Volumes</i> <table><tr><th rowspan="3">Road Link</th><th colspan="6">Peak Period</th></tr><tr><th colspan="2">AM</th><th colspan="2">Midday</th><th colspan="2">PM</th></tr><tr><th>Taxi*</th><th>Bus**</th><th>Taxi</th><th>Bus</th><th>Taxi</th><th>Bus</th></tr><tr><td>D1527</td><td>0</td><td>3</td><td>0</td><td>1</td><td>0</td><td>3</td></tr><tr><td>B6</td><td>1</td><td>86</td><td>4</td><td>47</td><td>1</td><td>76</td></tr></table> * <i>Taxis refer to sedan-based taxi services</i> ** <i>Buses include both minibus taxis and large buses</i> The recorded taxi volumes along the study road network were relatively low, while bus volumes are significantly higher, particularly along the B6. This trend is likely influenced by the long travel distances between towns, the airport and employment opportunities, leading public transport operators to favour higher-capacity vehicles along the B6 for efficiency.	Road Link	Peak Period						AM		Midday		PM		Taxi*	Bus**	Taxi	Bus	Taxi	Bus	D1527	0	3	0	1	0	3	B6	1	86	4	47	1	76
Road Link	Peak Period																																	
	AM		Midday		PM																													
	Taxi*	Bus**	Taxi	Bus	Taxi	Bus																												
D1527	0	3	0	1	0	3																												
B6	1	86	4	47	1	76																												

	Observations during the survey periods indicate that passenger pick-ups and drop-offs in the area occur at the B6 / Gemsbok Street intersection. Recommended Facilities: To accommodate the expected public transport demand at the Gondwana development, the following facilities are recommended: • Public Transport embayments along D1527, on both downstream sides of the School Access intersection. • A public transport hub within the business node (i.e. near Phase 2B), to centralise the transport services. • Consider three or four embayments along the internal road network, that could be used as public transport pick-up or drop-off points.
22 Parking	The following parking rates are recommended for the different land uses proposed as part of the Gondwana development, based on City of Windhoek (CoW) guidelines: • Residential Dwelling 1 bay / dwelling - three bedrooms 2 bay / dwelling - four bedrooms • Flats & Group housing 1 bay / dwelling - three bedrooms 2 bays / dwelling - four bedrooms 1 bay / 3 units - visitors • Hotels 0,66 bays / room plus 5 bays / 100m² plus, loading zone • Restaurants 1 bay / 3 seats, plus loading zone • Retail / Shops 5 bays per 100m² plus loading area • Gymnasiums 7 bays / 100m² • Hospitals 1.20 bays / bed, plus 4 bays / medical practitioner • Office 1 bay / 25m² • School 1 bay / classroom-office + 1 bay per 10 children for on and off loading

23 Conclusion & Recommendations

This report summarises an investigation of the transport impacts, expected as part of the Gondwana Lifestyle and Country Estate development, planned on the Farm Hoffnung 66, in Windhoek.

The development will include the following land uses / extents:

Land Use	Units	Units	GLA (m ²)
Single Residential	641		
Townhouses	510		
Retirement Village	159		
Apartments	347		
Primary School (Learners)		280	22 000
High School (Learners)		200	
Hotel (Rooms)		34	844
Conference (Seats)		100	844
Leisure - Health and Fitness			2171
Leisure - Community Facility			2171
Restaurant			836
Commercial - Business			2991
Office			1994
Medical (Private Hospital)			1495

The following can be concluded, based on this investigation:

2025 Existing (Scenario 1) Traffic: No upgrades are required or proposed, from an intersection capacity point of view.

2030 Background (Scenario 2) Traffic: No upgrades are required or proposed, from an intersection capacity point of view.

Site Access: Refer to **Section 11** of this report for a discussion on the proposed development accesses.

Development Trips: the full development is expected to generate 1 229 total weekday AM-, 800 midday- and 1 281 PM peak hour trips respectively.

2030 Total (Scenario 3) Traffic, with the existing B6 / D1527 geometry / control: Note that approximately 300 weekday peak hour development trips, or $(300/1200=)$ **25 percent** of the full Gondwana development, could be approved / implemented as part of this traffic scenario. The following upgrades are recommended:

- Int 1. D1527 / Nort Access: Formalise this T-intersection, with one lane per direction on each approach.
- Int. 2. D1527 / School Access: Formalise this T-intersection, with one lane per direction on each approach.
- Int. 3. D1527 / Existing Heja Access: Formalise this T-intersection, with one lane per direction on each approach.

	Link upgrades: • Re-construct D1527 from the B6 to the North Access, including the at-grade road over rail crossing. Refer to Section 19 and Annexure D for more details. • Re-construct the Heja Access Road from the D1527, at least to the development site boundary. 2030 Total (Scenario 4) Traffic, with SMEC upgrades at the B6 / D1527 intersection: Note that approximately 550 weekday peak hour development trips, or $(550/1200=)$ 45 percent of the full development, could be approved / implemented, with the upgrade that is currently being implemented. • No other / additional upgrades are required / proposed as part of this traffic scenario. 2030 Total (Scenario 5) Traffic, when the development exceeds 45 percent of the full development (or 550 total peak hour trips), the following upgrades are recommended: <u>Int. 2 – D1527 / School Access:</u> A southbound right-turn lane is recommended along D1527, based on the (Hammerlink) right-turn safety warrants. <u>Int. 3 – D1527 / Heja Access Road:</u> the following upgrades are proposed: • Eastbound – construct a separate left turn lane • Northbound – construct a separate left-turn lane • Southbound – construct a separate right-turn lane (based on right-turn lane safety warrants). <u>Int. 4 - D1527 / At-grade Road over Rail crossing:</u> • Install / replace the following road markings / signage: ○ Replace the existing W318 signs with Type WD high-visibility background signs on both approaches, including: ▪ W318 – Railway Crossing Advance Warning Sign; ▪ W302 – Stop Control Ahead Advance Warning Sign; ▪ IN11.3 – Distance supplementary plate ○ WM1 – Railway Crossing Ahead Symbol road marking; ○ R1 - Stop Sign / RTM1 – Stop Line Road Markings / GM7- Stop Markings Text ○ W403 – Railway Crossing Hazard Marker Sign. ○ Replace whistle boards on the eastern approach with new boards. ○ Provide whistle boards on the western approach. • The rail and concrete slab section at this level crossing must be re-constructed to acceptable SANS 3000 standards.
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	• The vegetation must be cleared to ensure acceptable lines of sight are maintained, for both the train- and vehicle drivers. • The following additional advance warning measures should be considered, after consultation with the road authority and rail network operator: ○ Flashing Red Disk Signals ○ Whistle boards / Bells ○ Illumination (street lighting) at the crossing • The implementation and maintenance of these safety measures must be discussed and agreed between the road authority / rail network operator, to ensure continued and safe use of these level crossings. <u>Int. 5 – B6 / D1527</u>: Construct a single circulation lane Roundabout, plus the following safety measures: • Design both B6 approaches with chicane geometries to reduce vehicle entry speeds. Refer to Figure 17B: • Provide street lighting to enhance visibility and safety at night. • Provide R101 speed limit signs on both approaches, reducing the speed in 20 km/h increments from 120 km/h to 60 km/h. • Install high-visibility Type WB signs on the B6 approaches, including: ○ W201 – Roundabout Ahead Warning Signs ○ “Slow Down” text on the background underneath the warning sign. • Provide road studs on the approaches and along the chicane geometry to increase visibility at night. • Provide splitter islands marked with RM8 kerb road markings. <i>Pedestrians and Cyclists facilities:</i> • Construct a minimum 1.5-meter-wide sidewalks along all internal residential roads and a minimum 2,0-meter-wide sidewalks along streets within the business node. • Construct a minimum 1,5 meters wide surfaced shoulder along D1527, to accommodate cyclist movements. • Although the pedestrian / cyclist demands along the D1527 is expected to be relatively low, it is recommended to provide gravel shoulders along D1527, across the B6 as well as across the Trans Kalahari Corridor highway. • Streetlights should be installed at all intersections along D1527 to enhance visibility and safety for all road users.
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	Public Transport facilities: • Construct public transport embayments along D1527, on both downstream sides of the School Access intersection. • Plan / implement a public transport hub within the business node (i.e. near Phase 2B), to centralise the transport services. • Consider three or four embayments along the internal road network, that could be used as public transport pick-up or drop-off points. Parking: for the land uses proposed as part of this development, should be provided at the rates recommended in Section 22 of this report. Based on this investigation, it is evident that the expected transport impacts from the Gondwana Lifestyle and Country Estate development could be sufficiently mitigated, <i>provided that the upgrades as discussed in this report are in place</i>. Hence, it is recommended that this development be considered for approval, <i>from a transport point of view</i>.
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Annexure A

Figures

Figure 1: Locality Plan

Figure 2: Development Framework Plan

Figure 3: 2025 Existing Lane Configuration and Control

Figure 4: 2025 Existing Traffic Conditions - Scenario 1

Figure 5: 2030 Background Traffic Conditions - Scenario 2

Figure 6: 2030 Expected Development Trips - Scenario 3

Figure 7: 2030 Lane Configuration and Control - Scenario 3

Figure 8: 2030 Total Traffic Conditions - Scenario 3

Figure 9: 2030 Expected Development Trips - Scenario 4

Figure 10: B6 / D1527 Intersection Upgrades

Figure 11: Trans-Kalahari Corridor / D1527 Interchange Upgrades

Figure 12: 2030 Lane Configuration and Control - Scenario 4

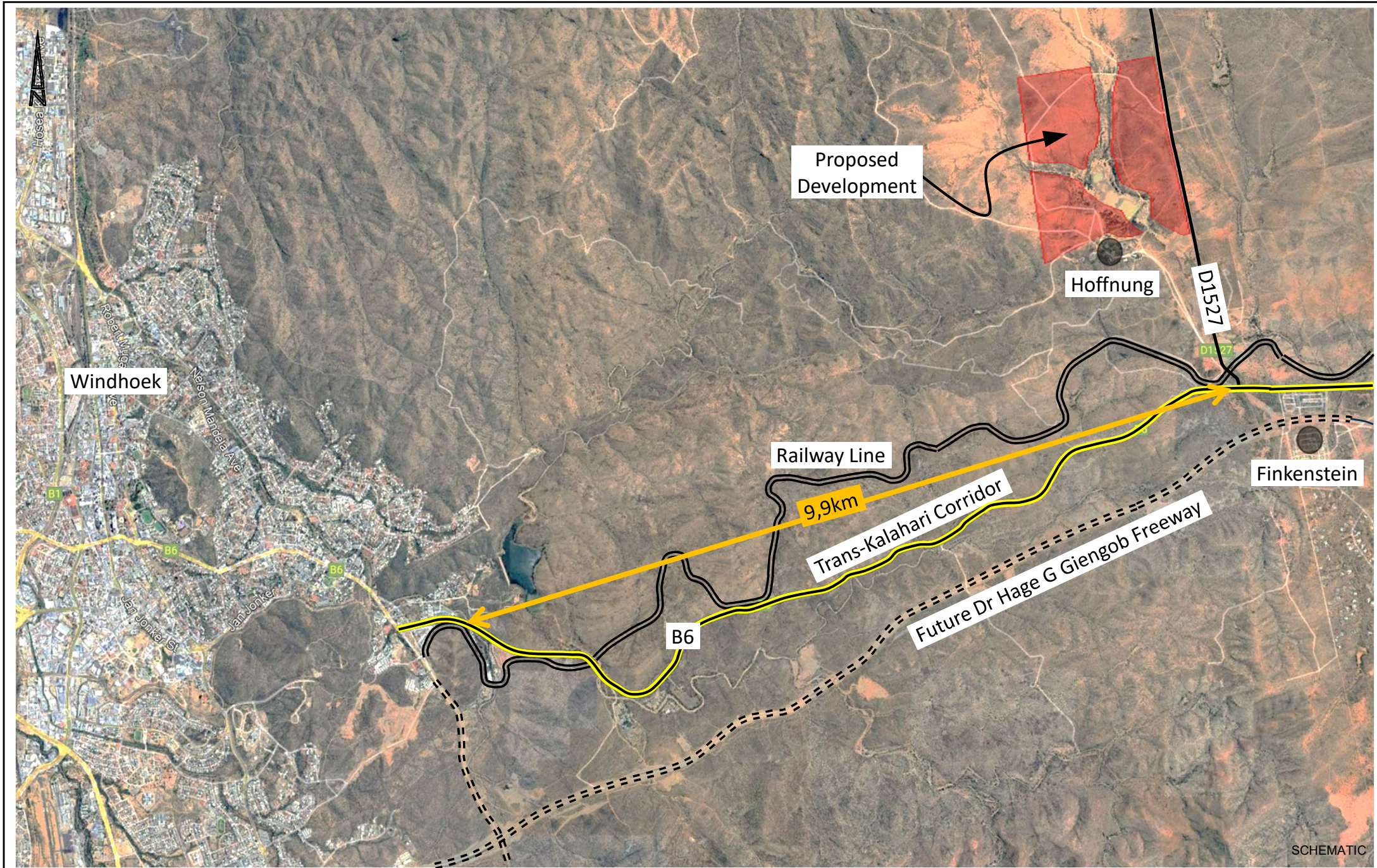
Figure 13: 2030 Total Traffic Conditions - Scenario 4

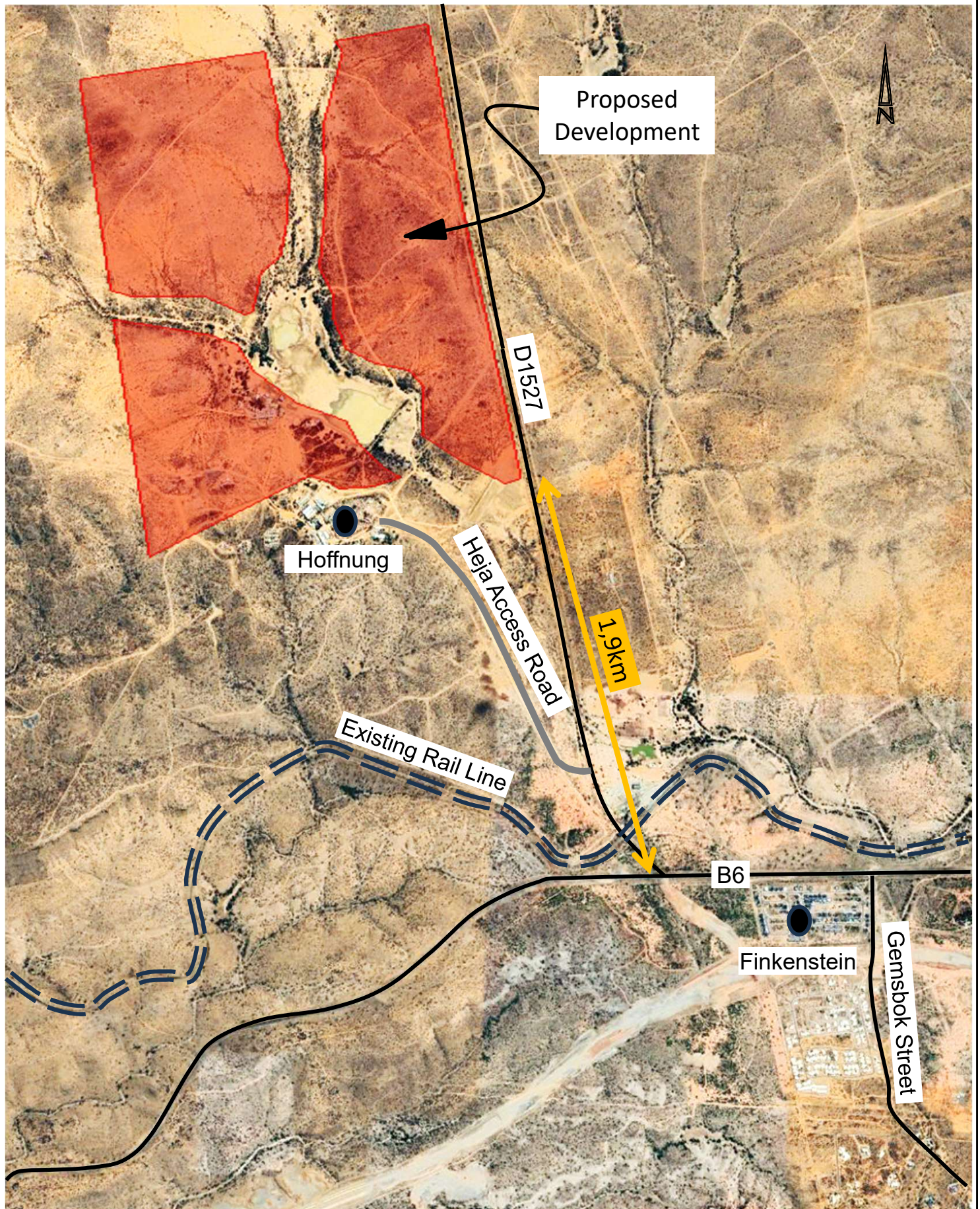
Figure 14: 2030 Expected Development Trips – Scenario 5 (FULL Development)

Figure 15: 2030 Lane Configuration and Control - Scenario 5

Figure 16: 2030 Total Traffic Conditions - Scenario 5 (FULL Development)

Figure 17: Future B6 / D1527 Intersection Upgrades - Alternatives





SCHEMATIC



PHASE 3B
502 UNITS

PHASE 3B
FAR 0.2
TOTAL AREA/
CONSTRUCTION AREA-
2 777m²
POSSIBLE CLUBHOUSE
SPORT FACILITY

PHASE 1C
274 UNITS

PHASE 1B
218 UNITS

PHASE 1A
323 UNITS

PHASE 3A
683 UNITS

PHASE 2A
FAR 0.2
TOTAL AREA/
CONSTRUCTION AREA-
25 876m²
SCHOOL

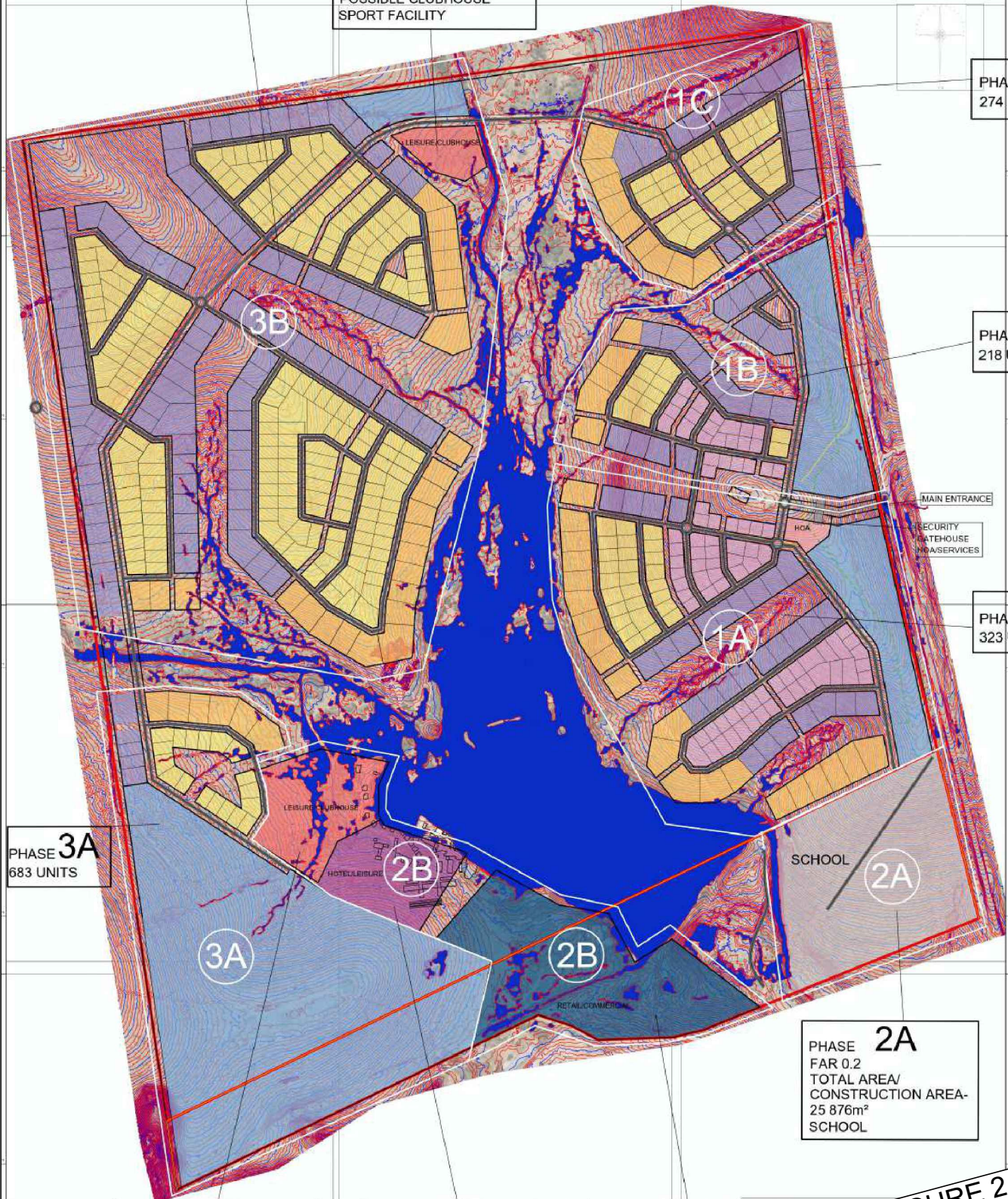
PHASE 2B
FAR 0.2
TOTAL AREA/
CONSTRUCTION AREA-
9 120m²
POSSIBLE CLUBHOUSE
SPORT FACILITY
SHARE WITH HOTEL/
COMMERCIAL

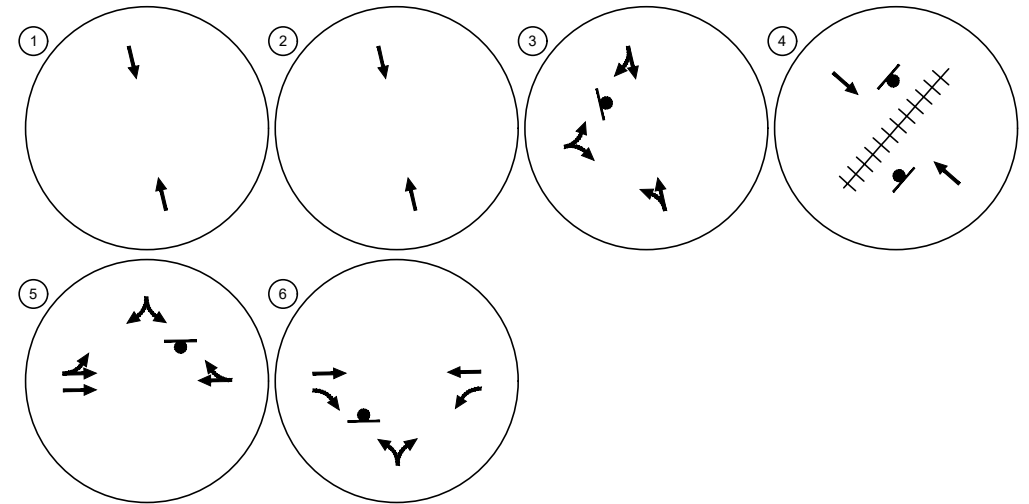
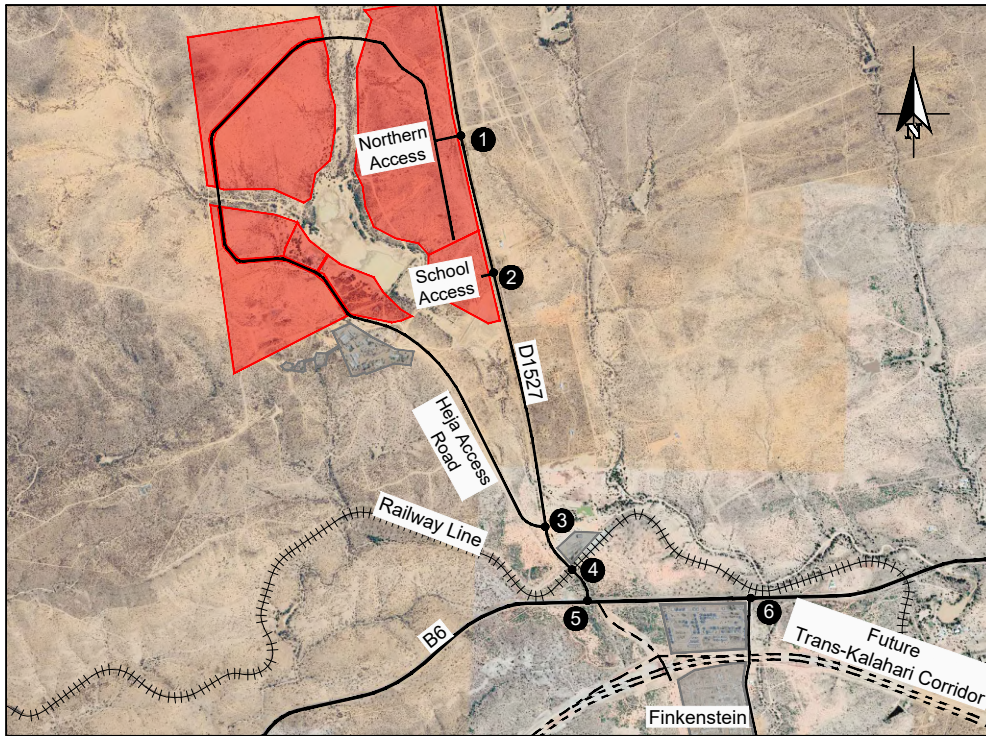
PHASE 2B
FAR 0.5
TOTAL AREA/
CONSTRUCTION AREA-
19 870m²
HOTEL
LEISURE
RETAIL
RESTAURANTS

PHASE 2B
FAR 0.5
TOTAL AREA/
CONSTRUCTION AREA-
58 645m²
COMMERCIAL
RETAIL
OFFICES
LEISURE
RESTAURANTS
MEDICAL

Strydom & Associates
Address: PO Box 1111
Windhoek
Tel: +264 61 25 1111
Email: info@strydom.co.na

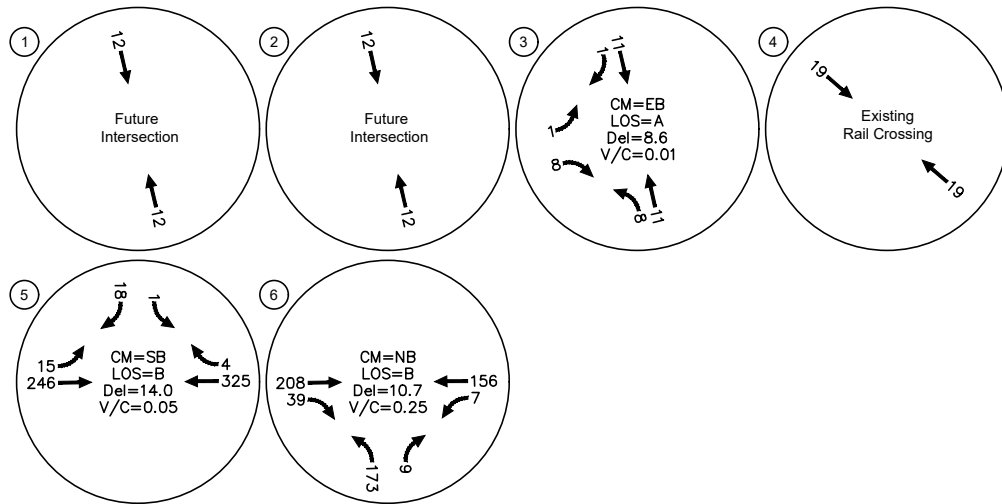
FIGURE 2
DEVELOPMENT
FRAMEWORK
PLAN



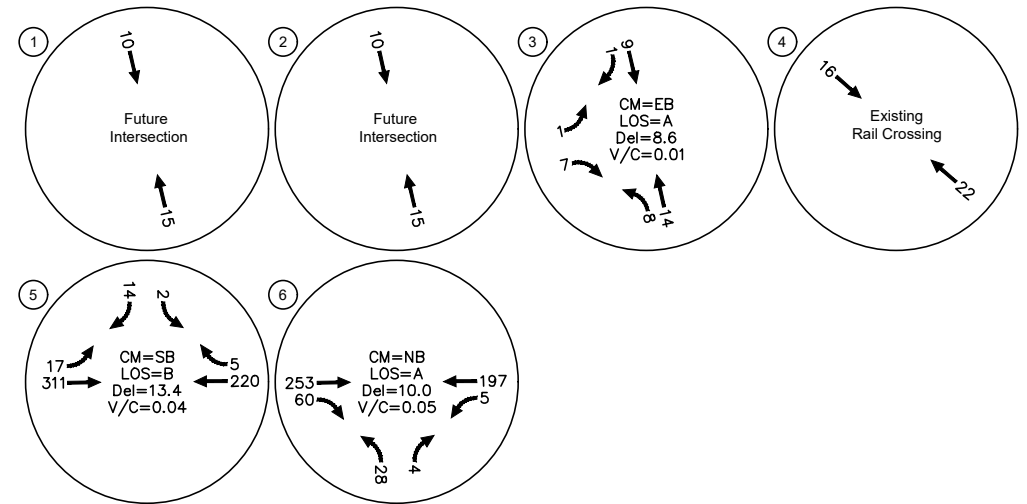


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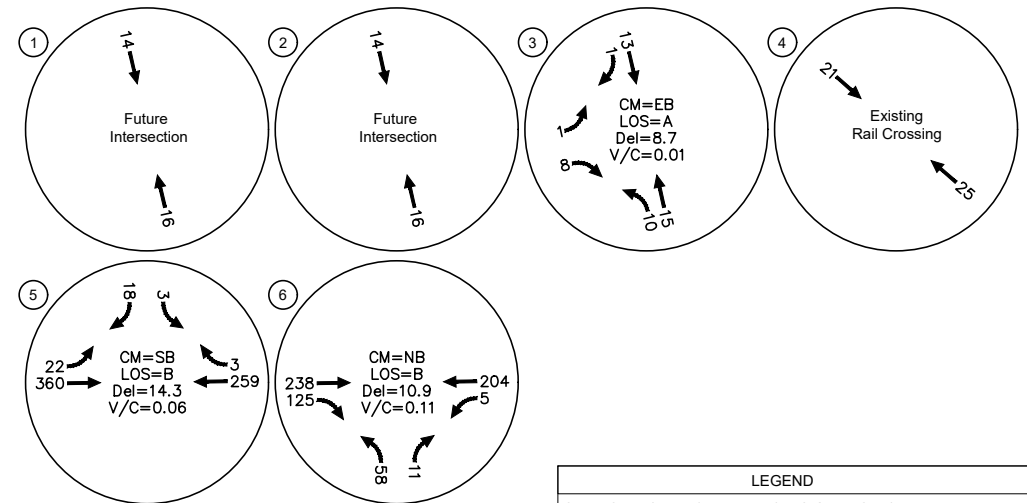
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MIDDAY PEAK HOUR

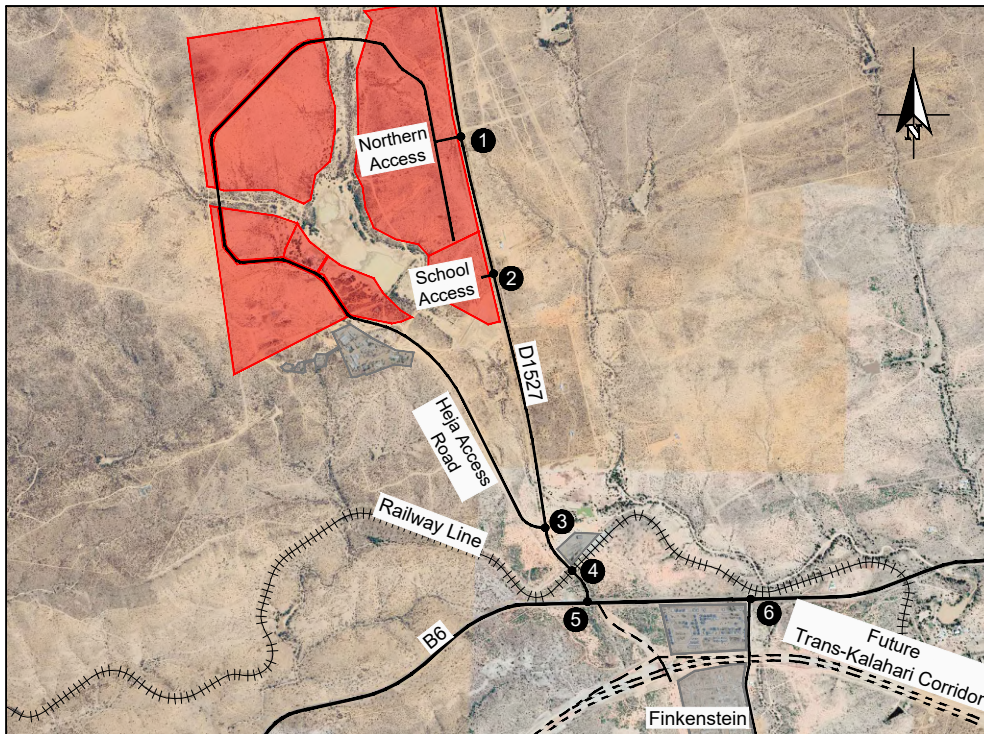


P.M. PEAK HOUR



LEGEND
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LOS = INTERSECTION LEVEL OF SERVICE SIGNALISED / CRITICAL MOVEMENT LEVEL OF SERVICE UNSIGNALISED
Del = INTERSECTION AVERAGE DELAY SIGNALISED / CRITICAL MOVEMENT DELAY UNSIGNALISED
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

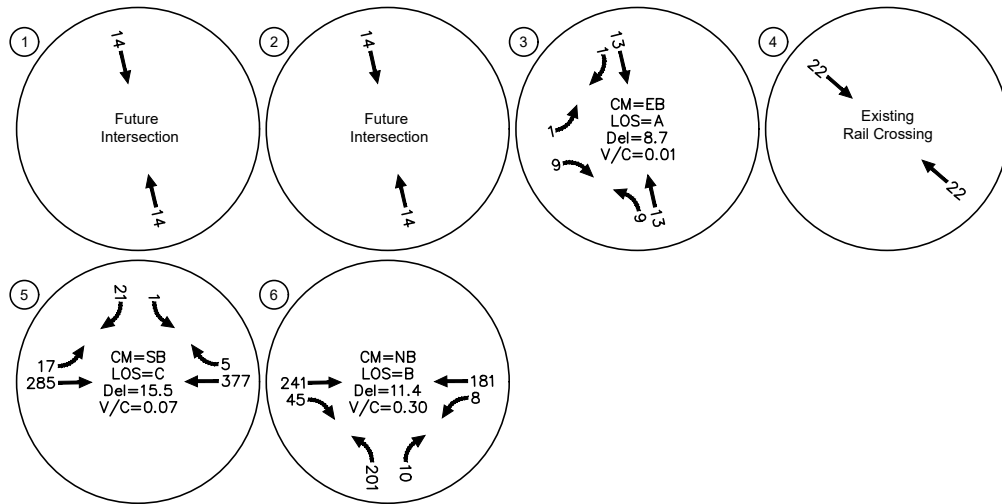
COUNT DATE: TUESDAY, 19 NOVEMBER 2024



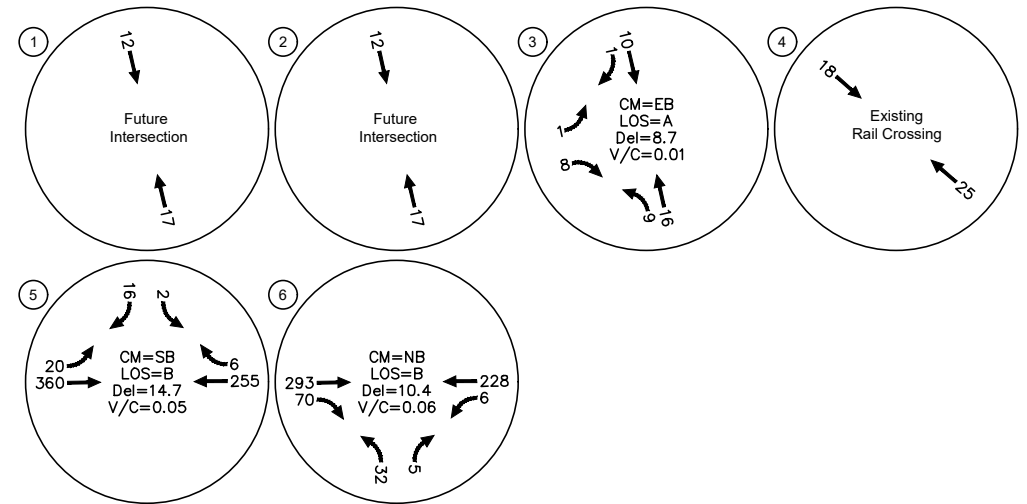
PROJECT: GONDWANA LIFESTYLE AND COUNTRY ESTATE,
HOFFNUNG, NAMIBIA

FIGURE: 2025 EXISTING TRAFFIC CONDITIONS
SCENARIO 1

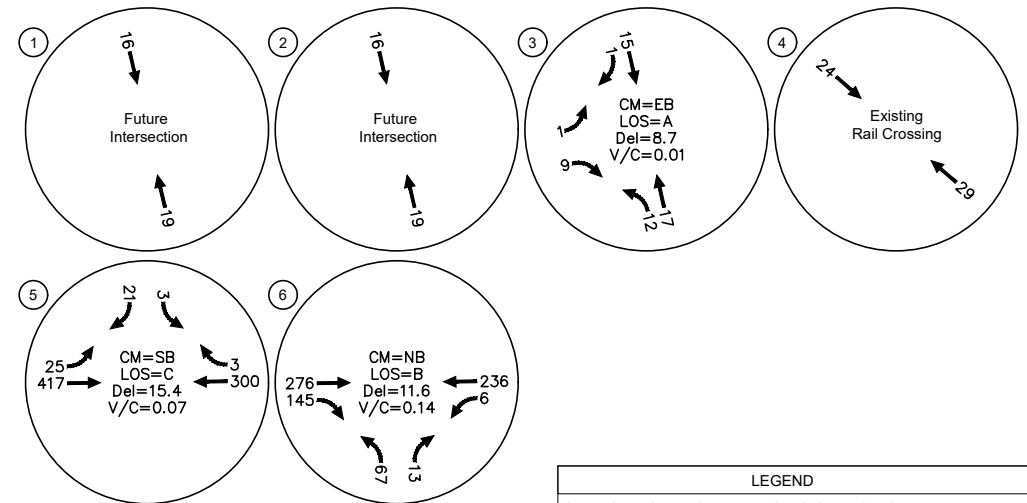
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MIDDAY PEAK HOUR

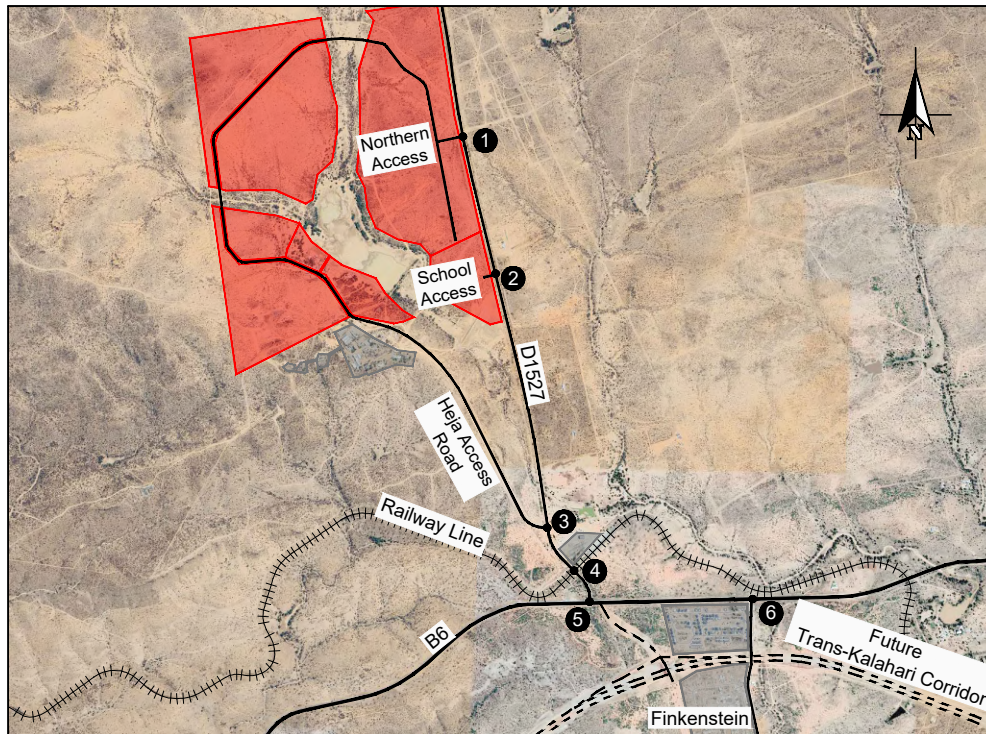


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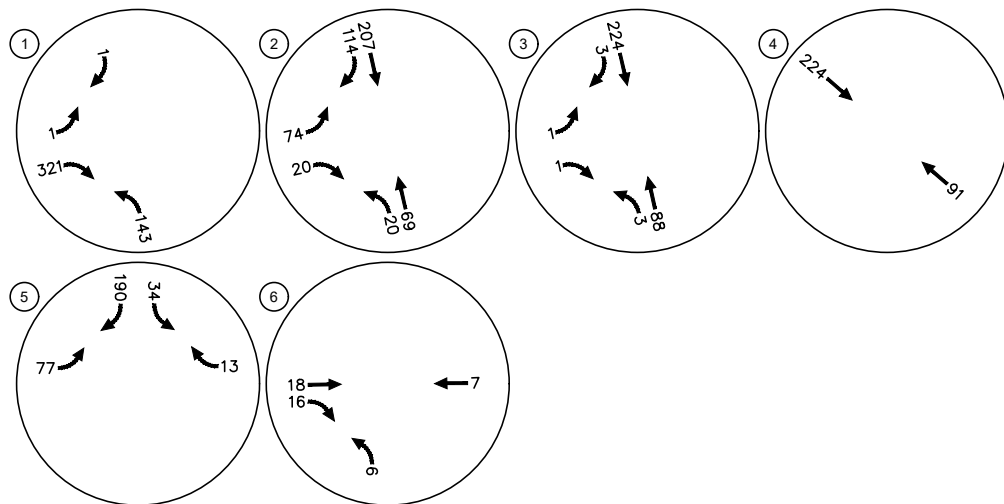
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 CRITICAL MOVEMENT DELAY UNSIGNALISED
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

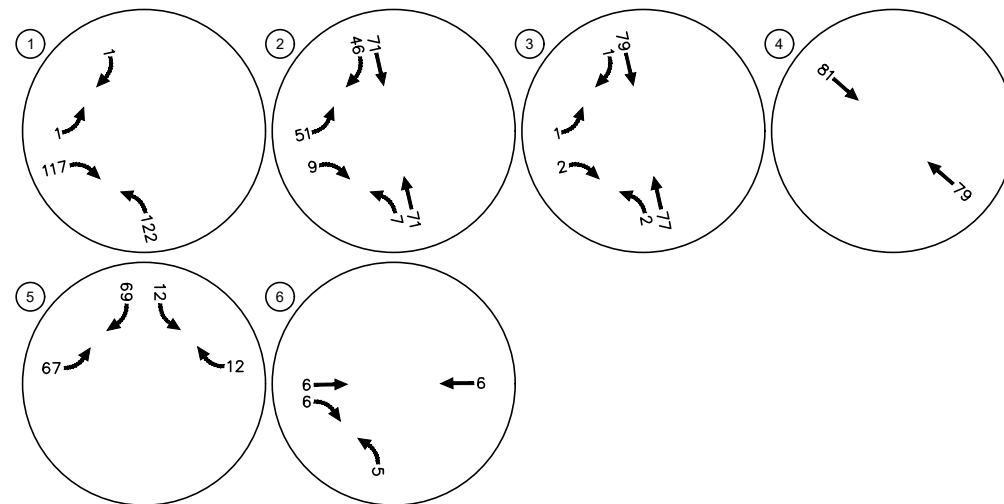


BASED ON EXISTING COUNTS ADJUSTED WITH A HISTORICAL
 GROWTH RATE OF 3% PER ANNUM OVER 5 YEARS.

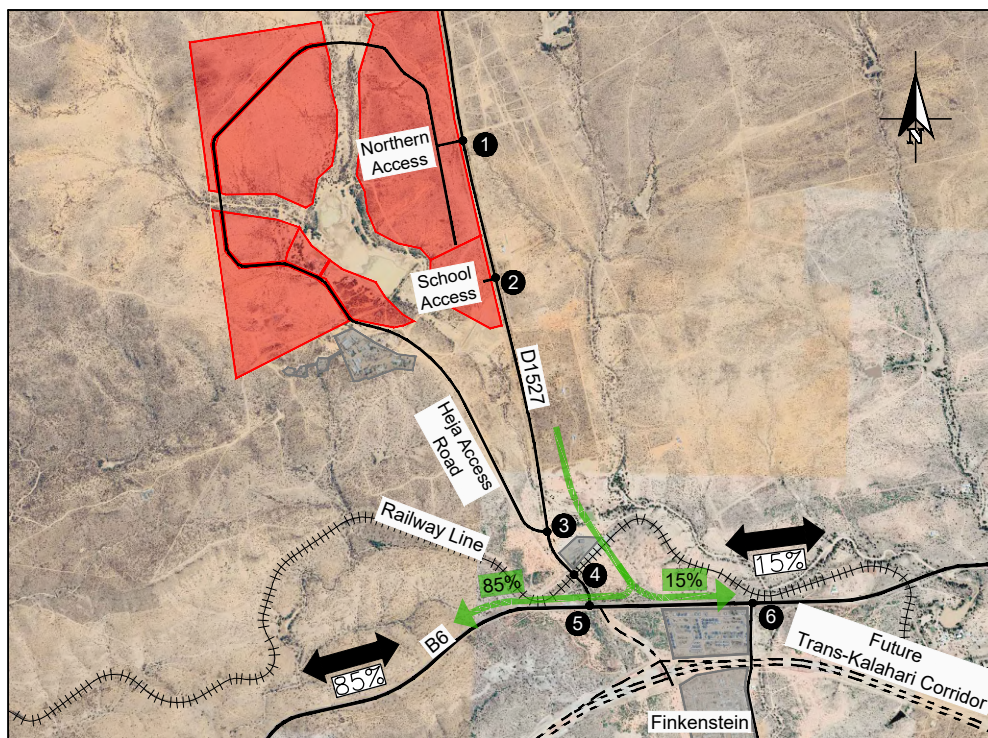
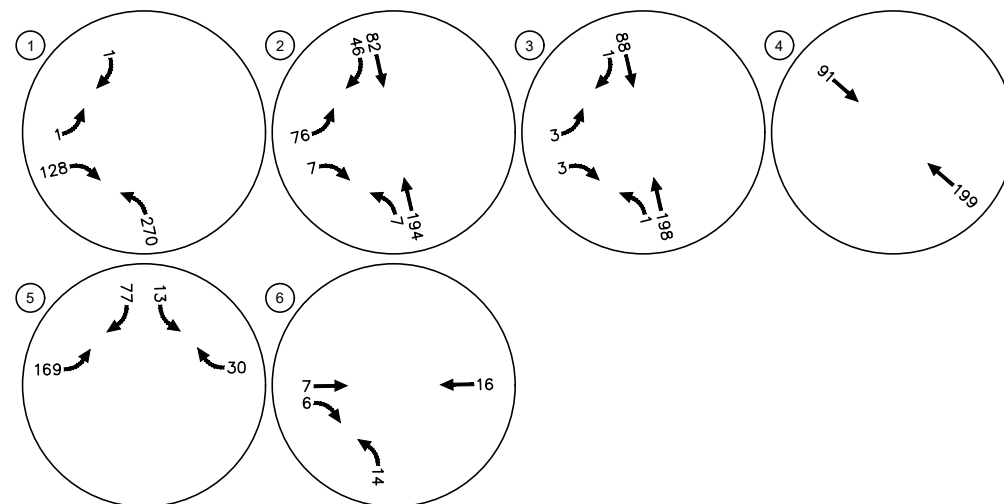
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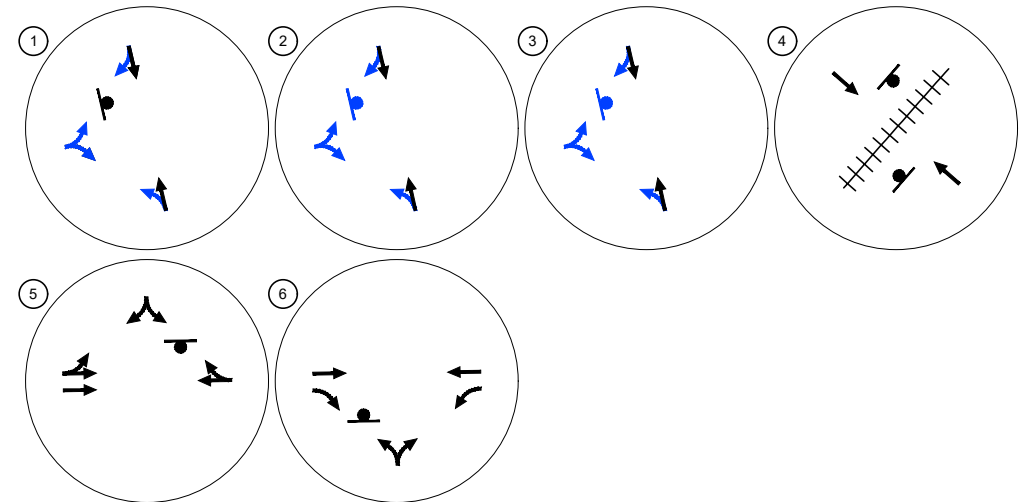
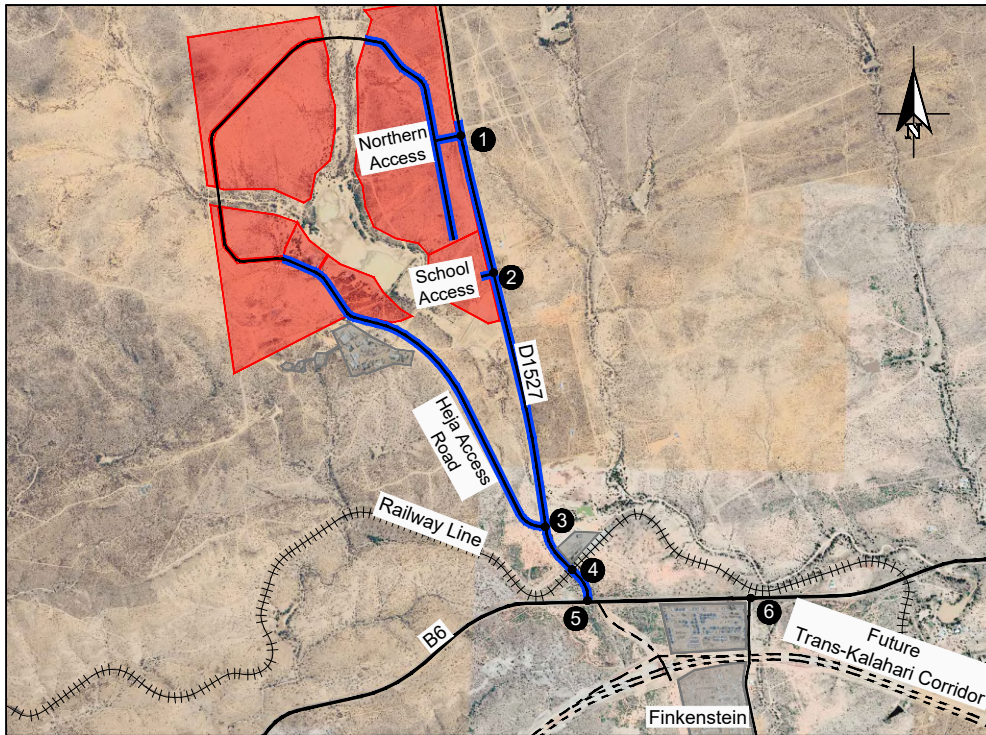
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P.M. PEAK HOUR

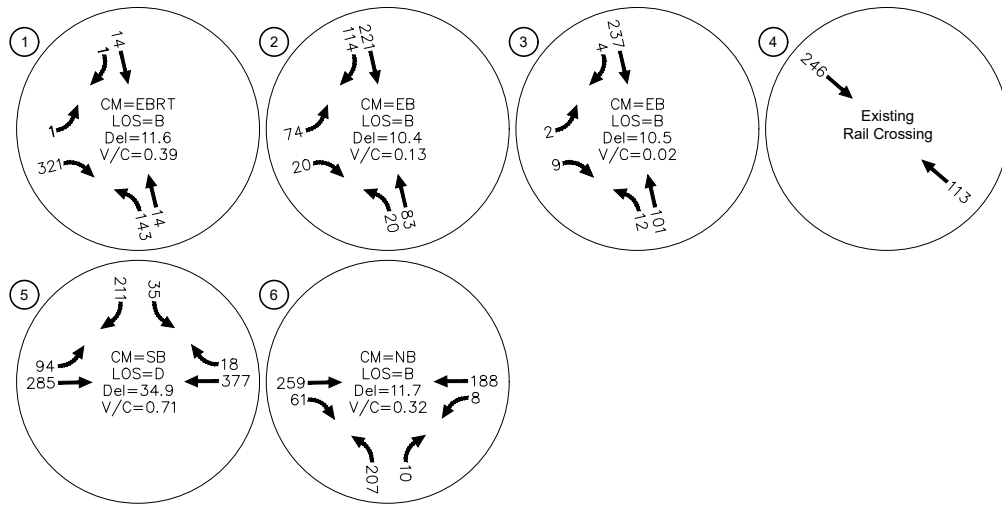


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Midday	90	92	182
PM	185	97	282

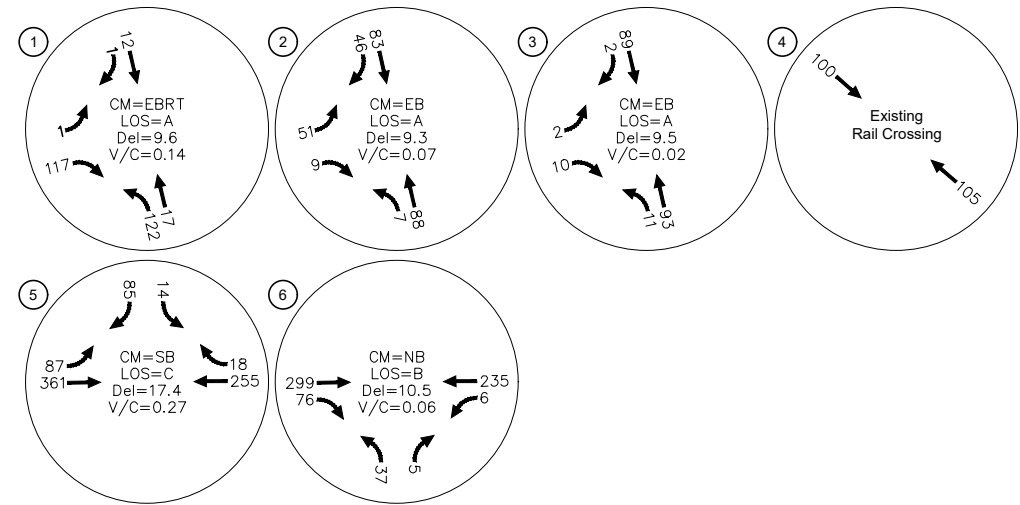


LEGEND	
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	2030 SCENARIO 3 - GONDWANA - ROAD LINK UPGRADES

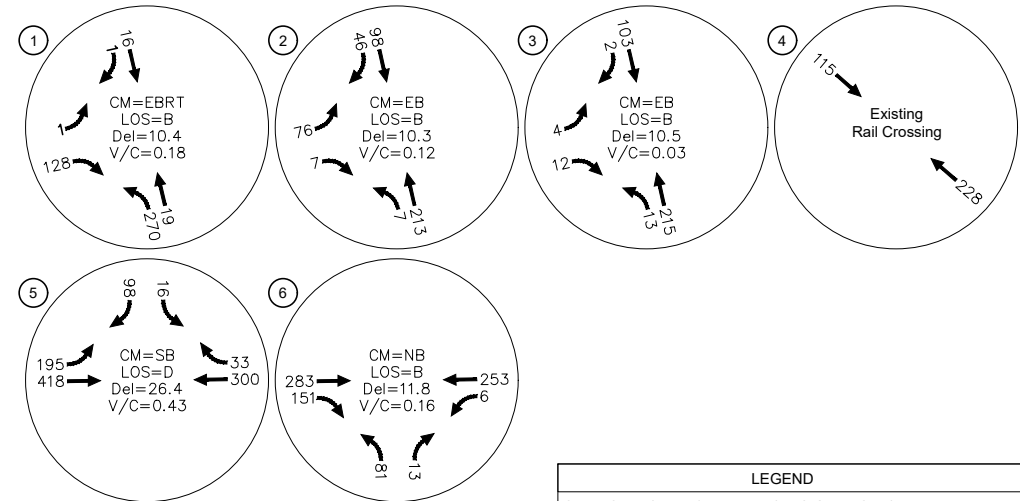
A.M. PEAK HOUR



MIDDAY PEAK HOUR

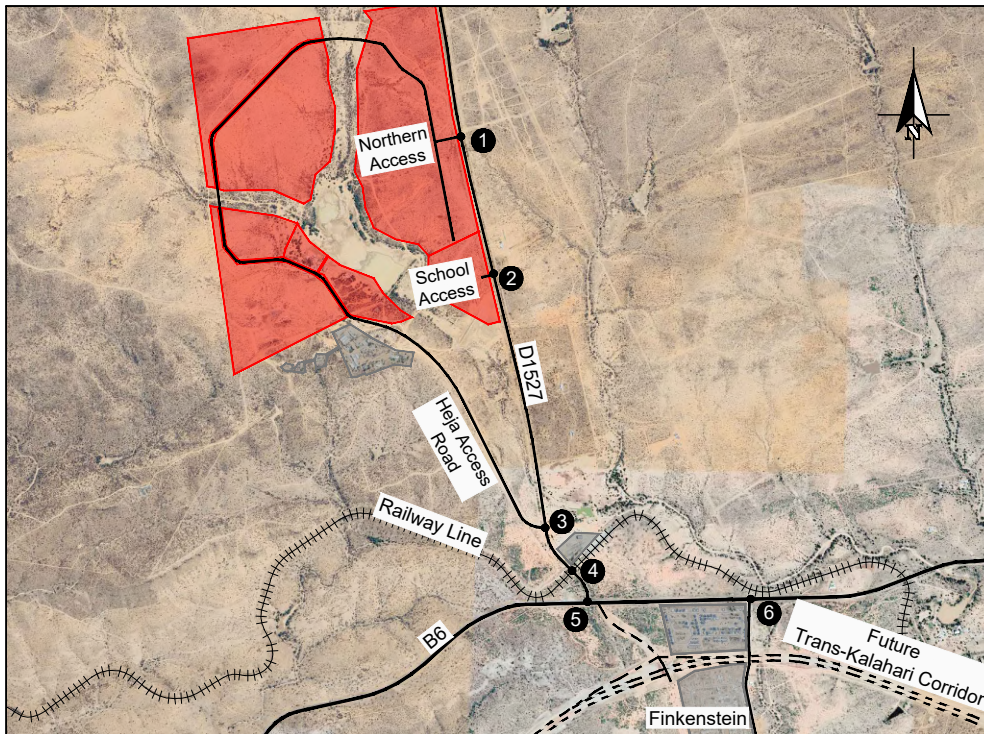


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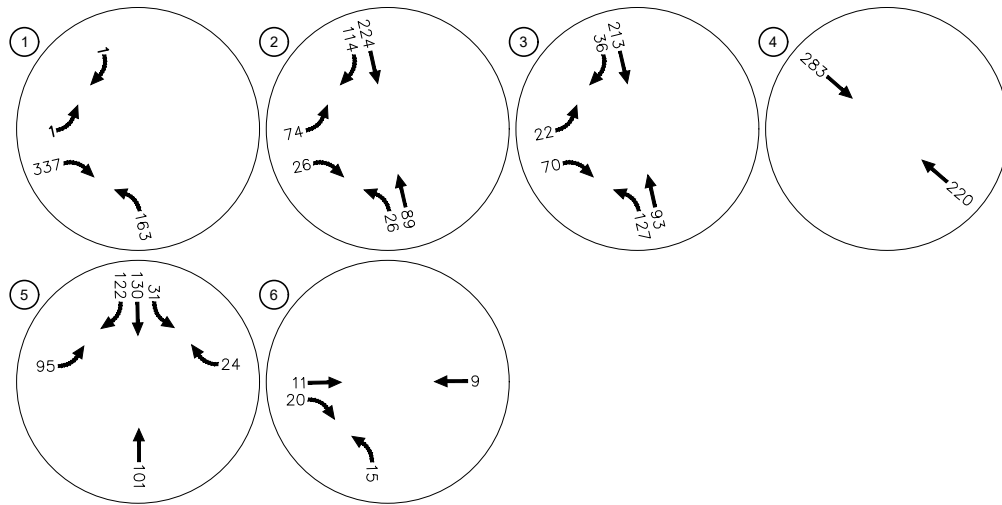


LEGEND

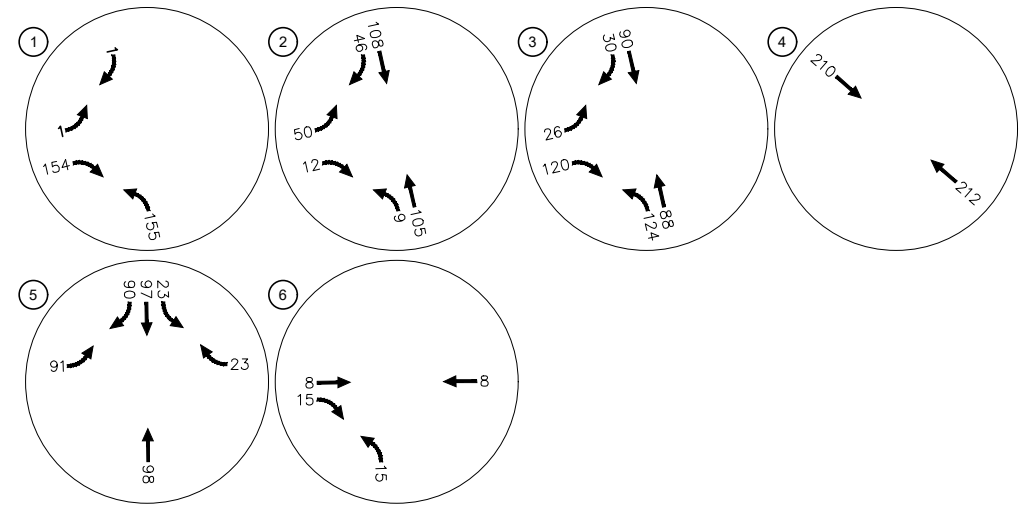
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 LOS = INTERSECTION LEVEL OF SERVICE SIGNALISED /
 CRITICAL MOVEMENT LEVEL OF SERVICE UNSIGNALISED
 CRITICAL MOVEMENT LEVEL OF SERVICE ROUNDABOUTS
 Del = INTERSECTION AVERAGE DELAY SIGNALISED /
 CRITICAL MOVEMENT DELAY UNSIGNALISED
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO



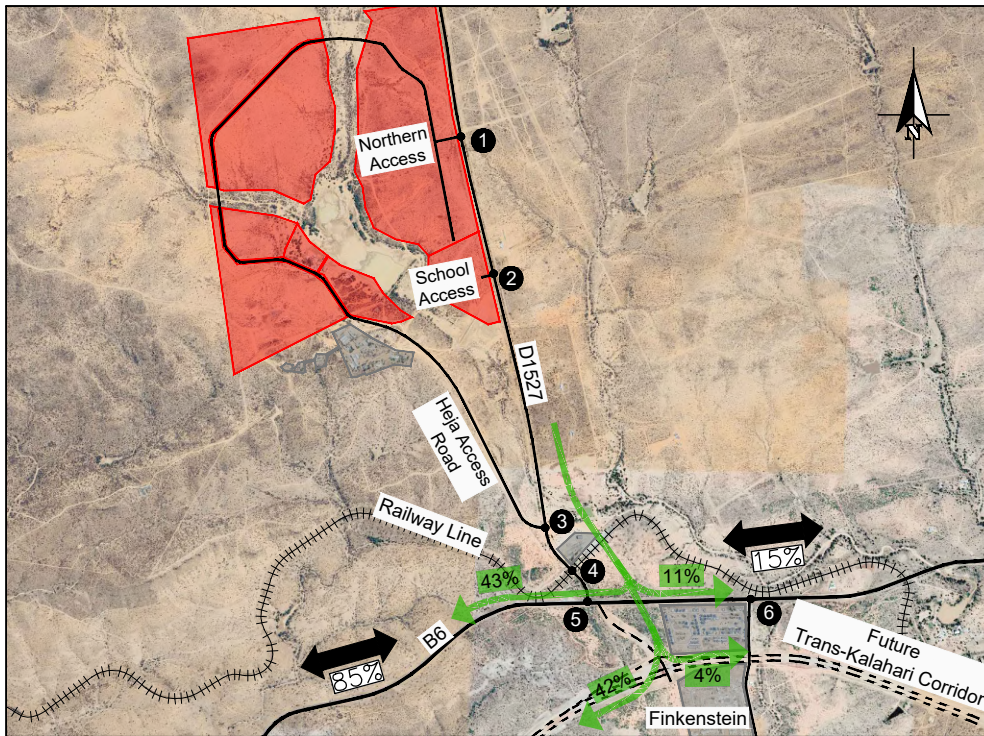
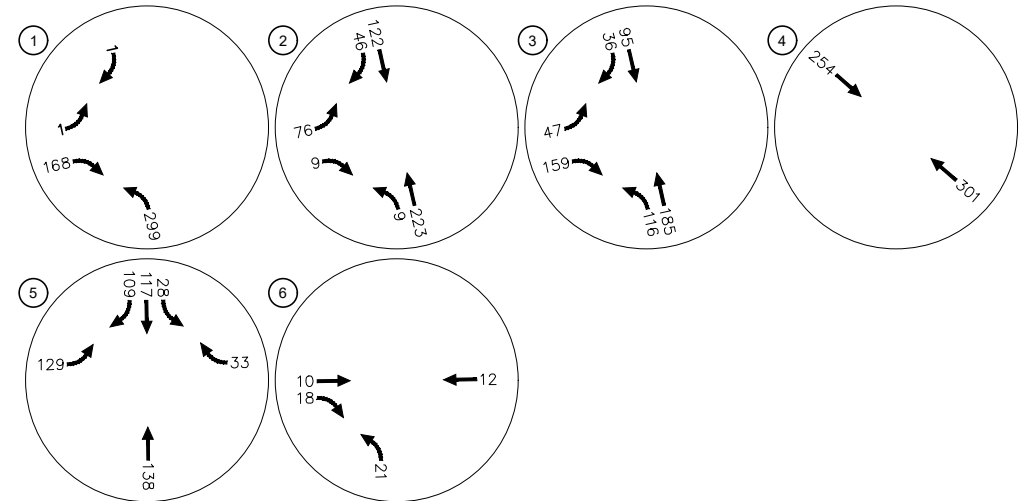
A.M. PEAK HOUR



MIDDAY PEAK HOUR



P.M. PEAK HOUR



Peak Hour	In	Out	Total
AM	220	284	504
Midday	213	210	423
PM	302	254	556

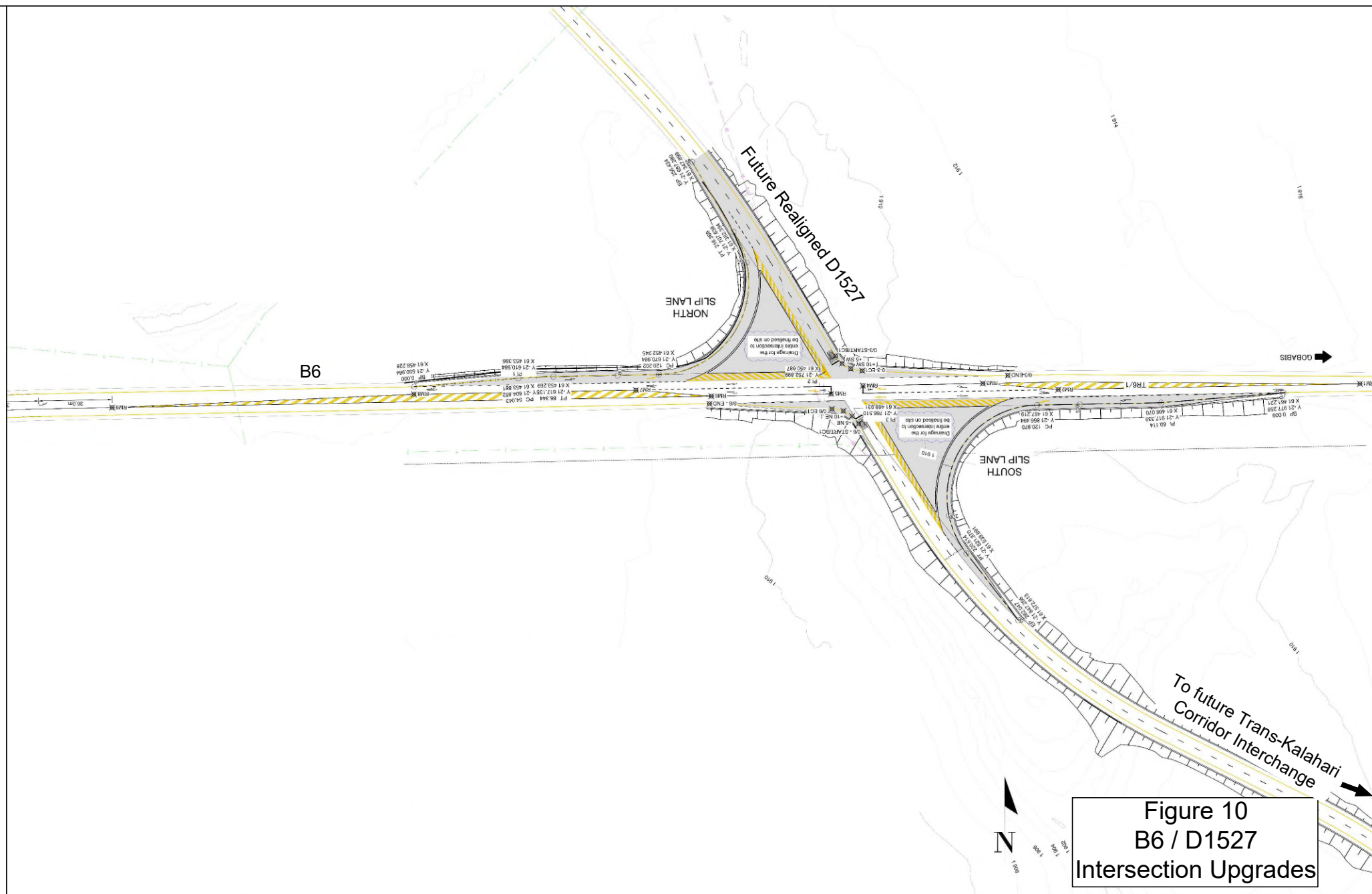
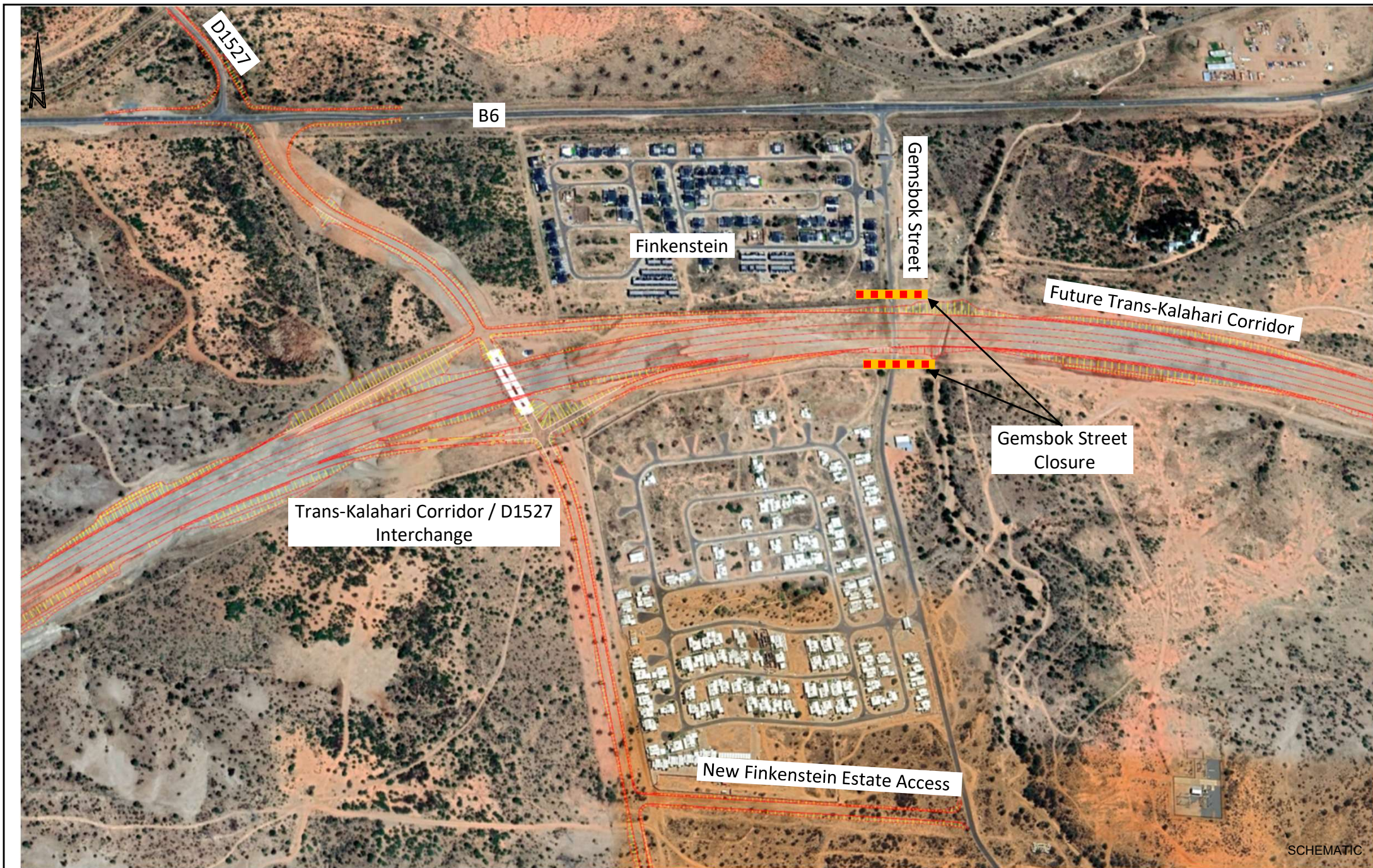
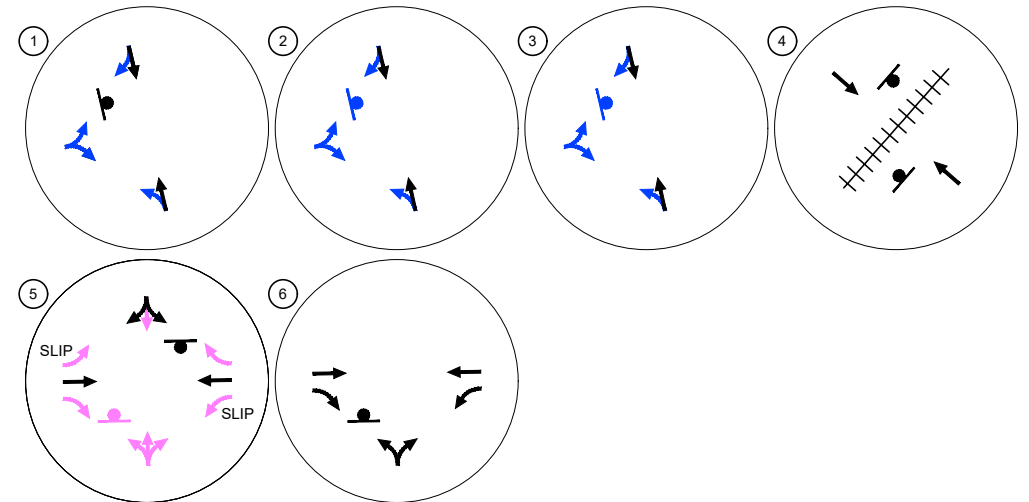
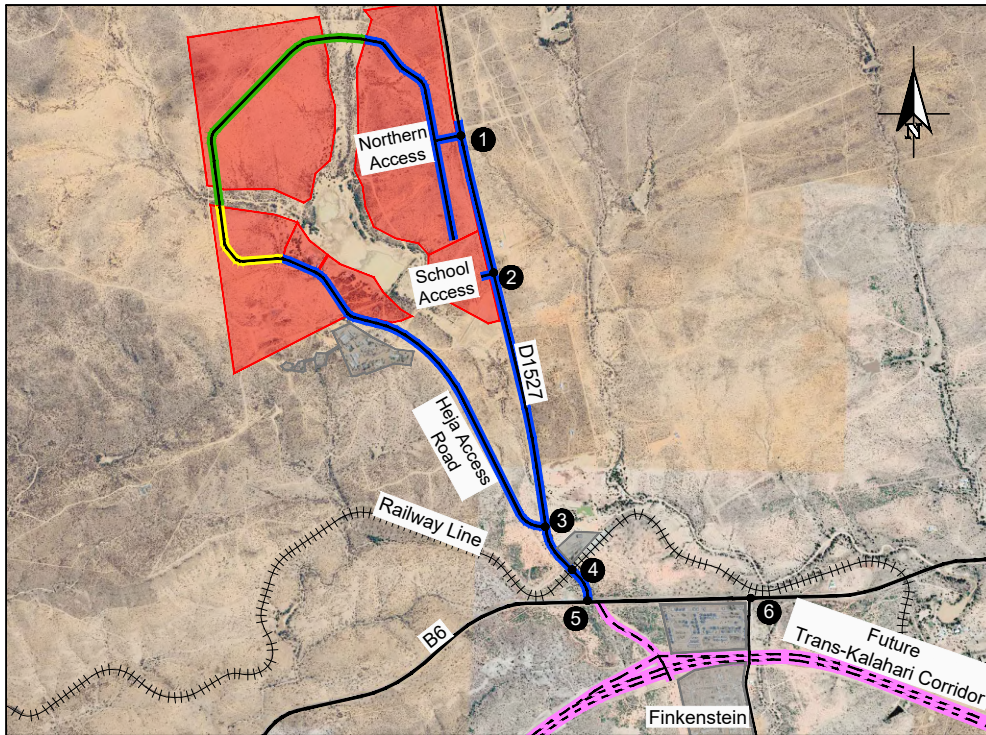


Figure 10
B6 / D1527
Intersection Upgrades

			 an smc company 54 Simeon Shikungilani St, PO Box 45, Windhoek, Namibia E namibia@smec.com T +264 (61) 237642 www.smeccom		<table><tr><td>DESIGNED BY</td><td>NICKY AMUSHILA</td></tr><tr><td>CHECKED BY</td><td>VIRGIL VIBAGE</td></tr><tr><td>DRAWN BY</td><td>NICKY AMUSHILA</td></tr></table> DATE: 4/11/2024 TIME: 10:23:24		DESIGNED BY	NICKY AMUSHILA	CHECKED BY	VIRGIL VIBAGE	DRAWN BY	NICKY AMUSHILA	<table><tr><td>ROADS AUTHORITY</td><td>REPUBLIC OF NAMIBIA</td></tr><tr><td>PRIVATE BAG 12030</td><td>TELEPHONE +264 61 2847026</td></tr><tr><td>AUSSPANNPLATZ</td><td></td></tr><tr><td>WINDHOEK</td><td></td></tr></table>  SAFE ROADS TO PROSPERITY		ROADS AUTHORITY	REPUBLIC OF NAMIBIA	PRIVATE BAG 12030	TELEPHONE +264 61 2847026	AUSSPANNPLATZ		WINDHOEK		<table><tr><td>RA PROJECT CONTROL ENGINEER</td><td>MURAMBE SHIMETE</td></tr><tr><td>RA DIVISIONAL ENGINEER (CAR)</td><td>FINA NM NWAENDI</td></tr><tr><td>RA CHIEF EXECUTIVE OFFICER</td><td>CONRAD LUTOMBI</td></tr></table>		RA PROJECT CONTROL ENGINEER	MURAMBE SHIMETE	RA DIVISIONAL ENGINEER (CAR)	FINA NM NWAENDI	RA CHIEF EXECUTIVE OFFICER	CONRAD LUTOMBI	<table><tr><td colspan="2">CONSTRUCTION OF TR6/1 TO FREEWAY STANDARDS BETWEEN WINDHOEK AND HOSEA KUTAKO INTERNATIONAL AIRPORT - PHASE 2A</td></tr><tr><td colspan="2">TR6/1 - DR1527 INTERSECTION SETTING OUT DATA</td></tr><tr><td>SCALE: 1:750</td><td>SHEET 1 OF 1</td></tr></table>		CONSTRUCTION OF TR6/1 TO FREEWAY STANDARDS BETWEEN WINDHOEK AND HOSEA KUTAKO INTERNATIONAL AIRPORT - PHASE 2A		TR6/1 - DR1527 INTERSECTION SETTING OUT DATA		SCALE: 1:750	SHEET 1 OF 1	<table><tr><td>CONTRACT NUMBER</td><td>RA/DC-CR/05-2014-2A</td></tr><tr><td>DRAWING LOCATION DATA</td><td></td></tr><tr><td>ROUTE</td><td>N/A</td></tr><tr><td>SECTION</td><td>N/A</td></tr><tr><td>DRAWING TYPE</td><td>ROADS - LAYOUTS AND LONGSECTIONS</td></tr><tr><td>BRIDGE/STRUCTURE No.</td><td>N/A</td></tr><tr><td>CONSULTANT DRAWING No.</td><td>N0108-0000-167</td></tr><tr><td>RA DOCUMENT #</td><td></td></tr></table>		CONTRACT NUMBER	RA/DC-CR/05-2014-2A	DRAWING LOCATION DATA		ROUTE	N/A	SECTION	N/A	DRAWING TYPE	ROADS - LAYOUTS AND LONGSECTIONS	BRIDGE/STRUCTURE No.	N/A	CONSULTANT DRAWING No.	N0108-0000-167	RA DOCUMENT #		<table><tr><td>START</td><td>END</td></tr><tr><td>N/A</td><td>N/A</td></tr><tr><td>N/A</td><td>N/A</td></tr><tr><td>N/A</td><td>N/A</td></tr></table>		START	END	N/A	N/A	N/A	N/A	N/A	N/A	FOR CONSTRUCTION	
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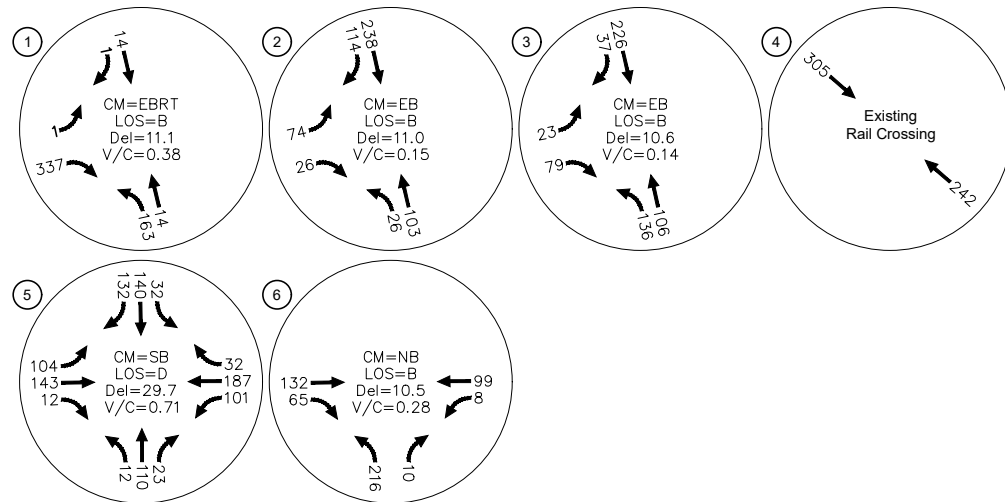
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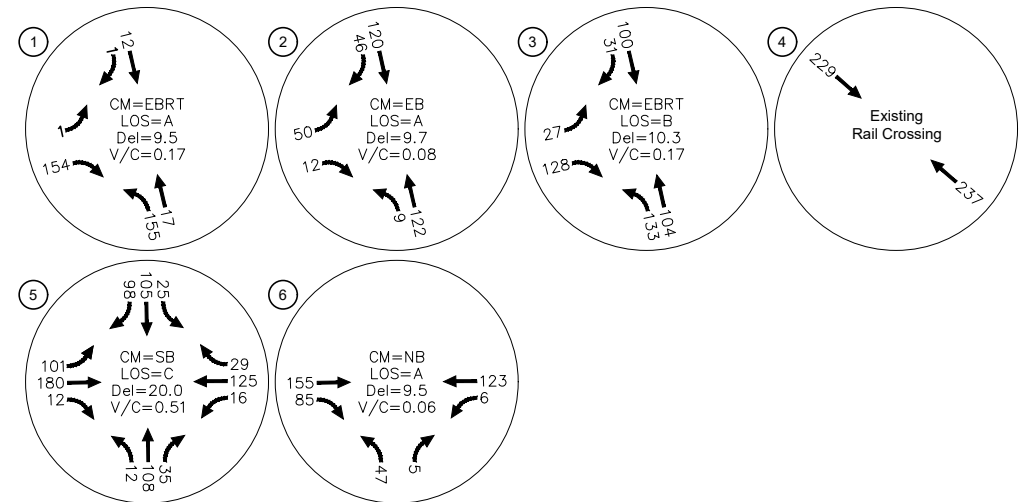


LEGEND	
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	2030 SCENARIO 3 - GONDWANA - INTERSECTION UPGRADES
	2030 SCENARIO 4 - ROAD AUTHORITY - INTERSECTION UPGRADES
	2030 SCENARIO 3 - GONDWANA - ROAD LINK UPGRADES
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	2030 SCENARIO 4 - ROAD AUTHORITY - LINK UPGRADES

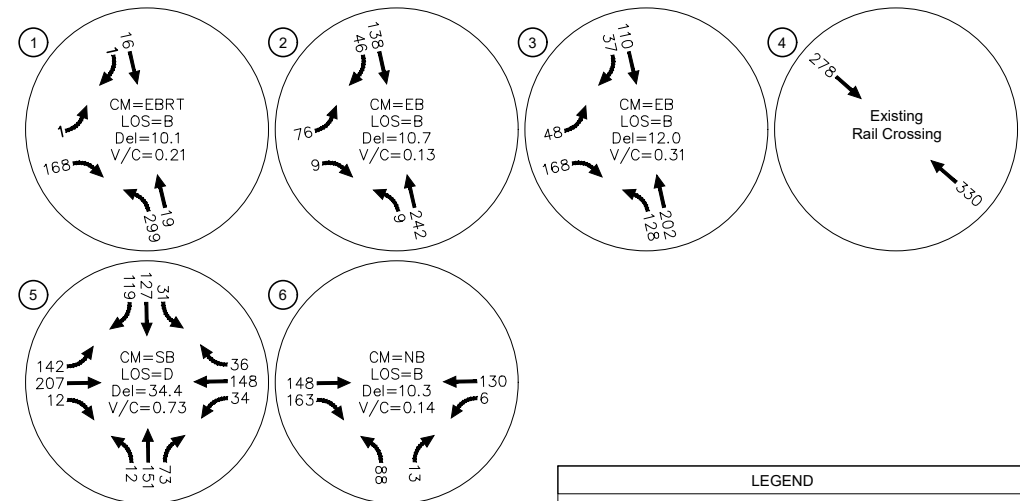
A.M. PEAK HOUR



MIDDAY PEAK HOUR

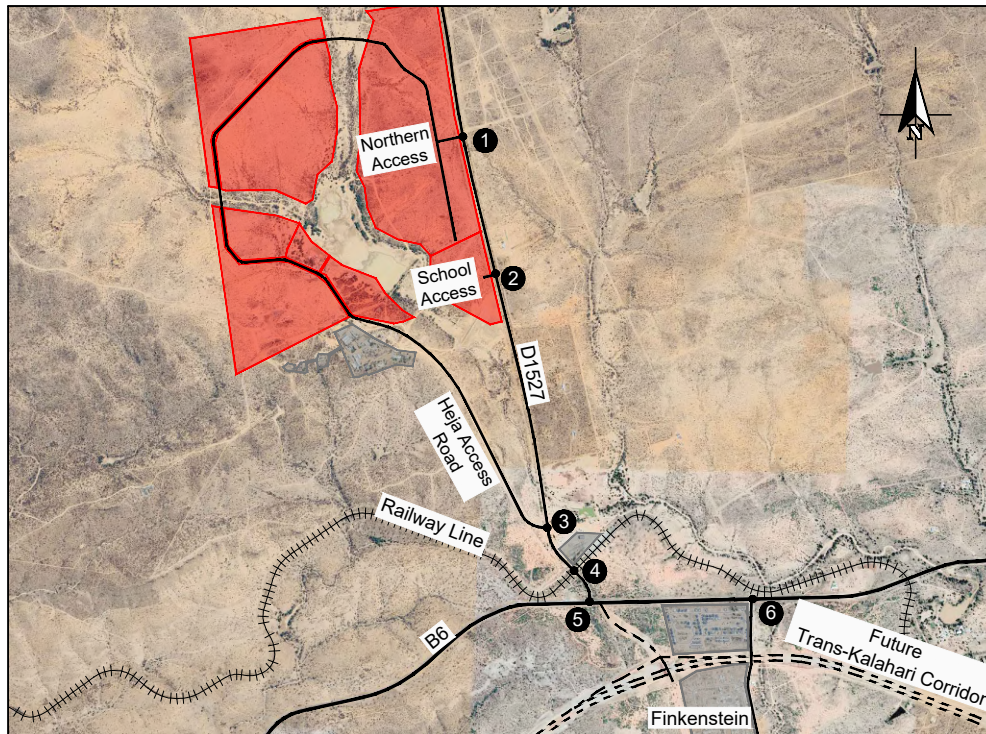


P.M. PEAK HOUR

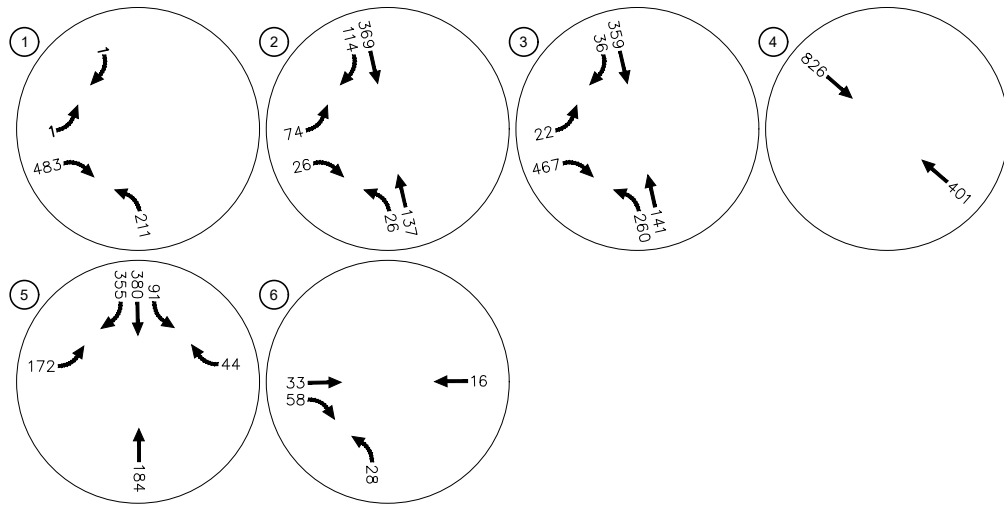


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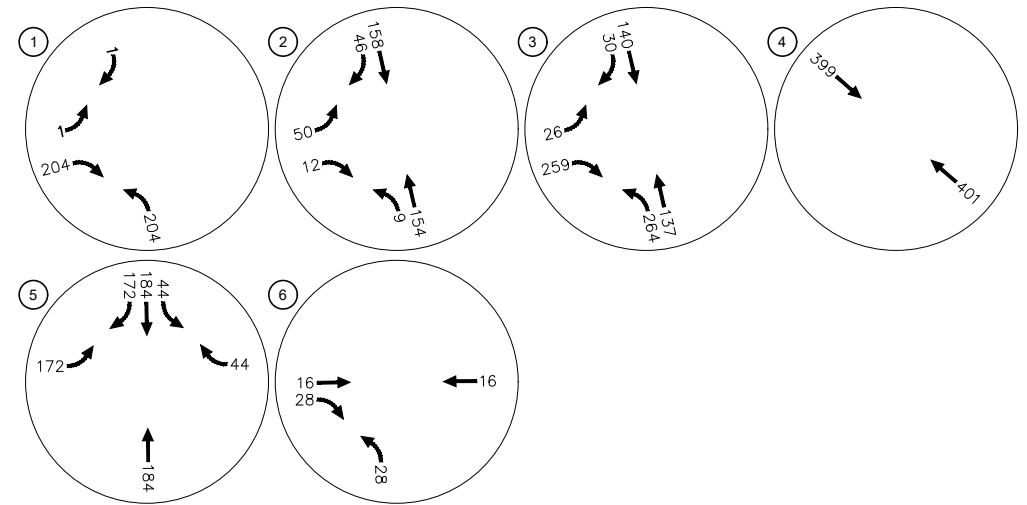
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 CRITICAL MOVEMENT LEVEL OF SERVICE ROUNDABOUTS
 Del = INTERSECTION AVERAGE DELAY SIGNALISED /
 CRITICAL MOVEMENT DELAY UNSIGNALISED
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO



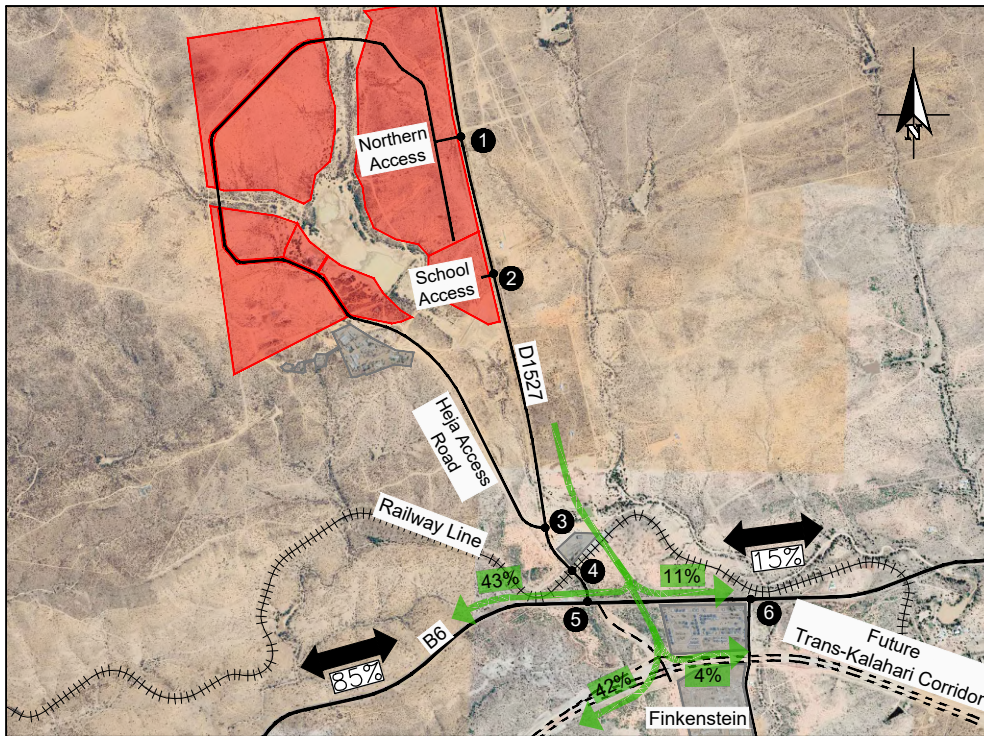
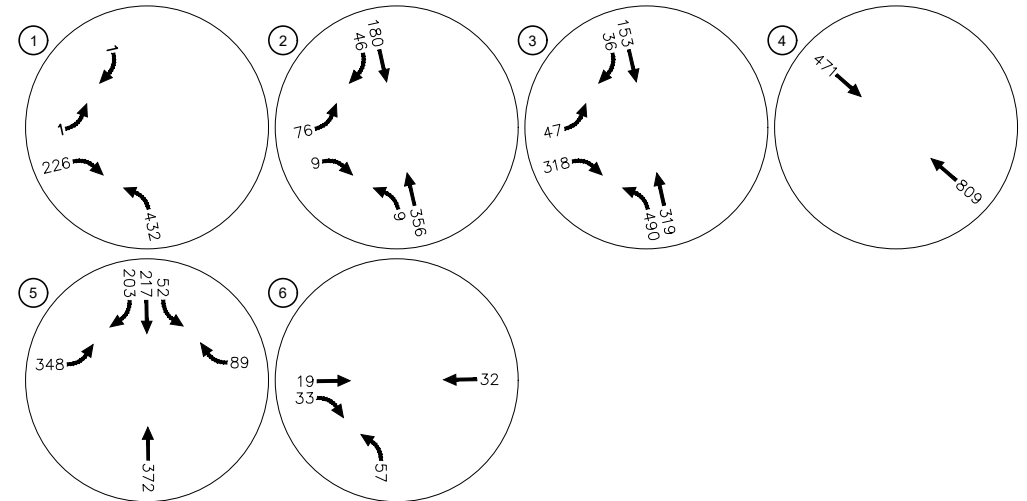
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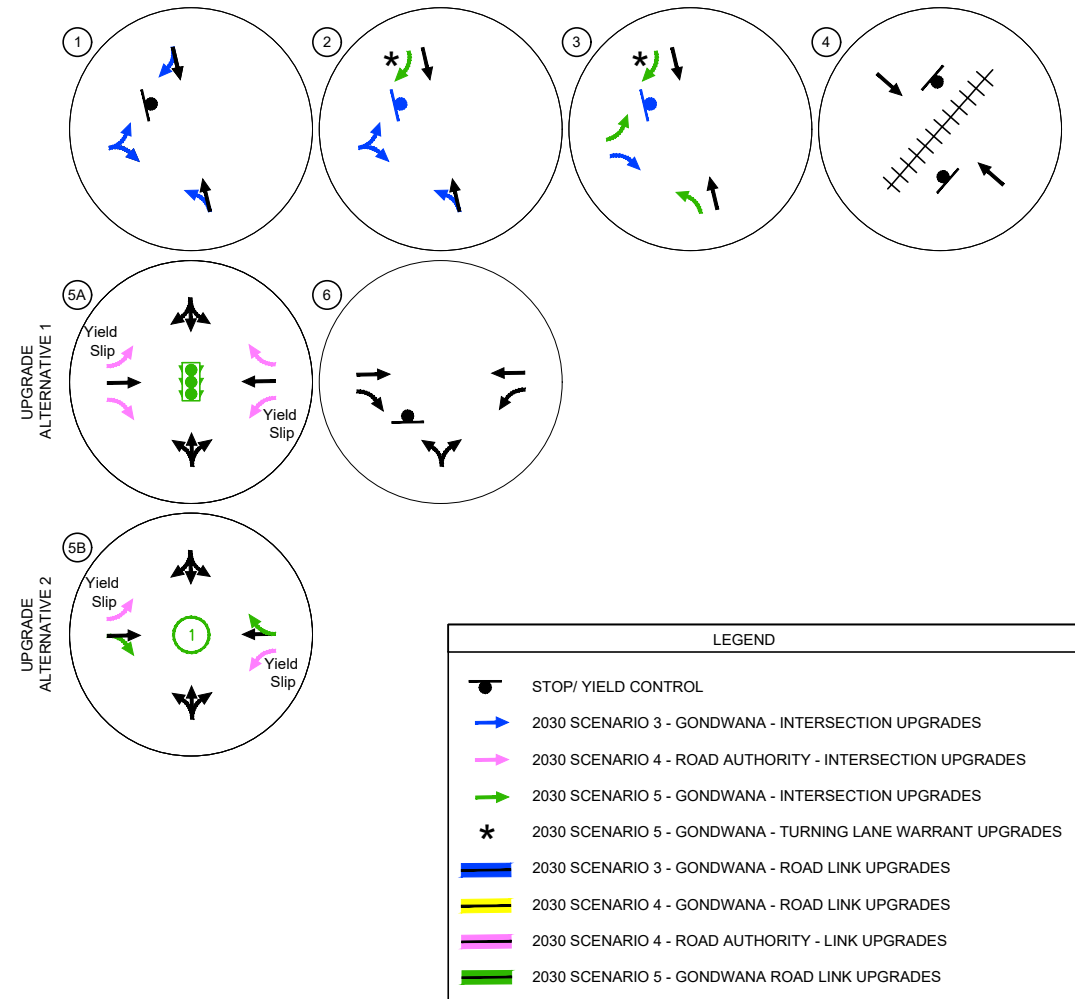
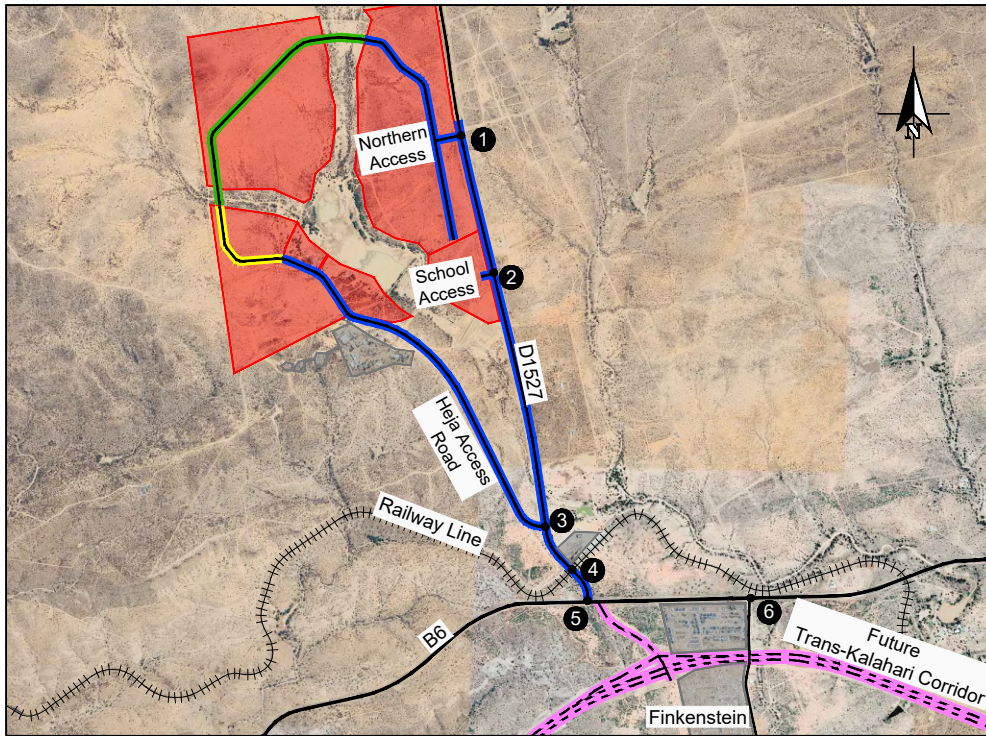
MIDDAY PEAK HOUR

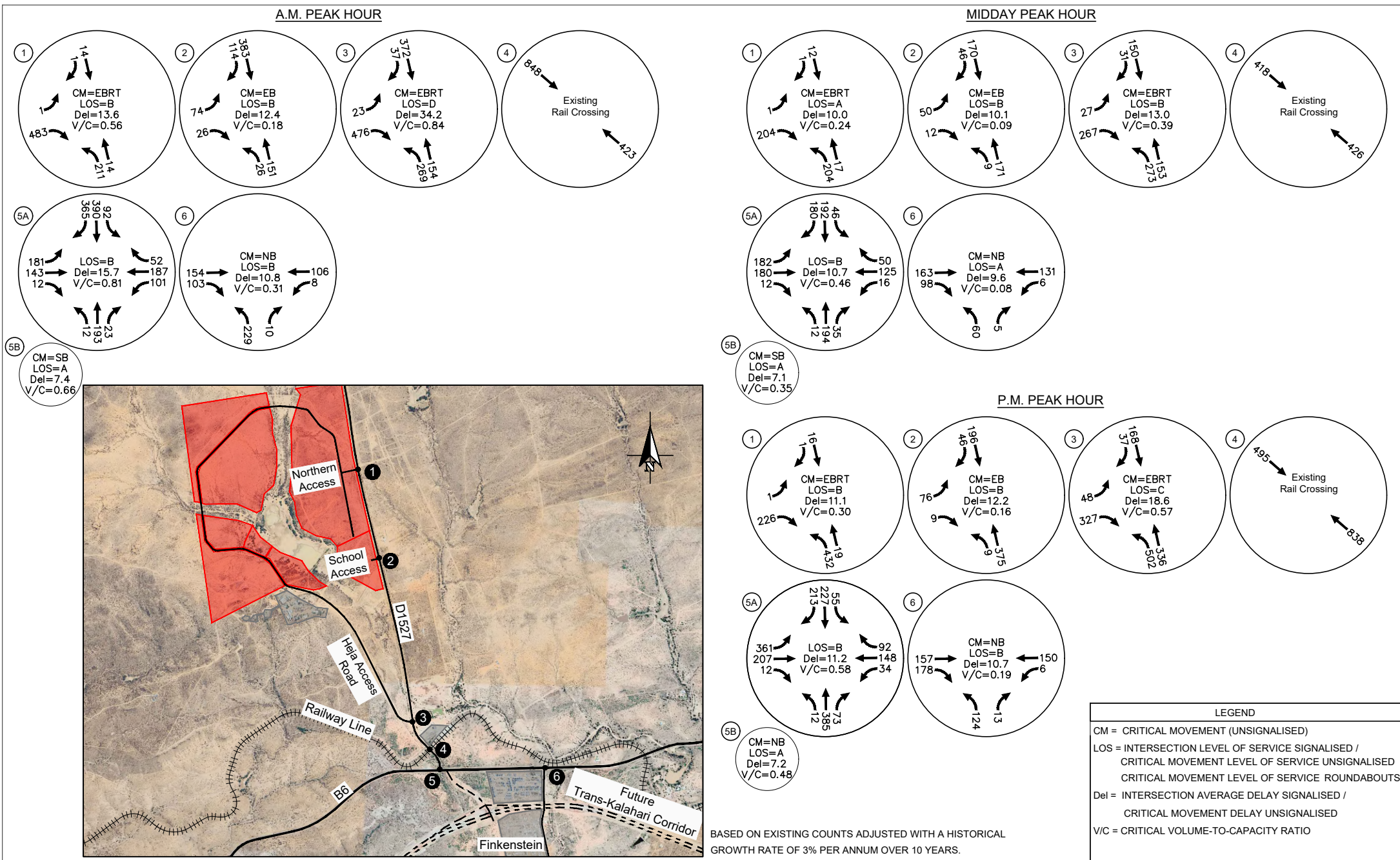


P.M. PEAK HOUR



Peak Hour	In	Out	Total
AM	402	827	1229
Midday	401	399	800
PM	810	472	1281





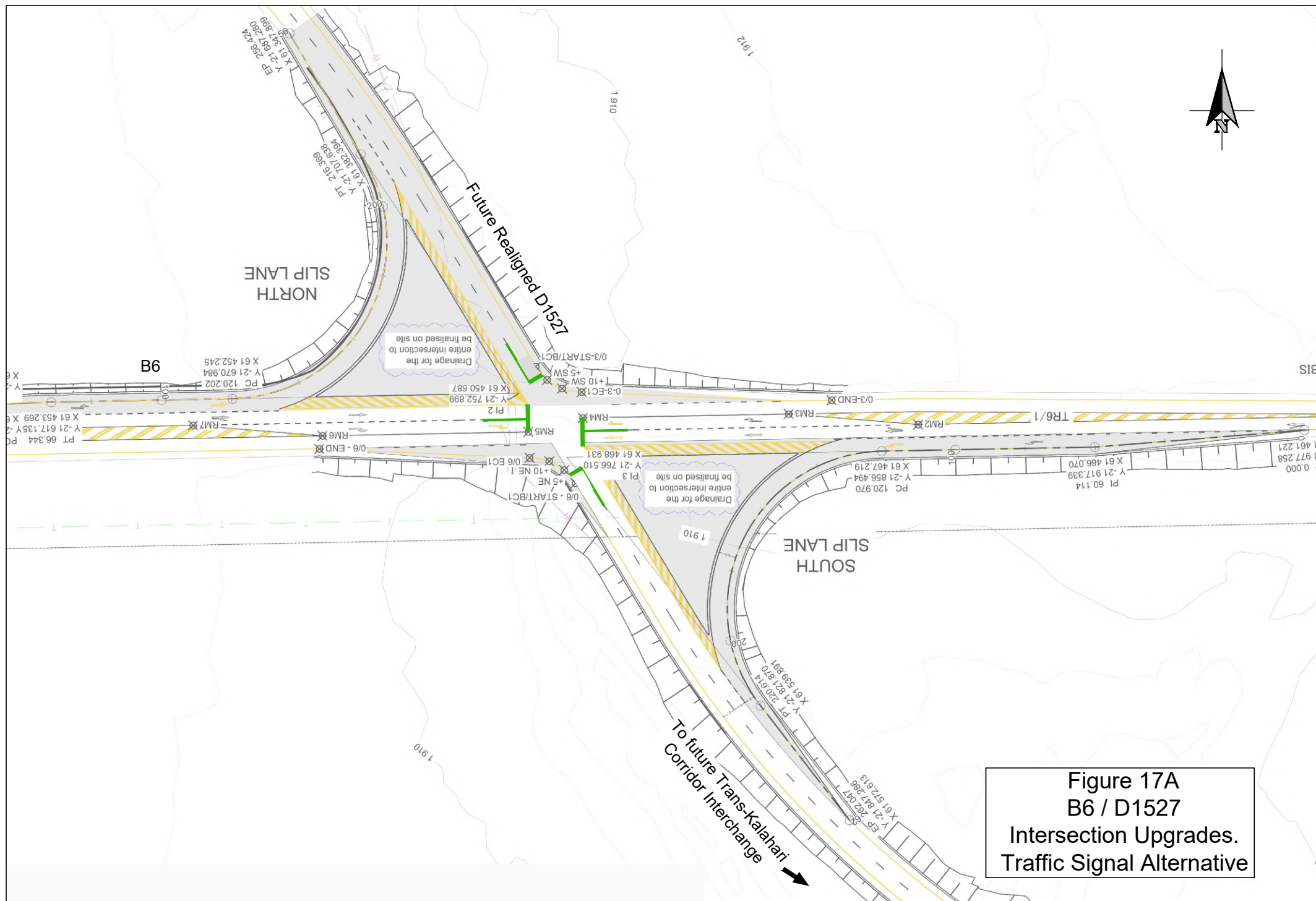
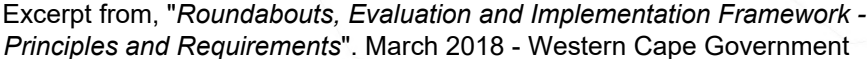


Figure 17A
B6 / D1527
Intersection Upgrades.
Traffic Signal Alternative



Annexure B

Tables

Table 1: Trip Generation Rates

Phase	Land Use	Unit	Source	Size (m ²) / Units	Weekday AM Peak Hour			Weekday Midday Peak Hour			Weekday PM Peak Hour			Adjustment Factors		
					Rate	In	Out	Rate	In	Out	Rate	In	Out	Mixed Use		
														AM	Midday	PM
1A	Single Residential	Units	CoTO210	171	1,00	25%	75%	0,50	50%	50%	1,00	70%	30%	25%	25%	25%
	Townhouses	Units	CoTO231	76	0,85	25%	75%	0,45	50%	50%	0,85	70%	30%	25%	25%	25%
1B	Retirement Village	Units	CoTO251	159	0,35	40%	60%	0,40	50%	50%	0,35	50%	50%	25%	25%	25%
1C	Single Residential	Units	CoTO210	46	1,00	25%	75%	0,50	50%	50%	1,00	70%	30%	25%	25%	25%
	Townhouses	Units	CoTO231	20	0,85	25%	75%	0,45	50%	50%	0,85	70%	30%	25%	25%	25%
2A	Educational (Primary School)	Students	CoTO520	280	0,85	50%	50%	0,35	45%	55%	0,30	50%	50%	90%	90%	90%
	Educational (High School)	Students	CoTO530	200	0,75	50%	50%	0,35	45%	55%	0,25	50%	50%	90%	90%	90%
2B	Hotel	Rooms	CoTO310	34	0,5	60%	40%	0,25	50%	50%	0,5	55%	45%	20%	10%	15%
	Conference	Seats	CoTO780	100	0,5	90%	10%	0,5	50%	50%	0,5	10%	90%	15%	10%	10%
	Leisure - Health and Fitness	100m ²	CoTO492	676	5,00	50%	50%	7,25	50%	50%	9,50	60%	40%	60%	40%	50%
	Leisure - Community Centre	100m ²	ITE495	676	1,62	61%	39%	1,28	49%	51%	1,64	29%	71%	20%	10%	15%
	Restaurant	100m ²	CoTO931	338	0,75	70%	30%	9,80	60%	40%	11,80	40%	60%	80%	70%	80%
2B	Commercial (Business Park)	100m ²	CoTO770	2 991	1,50	85%	15%	1,50	50%	50%	1,50	20%	80%	50%	40%	50%
	Office	100m ²	CoTO710	1 994	2,10	85%	15%	0,45	55%	45%	2,10	20%	80%	60%	40%	50%
	Leisure - Health and Fitness	100m ²	CoTO492	1 495	5,00	50%	50%	7,25	50%	50%	9,50	60%	40%	50%	40%	50%
	Leisure - Community Centre	100m ²	ITE495	1 495	1,62	61%	39%	1,28	49%	51%	1,64	29%	71%	80%	70%	80%
	Restaurant	100m ²	CoTO931	498	0,75	70%	30%	9,80	60%	40%	11,80	40%	60%	80%	70%	80%
	Medical (Private Hospital)	100m ²	CoTO612	1495	1,65	60%	40%	1,6	45%	55%	1,5	40%	60%	50%	40%	50%
3A	Single Residential	Units	CoTO210	115	1,00	25%	75%	0,50	50%	50%	1,00	70%	30%	25%	25%	25%
	Townhouses	Units	CoTO231	220	0,85	25%	75%	0,45	50%	50%	0,85	70%	30%	25%	25%	25%
	Apartments	Units	CoTO220	347	0,65	25%	75%	0,35	50%	50%	0,65	70%	30%	25%	25%	25%
3B	Single Residential	Units	CoTO210	308	1,00	25%	75%	0,50	50%	50%	1,00	70%	30%	25%	25%	25%
	Townhouses	Units	CoTO231	194	0,85	25%	75%	0,45	50%	50%	0,85	70%	30%	25%	25%	25%

Table 2: Expected Development Trips – Full Development

Total Driveway Trips										
Phase Figure 2	Land Use	Weekday AM Peak Hour			Weekday Midday Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total	In	Out	Total
1A	Single Residential	43	129	171	43	43	86	120	51	171
	Townhouses	16	48	64	17	17	34	45	19	64
1B	Retirement Village	22	33	56	32	32	64	28	28	56
1C	Single Residential	12	35	46	12	12	23	32	14	46
	Townhouses	4	13	17	5	5	9	12	5	17
2A	Educational (Primary School)	119	119	238	44	54	98	42	42	84
	Educational (High School)	75	75	150	32	39	70	25	25	50
2B	Hotel	10	7	17	4	4	8	9	8	17
	Conference	45	5	50	25	25	50	5	45	50
	Leisure - Health and Fitness	17	17	34	24	24	49	39	26	64
	Leisure - Community Centre	7	4	11	4	4	9	3	8	11
	Restaurant	2	1	3	20	13	33	16	24	40
	Commercial (Business Park)	38	7	45	22	22	45	9	36	45
	Office	36	6	42	5	4	9	8	33	42
2B	Leisure - Health and Fitness	37	37	75	54	54	108	85	57	142
	Leisure - Community Centre	15	9	24	9	10	19	7	17	25
	Restaurant	3	1	4	29	20	49	24	35	59
	Medical (Private Hospital)	15	10	25	11	13	24	9	13	22
3A	Single Residential	29	87	115	29	29	58	81	35	115
	Townhouses	47	140	187	50	50	99	131	56	187
	Apartments	56	169	226	61	61	122	158	68	226
3B	Single Residential	77	231	308	77	77	154	216	92	308
	Townhouses	41	124	165	44	44	87	115	49	165
Total Driveway Trips		765	1307	2072	652	654	1306	1219	787	2006
Internal										
1A	Single Residential	11	32	43	11	11	21	30	13	43
	Townhouses	4	12	16	4	4	9	11	5	16
1B	Retirement Village	6	8	14	8	8	16	7	7	14
1C	Single Residential	3	9	12	3	3	6	8	3	12
	Townhouses	1	3	4	1	1	2	3	1	4
2A	Educational (Primary School)	107	107	214	40	49	88	38	38	76
	Educational (High School)	68	68	135	28	35	63	23	23	45
2B	Hotel	2	1	3	0	0	1	1	1	3
	Conference	7	1	7	2	2	5	0	4	5
	Leisure - Health and Fitness	10	10	20	10	10	20	19	13	32
	Leisure - Community Centre	1	1	2	0	0	1	0	1	2
	Restaurant	1	1	2	14	9	23	13	19	32
	Commercial (Business Park)	19	3	22	9	9	18	4	18	22
	Office	21	4	25	2	2	4	4	17	21
2B	Leisure - Health and Fitness	19	19	37	22	22	43	43	28	71
	Leisure - Community Centre	12	8	19	7	7	13	6	14	20
	Restaurant	2	1	3	21	14	34	19	28	47
	Medical (Private Hospital)	7	5	12	4	5	10	4	7	11
3A	Single Residential	7	22	29	7	7	14	20	9	29
	Townhouses	12	35	47	12	12	25	33	14	47
	Apartments	14	42	56	15	15	30	40	17	56
3B	Single Residential	19	58	77	19	19	39	54	23	77
	Townhouses	10	31	41	11	11	22	29	12	41
Total Internal Trips		364	480	843	251	256	506	409	316	725

Net New Trips										
1A	Single Residential	32	96	129	32	32	64	90	39	129
	Townhouses	12	36	48	13	13	26	34	14	48
1B	Retirement Village	17	25	42	24	24	48	21	21	42
1C	Single Residential	9	26	35	9	9	17	24	10	35
	Townhouses	3	10	13	3	3	7	9	4	13
2A	Educational (Primary School)	12	12	24	4	5	10	4	4	8
	Educational (High School)	8	8	15	3	4	7	3	3	5
2B	Hotel	8	5	14	4	4	8	8	6	14
	Conference	38	4	42	22	22	45	4	40	45
	Leisure - Health and Fitness	7	7	14	15	15	29	19	13	32
	Leisure - Community Centre	5	3	9	4	4	8	3	7	9
	Restaurant	0	0	1	6	4	10	3	5	8
	Commercial (Business Park)	19	3	22	13	13	27	4	18	22
	Office	14	3	17	3	2	5	4	17	21
2B	Leisure - Health and Fitness	19	19	37	33	33	65	43	28	71
	Leisure - Community Centre	3	2	5	3	3	6	1	3	5
	Restaurant	1	0	1	9	6	15	5	7	12
	Medical (Private Hospital)	7	5	12	6	8	14	4	7	11
3A	Single Residential	22	65	87	22	22	43	61	26	87
	Townhouses	35	105	140	37	37	74	98	42	140
	Apartments	42	127	169	46	46	91	119	51	169
3B	Single Residential	58	173	231	58	58	116	162	69	231
	Townhouses	31	93	124	33	33	65	86	37	124
Total Driveway Trips		402	827	1229	401	399	800	810	472	1281

Table 3: Expected Development Trips – Scenario 3

Scenario 3 Trips									
Land Use	Weekday AM Peak Hour			Weekday Midday Peak Hour			Weekday PM Peak Hour		
	In	Out	Total	In	Out	Total	In	Out	Total
Single Residential	32	96	129	32	32	64	90	39	129
Townhouses	12	36	48	13	13	26	34	14	48
Retirement Village	17	25	42	24	24	48	21	21	42
Single Residential	9	26	35	9	9	17	24	10	35
Townhouses	3	10	13	3	3	7	9	4	13
Educational (Primary School)	12	12	24	4	5	10	4	4	8
Educational (High School)	8	8	15	3	4	7	3	3	5
Commercial (Business Park)	3	1	3	2	2	4	1	3	3
Scenario 3 Nett New Trips	95	213	308	90	92	182	185	97	282

Table 4: Expected Development Trips – Scenario 4

Scenario 4 Trips									
Land Use	Weekday AM Peak Hour			Weekday Midday Peak Hour			Weekday PM Peak Hour		
	In	Out	Total	In	Out	Total	In	Out	Total
Single Residential	32	96	129	32	32	64	90	39	129
Townhouses	12	36	48	13	13	26	34	14	48
Retirement Village	17	25	42	24	24	48	21	21	42
Single Residential	9	26	35	9	9	17	24	10	35
Townhouses	3	10	13	3	3	7	9	4	13
Educational (Primary School)	12	12	24	4	5	10	4	4	8
Educational (High School)	8	8	15	3	4	7	3	3	5
Hotel	8	5	14	4	4	8	8	6	14
Conference	38	4	42	22	22	45	4	40	45
Leisure - Health and Fitness	7	7	14	15	15	29	19	13	32
Leisure - Community Centre	5	3	9	4	4	8	3	7	9
Restaurant	0	0	1	6	4	10	3	5	8
Commercial (Business Park)	19	3	22	13	13	27	4	18	22
Office	14	3	17	3	2	5	4	17	21
Leisure - Health and Fitness	19	19	37	33	33	65	43	28	71
Leisure - Community Centre	3	2	5	3	3	6	1	3	5
Restaurant	1	0	1	9	6	15	5	7	12
Medical (Private Hospital)	7	5	12	6	8	14	4	7	11
Single Residential	6	19	26	6	6	13	18	8	26
Scenario 4 Nett New Trips	220	284	504	213	210	423	302	254	556

Table 5: D1527 Link Volumes and Operations

Traffic Scenario	Direction	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
		Volume (veh/h)	LOS	Volume (veh/h)	LOS	Volume (veh/h)	LOS
2025 Existing	Northbound	19	A	22	A	25	A
	Southbound	19	A	16	A	21	A
2030 Total Traffic Scenario 3	Northbound	113	B	105	B	115	B
	Southbound	246	B	100	B	228	B
2030 Total Traffic Scenario 4	Northbound	242	C	237	C	330	C
	Southbound	305	C	229	C	278	C
2030 Total Traffic Scenario 5	Northbound	423	D	426	C	838	D
	Southbound	848	D	418	C	495	D

Reference HCM, 6th Edition, Chapter 15, Two Lane Highways, Page 15-13 to Page 15-27

Annexure C

Traffic Signal vs Roundabout

1 TRAFFIC SIGNAL VS ROUNDABOUT

To accommodate the Full Gondwana Lifestyle and Country Estate development, additional upgrades will be required at the B6 / D1527 intersection, over and above the (SMEC) upgrades that are currently being implemented by the Roads Authority. These upgrades will be required to accommodate the expected Full Gondwana Lifestyle and Country Estate development trips. The following two intersection control alternatives were evaluated:

- A traffic signal and a
- Single circulation lane roundabout

1.1 Roundabout

A (single circulation lane) roundabout would provide the following advantages/disadvantages, compared to a signalised intersection.

Advantages:

- Better overall operations,
- Lower maintenance costs,
- Improved safety, and
- Longer acceptable lifespan.

Disadvantages:

- Higher initial construction costs
- Potentially additional land requirements Refer to Figure17B, in Annexure A.

1.2 Traffic Signal

A signalised intersection would provide the following advantages/disadvantages, compared to a (single circulation lane) roundabout.

Advantages:

- Lower initial construction costs,
- No additional land required, and
- Provides controlled traffic regulation.

Disadvantages:

- Increased overall delays, as vehicles would be required to stop along the B6.
- Higher maintenance costs for software and traffic signal repairs due to collisions.
- Shorter operational lifespan

Refer to Table D1 and Table D2 for a comparative analysis of the expected life cycles of each intersection treatment.

Table D1: 2030 Total Traffic – Design Life – Roundabout

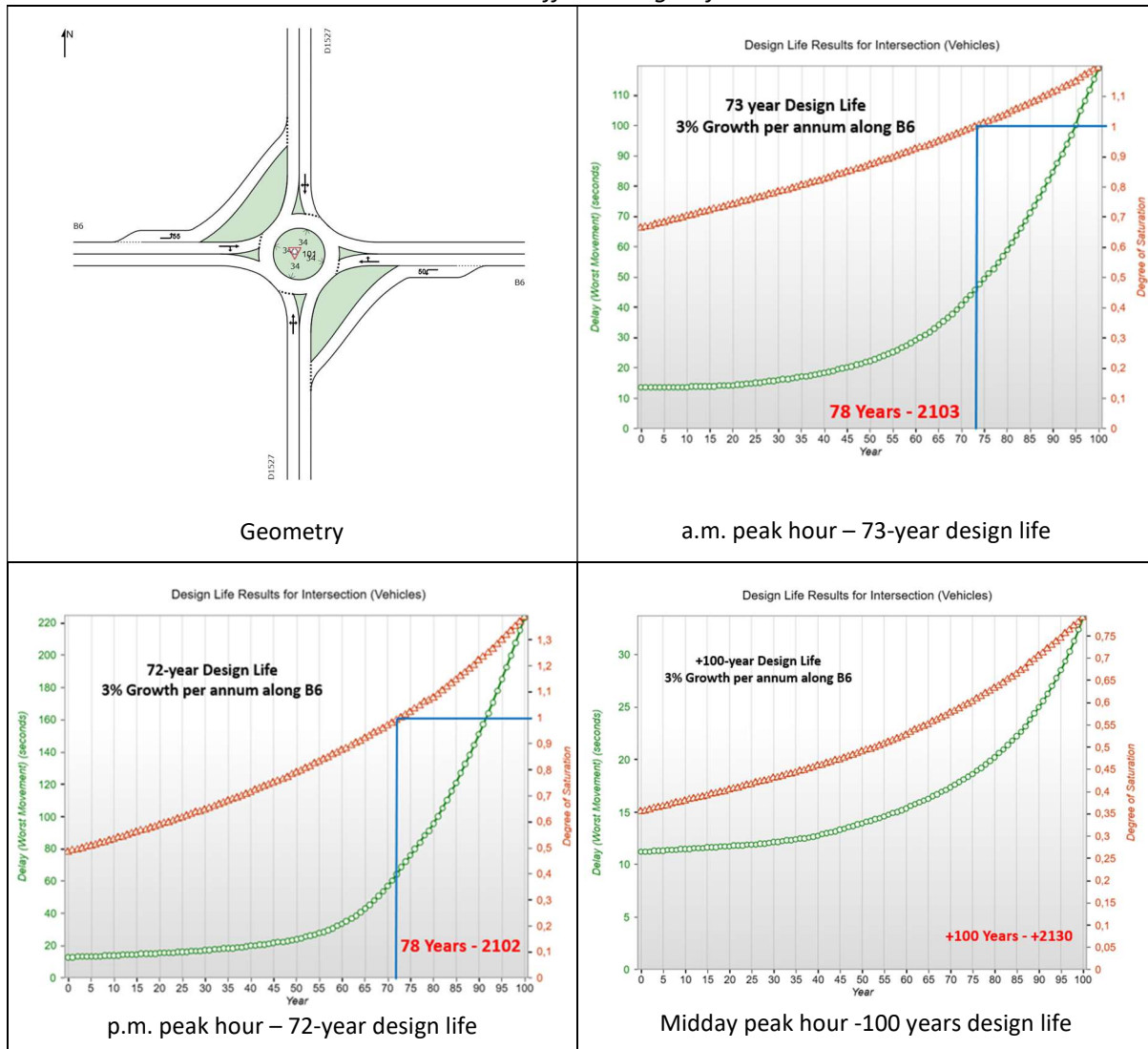
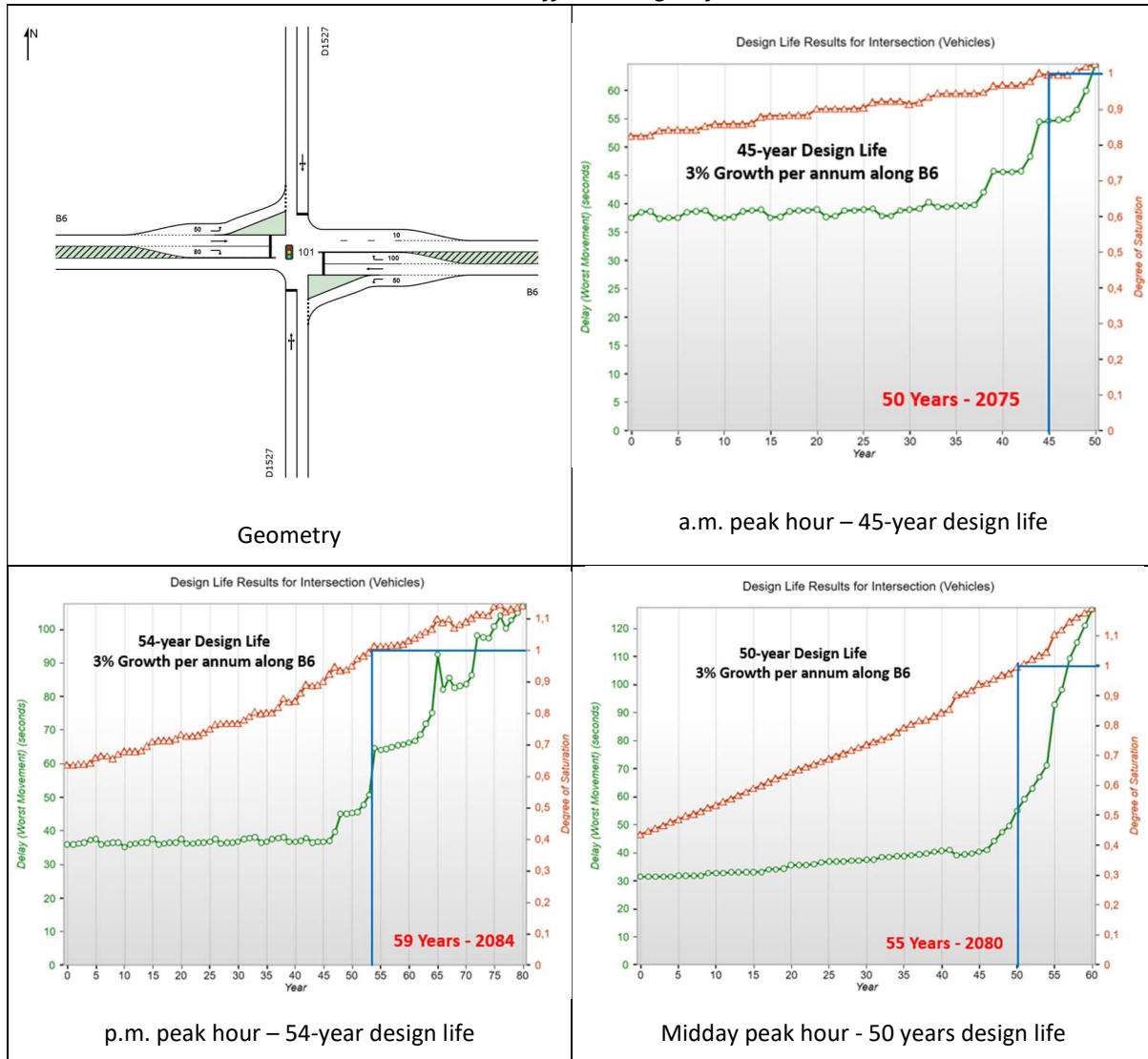


Table D2: 2030 Total Traffic – Design Life – Roundabout



1.3 Recommended Alternative

Due to the above factors, it is recommended that the Gondwana developer construct a (single circulation lane) roundabout at the B6 / D1527 intersection, once the development exceeds 45 percent (or 550 total peak hour trips) of the full development trips.

Annexure D

SANS 3000 – Level Crossing Risk Assessment

1 General Info on Level Crossing Risk Assessments

Introduction

The following section highlights important aspects related to level-crossing assessments that are relevant to this study.

1.1 Relevant Documents

The following documents were consulted as part of the level-crossing risk assessments:

- SANS 3000-1:2009, Edition 2, South African National Standards, Railway safety management. Part 1: General.
- SANS 3000-2-2-1:2012, Edition 1, South African National Standards, Railway safety management, Part 2-2-1: Technical requirements for engineering and operational standards.
- SANS 3000-4:2011, Edition 1, South African National Standards, Railway safety management, Part 4: Human factors management
- The South African Road Traffic Signs Manual (SARTSM) Vol.2 Chapter 7.

1.2 Exclusion Criteria

The following exclusion criteria (i.e. when level crossings should NOT be considered) are relevant for new level crossings or when existing level crossings are (reviewed) modified. It is included here to outline the overall criteria, and in Section 2, the specific exclusions are discussed in more detail:

- a) Where train speeds exceed 100 km/h.
- b) Where the road is classified as a freeway or where the crossing is within 1 km of another level crossing.
- c) Where there is an existing accessible grade-separated crossing within 10 km or another agreed distance from the proposed level crossing.
- d) Where the level crossing is within 500m from the end of a station platform.
- e) Where the road approach gradients are steeper than 1:50 within 8m of the nearest rail and 1:20 for 10m and beyond.
- f) Where the line of sight along the railway line is less than 230m for a running line or 50 m for a yard line, and
- g) Where a level crossing, road intersection or property access on the road approach to a level crossing is to be constructed, the location shall be such that no part of the travelled way of the intersecting road or entranceway, or the Stop line or the position for a traffic control device, is closer than 50m to the nearest rail of the level crossing.

1.3 When is an assessment required?

Risk- and physical assessments are required when:

- a) After two or more collisions at the level crossing in one calendar year;
- b) After a collision resulting in a fatality at the level crossing;
- c) When there are significant changes in the road traffic patterns, including a change in the road design vehicles passing over the level crossing;
- d) When there is a significant change in the railway traffic patterns, including the introduction of a new service;
- e) When there are proposed changes in the land use, including residential, recreational, commercial and industrial developments;
- f) When there is an increase in the maximum operating speed of road traffic or line speed of the railway at the level crossing;
- g) When the road is reclassified;
- h) When there is a proposed development that might impact the line of sight for both the train drivers and the road users;
- i) When the level crossing is intended to be relocated;
- j) If instructed by the relevant authorities; and
- k) If a dormant level crossing is re-introduced.

1.4 The Assessment Team

1. Physical assessments of level crossings shall be performed by a team of people who have sufficient experience and expertise in the life-cycle process of level crossings, risk management and occurrence investigations.
2. Network operators and road authorities are required to take joint responsibility for level-crossing assessments.
3. The team shall consist of at least two people with each one representing an organisation to conduct assessments. The relevant road authority (i.e. the City of Windhoek CoW and/or the Namibian Roads Authority RA) and the network operator (i.e. TransNamib) shall jointly plan and execute the physical assessment.
4. The assessment team shall be independent of the design team, the design process as well as the work being assessed.

1.5 Risk Assessment

Network operators and road authorities shall establish, develop, or adopt, implement, and maintain policies and procedures to conduct level crossing risk assessments on existing public level crossings, which include:

- a) Identification of hazards associated with the level crossing, including those arising from:
 - 1. Railway traffic
 - 2. Road traffic
 - 3. The railway networks
 - 4. The road layout and condition
 - 5. Adjoining property, and
 - 6. Geographical considerations,
- b) Evaluation of hazards identified in (a) (i.e. quantification in terms of frequency, probability, and severity, resulting in risks ranking),
- c) Determination of the level of control required to mitigate the risks to acceptable levels, and
- d) Implementation of the controls and monitoring of the effectiveness thereof, in accordance with the information obtained from the level of crossing physical assessment with full appreciation of the need to balance costs, benefits and opportunities.

1.6 Physical Assessments

This is a comprehensive set of field sheets that shall be used for physical assessments of level crossings. Refer to Table A.1 in SANS 3000 for step-by-step guidelines to complete these physical assessments. Also refer to the completed field assessment sheets of the level crossing, at the back of Annexure E.

1.7 Purpose of Evaluation

According to SANS 3000, risk assessments should be done by the relevant road authority/rail network operator. Hence, it is suggested that this evaluation be used as a guide to assist the authorities with their evaluation and decision-making process. The purpose of this evaluation is therefore to highlight potential risks and to suggest relevant mitigation measures. However, the final evaluation and decision on the level of control and additional safety measures at these level crossings remains with the road authority and rail network operator.

2 Hoffnung Rail Level Crossing Evaluation

2.1 Introduction

The assessment of this existing level crossing forms part of the further expansion planned at the Gondwana Lifestyle and Country Estate development. This risk- and physical assessments are required, due to the expected increase in the traffic volumes at this crossing.

2.2 Locality

This Hoffnung level crossing is located along the D1527, approx. 200 meters north of the intersection with the B6.

2.3 Exclusion Criteria

Based on a review of the exclusion criteria, it is evident that this level crossing complies with most exclusion criteria to ensure the continued use of this level crossing. However, this existing level crossing is located within 500 m from a station platform (i.e. Hoffnung). Hence, further discussions are proposed with the road authority / rail operator.

2.4 Traffic- and Train Volumes

The traffic volumes at the Hoffnung level crossing are expected to increase, as part of the proposed Gondwana Lifestyle and Country Estate development. Several future traffic scenarios were evaluated, as part of the Transport Impact Assessment (TIA), as discussed in Sections 8 of the report. The expected traffic volumes frequency at this level crossing, are summarised in the table below:

Table E 1: Traffic Volumes at Hofnung Level Crossing per Scenario

No.	Year	Traffic Scenario	Dir1	Dir2	Total
1	2025	Counted AM Peak Hour	19	19	38
2	2025	Counted PM Peak Hour	25	21	46
3	2030	Total Traffic (Scenario 3) - AM Peak	113	246	359
4	2030	Total Traffic (Scenario 3) - PM Peak	228	115	343
5	2030	Total Traffic (Scenario 4) - AM Peak	242	305	547
6	2030	Total Traffic (Scenario 4) - PM Peak	330	278	608
5	2030	Total Traffic (Scenario 5) - AM Peak	848	423	1271
6	2030	Total Traffic (Scenario 5) - PM Peak	495	838	1333

There are typically two freight trains during the day and another one at night. With these low train volumes, it is highly unlikely for a train to cross during peak traffic periods.

3 Physical Assessment

SANS 3000 requires that the physical assessments of level crossings be performed by the road authority/rail network operator. A physical assessment was conducted by Mercury Traffic Surveyors only, for the following reasons:

- To assist the road authority and rail operator, with their evaluation process.
- To highlight potential risks and to suggest appropriate mitigation measures.

The mitigation measures suggested as part of this evaluation should be discussed, negotiated, and agreed upon with the road authority/rail network operator before implementation.

The completed field sheet can be found at the back of this Annexure. Details from the field sheet were used as part of this evaluation. The following can be concluded from this evaluation:

Sheet 7 – Road Geometry:

- The travel lanes on both approaches are relatively wide (i.e. approx. 5-meter per direction).
- The required Stopping Sight Distance (SSD) per approaches is 85 meters. The available stopping site distance exceeds 200 meters. Hence, sufficient SSD is available.
- The road surfaces on the approaches are relatively flat with no vertical / horizontal curves near the level crossing.
- Although the road surface on the approaches is in a relatively poor condition, vehicles have no difficulty to cross the railway track.
- The only signs currently are R1 (Stop Sign), W318 Rail Crossing Ahead and W403 (Railway Crossing Hazard Marker)

Sheet 8 – Line of Sight:

- There is currently some vegetation located within 15m on both sides of the railway line, which limits the line of sight. Clearing this vegetation could establish an acceptable line of sight, meeting the minimum requirements of 50m along the railway line and 30m along the road.
- There are no other signs or structures that could restrict the line of sight.

Sheet 9 – Level of Protection:

- The existing controls on the approaches are stop controls.
- There are no flagmen currently operational at this level crossing.
- There are no gates/booms at this level crossing.
- The existing size of the R1 (Stop) signs is 900mm, which is appropriate for a 60km/h design speed. The Stop signs are supported by railway crossing warning signs (W403).

- There is a 2800mm (Sign and Pole Height) by 900mm (Sign size) advanced railway crossing sign (W318) along approach 2.
- The overall condition of the road signs ranges from average to poor.

Sheet 10 – Road Surface Markings:

- The current road markings at this level crossing are faded.

Sheet 11 – Flashing Red Disk Signals:

- There are no flashing red/yellow warning lights, traffic signals, or booms, or bells at this level crossing.

Sheet 12 – Whistle Board:

- There is whistle board displayed along the eastern approach of the railway line. The condition of these whistle boards is poor.

Sheet 13 – Overhead Lines and Protection:

- There are no overhead lines located at this level crossing and therefore no electrical hazard signage is required.

Sheet 14 – Illumination:

- There is currently no illumination provided at the crossing.
- It is uncertain if the trains that operate along this route are equipped with headlights.

4 Risk Assessment

Risk can be defined as the probability of having a crash/incident at the rail level crossing given the probabilities of having a train and a vehicle at the crossing at the same time.

Based on the daily train volumes, it is evident that the rail volumes are low. The time it takes for a train to cross a level crossing can vary depending on several factors such as the length of the train, its speed, and any additional factors like the condition of the tracks or the presence of other trains. On average, a typical train might take anywhere from 30 seconds to a few minutes to cross a level crossing. If it is assumed that 1 train passes the level crossing during the peak hours and it takes 2 minutes for a train to cross, the approximate queues at the approaches would be as follows:

Table E 2: Expected Queue's at Hofnung Railway Level Crossing

No.	Year	Traffic Scenario	Dir 1 - SB	Dir2 - NB	Total	Approx Q (Veh)		Approx Q (m)	
						Dir 1 - SB	Dir2 - NB	Dir 1 - SB	Dir2 - NB
1	2025	Counted AM Peak	19	19	38	1	1	4	4
2	2025	Counted PM Peak	25	21	46	1	1	5	4
3	2030	TT (Sce. 3) - AM Peak	113	246	359	4	8	23	49
4	2030	TT (Sce. 3) - PM Peak	228	115	343	8	4	46	23
5	2030	TT (Sce. 4) - AM Peak	242	305	547	8	10	48	61
6	2030	TT (Sce. 4) - PM Peak	330	278	608	11	9	66	56
5	2030	TT (Sce. 5) - AM Peak	848	423	1271	28	14	170	85
6	2030	TT (Sce. 5) - PM Peak	495	838	1333	17	28	99	168

Currently, there is sufficient space to accommodate these vehicular queues on both approaches.

There are currently no crash data available for this level crossing. However, should motorist stop and adhere to the rules of the road at the approach of this level crossing, then the potential for a vehicle/train conflict would be minimal. However, since this level crossing is currently set up to the minimum level of protection standards, the risk of a vehicle/train conflict can be lowered if a higher level of protection standard is implemented. Given that the existing train volumes are low, it is highly unlikely that a train will cross during peak hours. Hence, the expected risk of a vehicle / train conflict is relatively low.

5 Conclusions and Recommendations

The following can be concluded, based on this investigation:

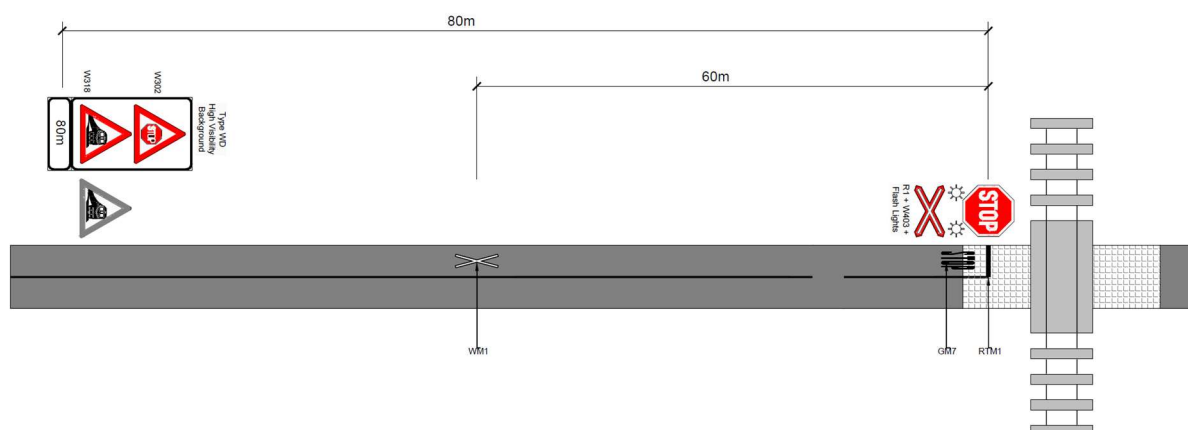
- This is a Single Low Speed (SLS) line with an operating speed of approx. 40km/h.
- The expected risk of a vehicle / train conflict is **low-to-medium**.
- The line of sight at this level crossing is currently limited due to vegetation next to the road and rail line. However, adequate line of sights can be achieved, if the vegetation is cleared and maintained in that cleared state.
- This level crossing is currently setup to minimum level of protection standards.
- There are currently no flashing lights, or illumination at this level crossing.
- Whistle boards are only present on the eastern approach to the level crossing.

The following upgrades are recommended **at the Hoffnung level crossing**:

- The min. level of protection should be Level 4A (restricted line of sight) and the following signs / road markings should be provided:
 - W302 – Stop Control Ahead Advance Warning Sign; This should be provided on a Type WD high visibility background in combination with new W318 Railway Crossing ahead signs to replace the existing W318 signs. A supplementary plate, IN11.3 distance sign, should be provided underneath.
 - WM1 – Railway Crossing Ahead Symbol.

- R1 - Stop Sign / RTM1 – Stop Line Road Markings / GM7- Stop Markings Text
- All signs to conform to SANS 3000 and SARTSM Volume 2 Chapter 7 standards.
- The rail and concrete slab section at this crossing must be re-constructed to acceptable SANS 3000 standards.
- Upgrade the D1527 road approaches to the level crossing to acceptable standards
- The vegetation must be cleared to ensure acceptable lines of sight, for both the train- as well as vehicle/truck drivers are maintained.
- The following **additional** advance warning measures should be considered, as part of further consultation with the road authority and rail network operator:
 - Flashing Red Disk Signals - Only activated, when a train approach the level crossing. These flashing red lights should be installed below the R1 (Stop) sign.
 - Whistle boards - Alongside the railway line to inform train drivers to sound the locomotive whistle on approach to the level crossing. The whistle boards on the eastern approach should be replaced with new boards and new boards should be provided on the western approach.
 - Bells – On the track, at the level crossing approaches.
 - Illumination – The area at the level crossing should be sufficiently illuminated and the trains operating along this route should be equipped with headlights to warn road users of oncoming trains.
- The *implementation and maintenance* of these safety measures must be discussed and agreed between the road authority / rail network operator, to ensure the continued and safe use of the Hoffnung level crossing.

Below is a conceptual layout for the proposed signage and road markings at the Hofnung level crossing:



Sheet 1 — Level crossing: Description

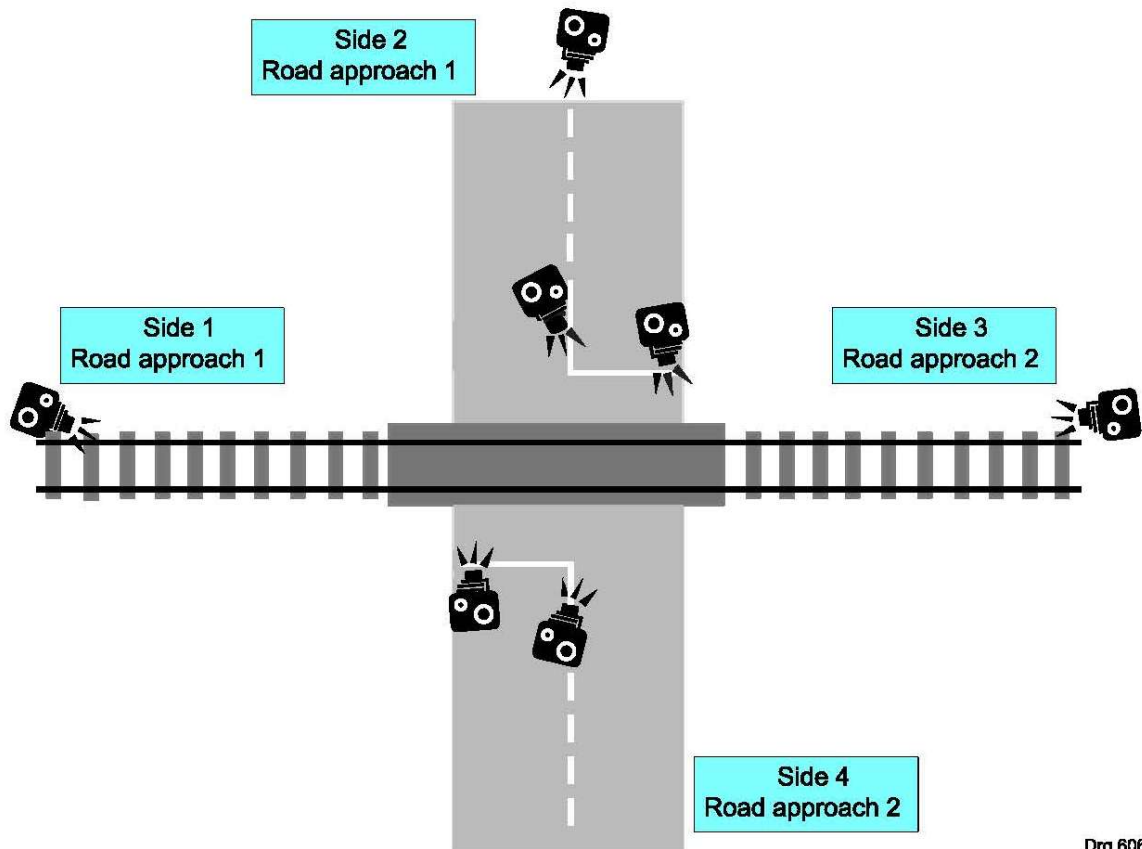
Date of assessment: <i>yyyy/mm/dd</i>	2024/11/19	Time [24:00]	07:00	Time of day	
Level crossing protection level : select from table A.2: Class					
Assessment team members and affiliations:	TITUS KAAPANGELWA				
	JASON ELAGO				
Reason for assessment of a level (grade) crossing : <i>Mark applicable box (LHS) with an X</i>					
After two or more collisions per year		An increase in road or rail operating speed		Significant change in design vehicle type	
After a collision resulting in a fatality		Proposed changes to land use including developments of any nature	✓	Significant change in rail traffic patterns including new services	
Reclassification of the road		A development impacting on the line of sight by road or rail		Significant change in road traffic patterns including new services	
Instructed by local authority		Scheduled assessment		Intention to relocate the crossing	
Proposed new level X		Other			
Network operator	TRANSNAMIB LTD		Municipality:	WINDHOK	
Crossing place/name	HOFFNUNG		Road name/number:	DIS27	
Coordinates GPS X	12,5536	GPS Y	17,2093	Province:	KHOMAS
Railway: km point	21,608		Location reference (control section etc.):	UNKNOWN	
Nearest town if not in a municipality	N/A		Road classification	DISTRICT	
Siding number	UNKNOWN		Type of level crossing:	AT GRADE	
Track type:	CAPE GAUGE				
Occurrence history (five-year period):					
Occurrences resulting in property damage:					
Occurrences resulting in personal injuries:			Number of persons injured:		
Occurrences resulting in fatal injury :			Number of persons killed:		
= Total collisions in last five-year period:			Total persons involved:		
Provide details of the collisions and any remedial measures taken if available:					
NO CRASH HISTORY					

Sheet 2 — Level crossing: Scene photographs

Note as a minimum, take pictures of all road/rail approaches and each quadrant – key the orientation of pictures to the scene sketch (below)

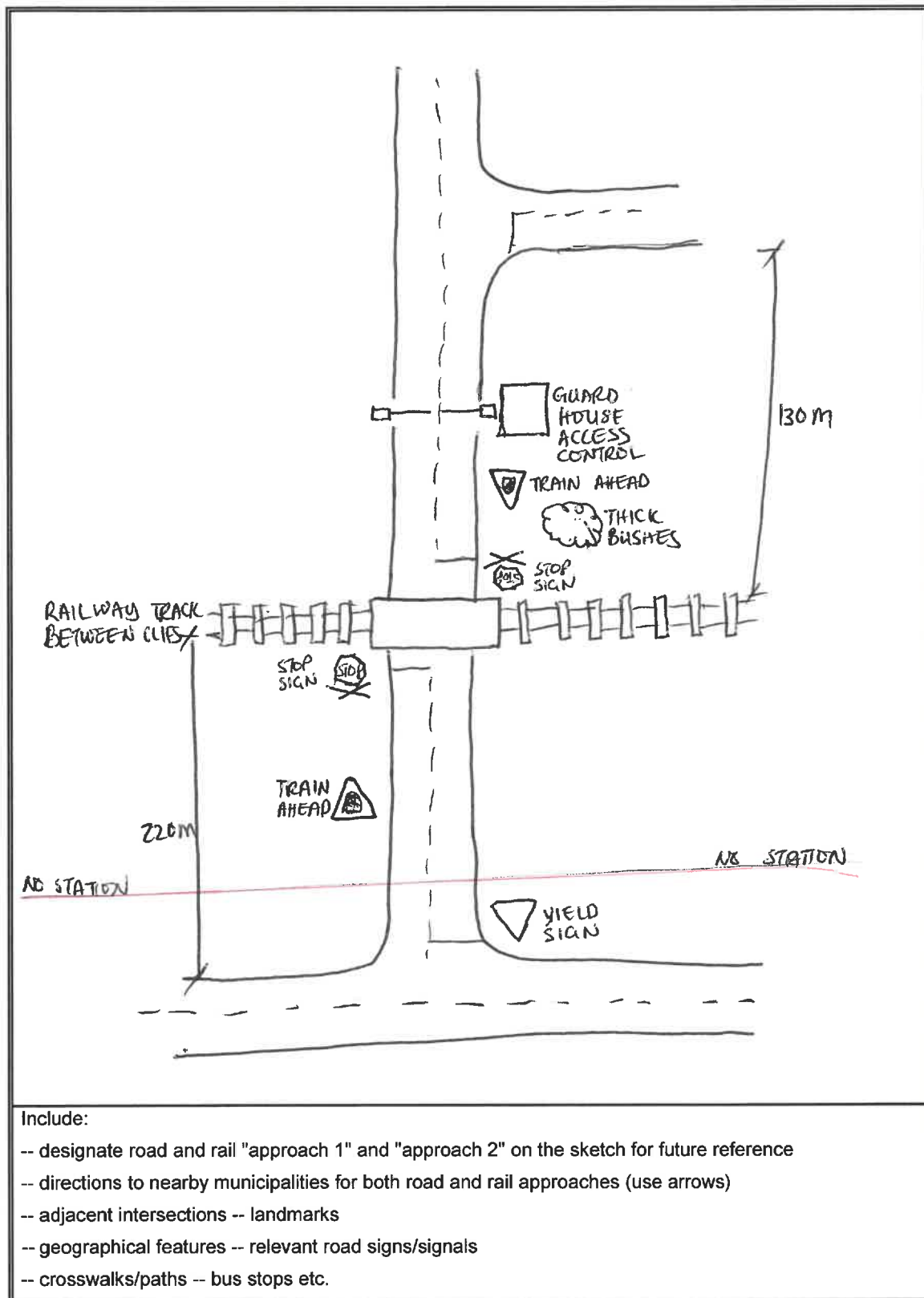


NOTE Photographs are in a clockwise sequence starting with the rail at 1

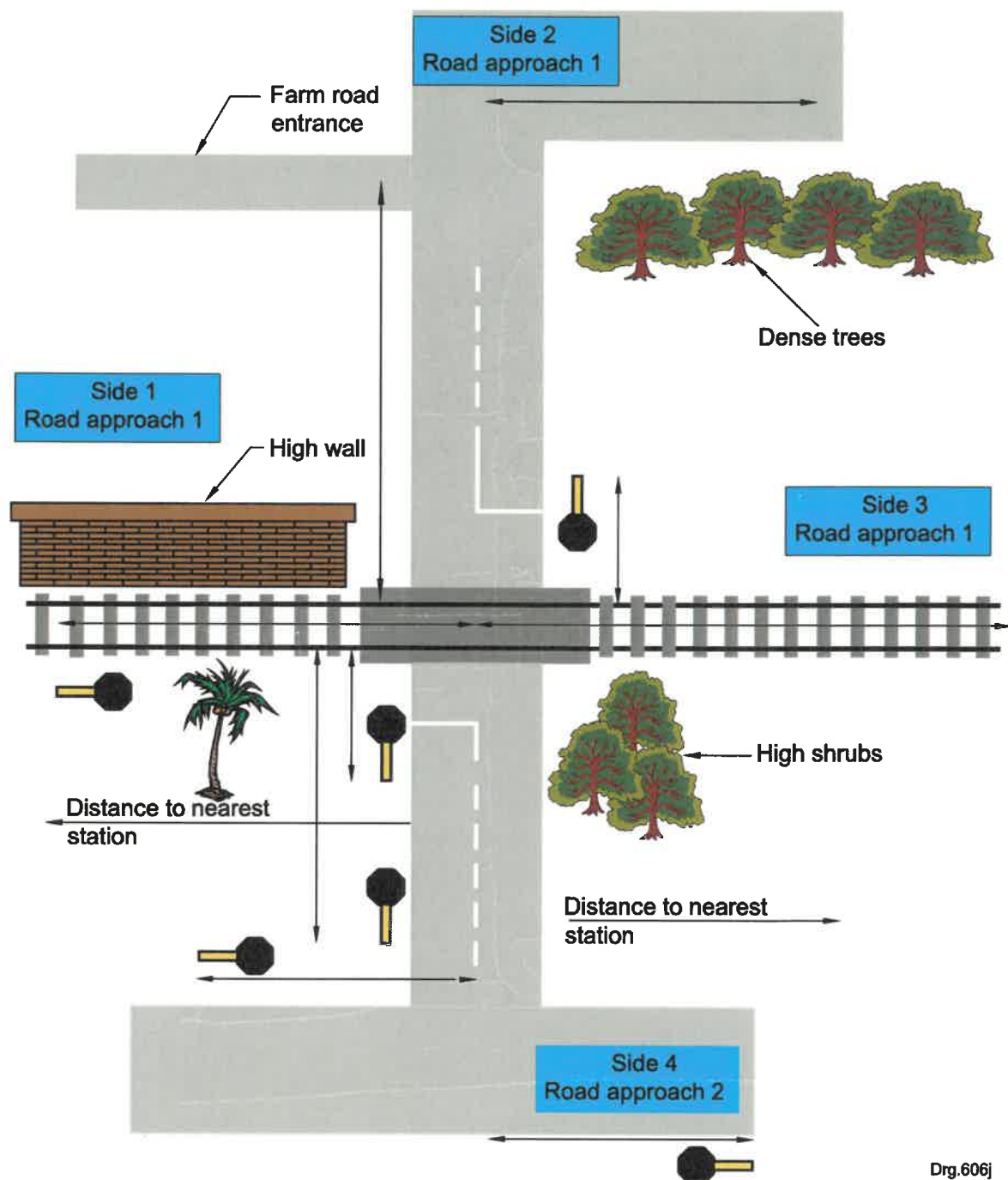


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Sheet 3 — Level crossing: Scene sketch



Example of level crossing: Scene sketch



Drg.606j

Sheet 4.1 — General information

Item		
Source	Information required	Response
Surrounding area	What is the predominant surrounding land use: Select?	RURAL/FARM
	Are any schools, retirement homes, etc. nearby? Y/N	N
Rail operator	Daily train volume	
	Number of freight trains during daytime	1
	Number of freight trains during night-time	1
	Number of passenger trains during daytime	0
	Number of passenger trains during night-time	0
	High seasonal fluctuation in volumes Y/N	N
	Train operations	
	V _t : Maximum railway operating speed in kilometres per hour (km/h)	40
Site observation rail	Number of railway lines at level crossing?	1
	Bi-direction lines during daytime? Y/N	Y
	Bi-direction lines during night-time? Y/N	Y
Road authority	Road traffic	
	Average annual daily traffic (AADT) in vehicles per day	SEE ATTACHED LATEST TRAFFIC SURVEY DATA
	Year of AADT count [yyyy]	
	High seasonal fluctuation in volumes? Y/N	
	Pedestrian volumes in pedestrians per day	
	Cyclist volumes in cyclists per day	
	Forecasted AADT in vehicles per day	
Year of AADT forecast [yyyy]		
Site observation road	Is the level crossing on a school bus route? Y/N	N
	Do dangerous goods trucks use this roadway? Y/N	UNKNOWN
	Regular use of crossing by persons with assistive devices? Y/N	N
	Other special road users? Y/N	N
	Type	N/A
	Number per day	N/A
	Approach 1	
	Design speed: km/h	60
	Posted speed: km/h	60
	Maximum operating speed: km/h	60
	Road surface type (asphalt, concrete, gravel, etc.):	ASPHALT
	Approach 2	
	Design speed: km/h	60
Posted speed: km/h	60	
Maximum operating speed: km/h	60	
Road surface type (asphalt, concrete, gravel, etc.):	ASPHALT	
Comments		

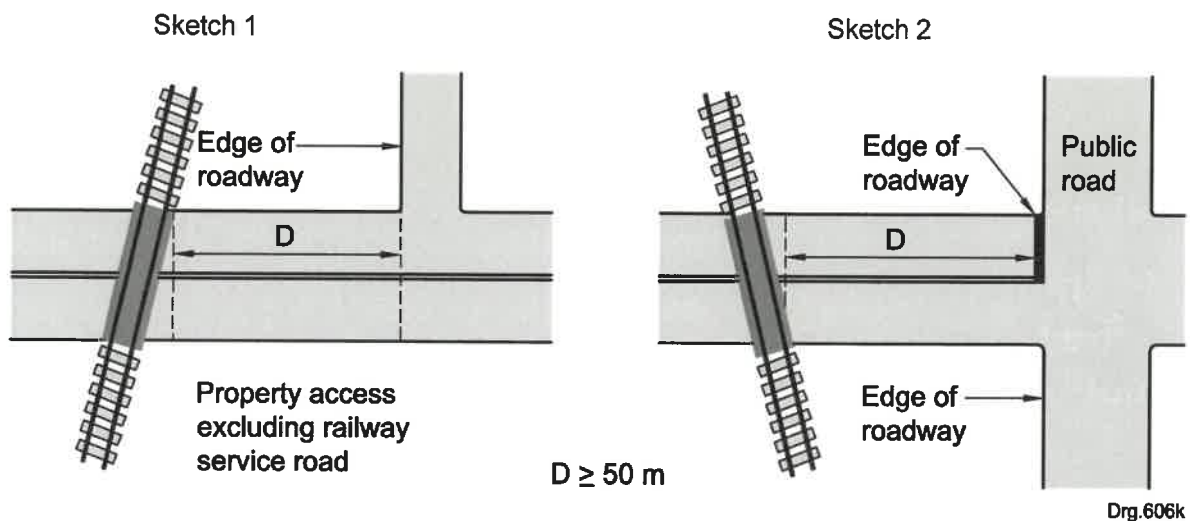
Sheet 4.2 — Design vehicle (B)

Item		
Source	Information required	Response
Design vehicle (longest vehicle known to use the crossing)		
Referred	Predominant surrounding land use	RURAL / FARM
Table 2	Predominant general type:	TRUCKS
Table 3	Length, $L = m$	22,0
Calculated	Road speed in kilometres per hour (km/h)	60
Calculated	Stopping sight distance (SSD) in metres (m)	130
Measure in accordance with figure 1	Clearance distance, cd , in metres (m)	8
Calculated	Vehicle travel distance: $S = L + cd$ in metres (m)	30,0
Site observation	Deviation from level continuous smooth surface	N/A
Site observation	How long do vehicles take to traverse crossing intact in seconds (s)	12
Figure 2	Vehicle departure time, t , in seconds (s)	11
	Road grade effect:	—
	maximum approach grade within 'S': $= \pm \% (- \text{downhill})$	0.5
	grade adjustment factor =	1
	$T = t \times \text{adjustment factor}$ in seconds	11
	Design vehicle departure time, $T_d = J + T + K$	
	where $J = 2$ s perception and reaction	
	where $K = \text{additional time due to crossing conditions}$	
	T_d , in seconds, $= (11 + 2 + 1)$	14
	Pedestrian, cyclist and assistive devices departure time	
	$T_p = \text{sec}$	
Hazard	$T_{act} > T_d$ indicates a threat	
Comments	NO THREAT	

Sheet 4.2 — Design vehicle (A)

Item		
Source	Information required	Response
Design vehicle (longest vehicle known to use the crossing)		
Referred	Predominant surrounding land use	RURAL / FARM
Table 2	Predominant general type:	PASSENGER
Table 3	Length, $L = m$	5,6
Calculated	Road speed in kilometres per hour (km/h)	6,0
Calculated	Stopping sight distance (SSD) in metres (m)	85
Measure in accordance with figure 1	Clearance distance, cd , in metres (m)	8
Calculated	Vehicle travel distance: $S = L + cd$ in metres (m)	13,6
Site observation	Deviation from level continuous smooth surface	N/A
Site observation	How long do vehicles take to traverse crossing intact in seconds (s)	6
Figure 2	Vehicle departure time, t , in seconds (s)	5
	Road grade effect:	/
	maximum approach grade within 'S': $= \pm \% (- \text{ downhill})$	0.5
	grade adjustment factor =	1
	$T = t \times \text{adjustment factor}$ in seconds	5
	Design vehicle departure time, $T_d = J + T + K$	
	where $J = 2$ s perception and reaction	
	where $K =$ additional time due to crossing conditions	
	T_d , in seconds, $= (5 + 2 + 1)$	8
	Pedestrian, cyclist and assistive devices departure time	
	$T_p = \text{sec}$	
Hazard	$T_{act} > T_d$ indicates a threat	
Comments	NO THREAT	

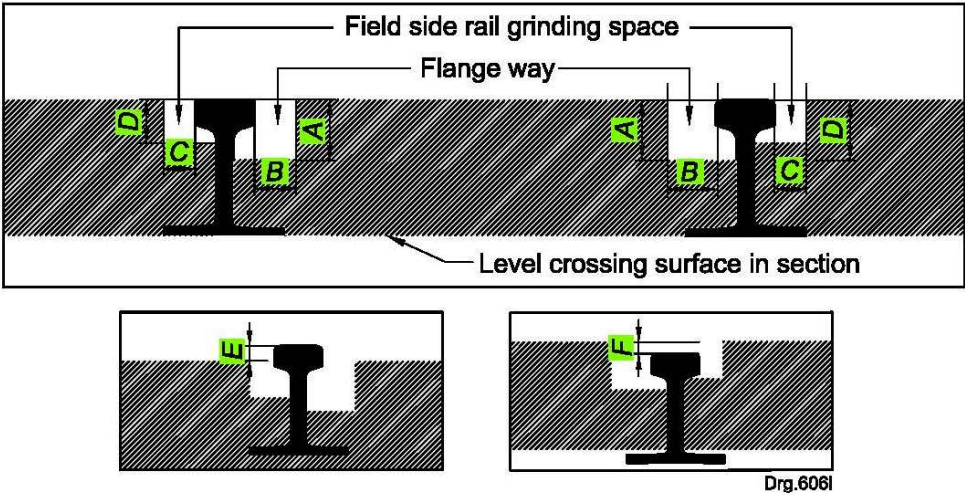
Sheet 5 — Location of grade crossing



Item		
Source	Information required	Response
Observation	Sketch 1: what is D in metres (m) closest to crossing	130
Observation	Sketch 2: what is D in metres (m) closest to crossing	220
Observation	Are there any crossings on either road approach that could cause vehicles to queue back to the tracks? Y/N	N
Observation	Is " D " insufficient such that road vehicles might queue onto the rail tracks? Y/N	N
Hazard	$D < 50 \text{ m}$ or a YES indicates a threat	Threat
Comments	NO THREAT	

Sheet 6 — Level crossing surface

Item		
Source	Information required	Response
Observation	Is the level crossing surface smooth enough to allow road vehicles, pedestrians, cyclists and other road users to cross at their normal speed without consequence? [Y/N]	Y
Observation	Type of grade crossing surface material	CONCRETE
Observation	Approach road surface type	ASPHALT
Observation	Approach road surface condition:	AVERAGE / POOR
Observation	Roadway illumination in place? [Y/N]	N
Observation	Roadway illumination operational? [Y/N]	N
Measure	Road surface crossing width measured at right angle to roadway centre line in metres (m) (note: min. = 8 m) dimension A	9.5
Measure	Level crossing surface extension beyond travel lanes measured in millimetres (mm), dimension B (note: min. = 500 mm)	0
Measure	Level crossing surface extension beyond travel lanes measured in millimetres (mm), dimension C (note: min. = 500 mm)	100
Measure	Level crossing surface width across sidewalk/path/trail measured in millimetres (mm) dimension D (note: min. = 1 500 mm)	N/A
Measure	Level crossing surface extension beyond sidewalk/path/trail measured in millimetres (mm) dimension E (note: min. = 500 mm)	N/A
Measure	Level crossing surface extension beyond sidewalk/path/trail measured in millimetres (mm) dimension F (note: min. = 500 mm)	N/A
Measure	Distance between travel lane and sidewalk, edge to edge, measured in metres (m) dimension G	N/A
Deducted	Distance between the travel way, sidewalk, etc. level crossing surfaces in millimetres (mm) dimension H (note min. = 1 000 mm)	N/A
Measure	Cross-section (see figure A.5)	9.5
Measure	Is the crossing in an urban area [Y/N]	N
Measure	Flangeway width in millimetres (mm) dimension B (max. = 76 mm or 100 mm)	65
Measure	Flangeway depth in millimetres (mm) dimension A (min. = 50 mm max. = 76 mm or none)	40
Measure	Side grinding width in millimetres (mm) dimension C (max. = 50 mm)	50
Measure	Side grinding depth in millimetres (mm) dimension D (min. = 38 mm)	40
Measure	Elevation of top rail above road surface = mm dimension E (max. = 13 mm, 25 mm or 50 mm)	LEVEL
Measure	Elevation of top rail below road surface = mm dimension F (max. = 7 mm, 25 mm or 50 mm)	LEVEL

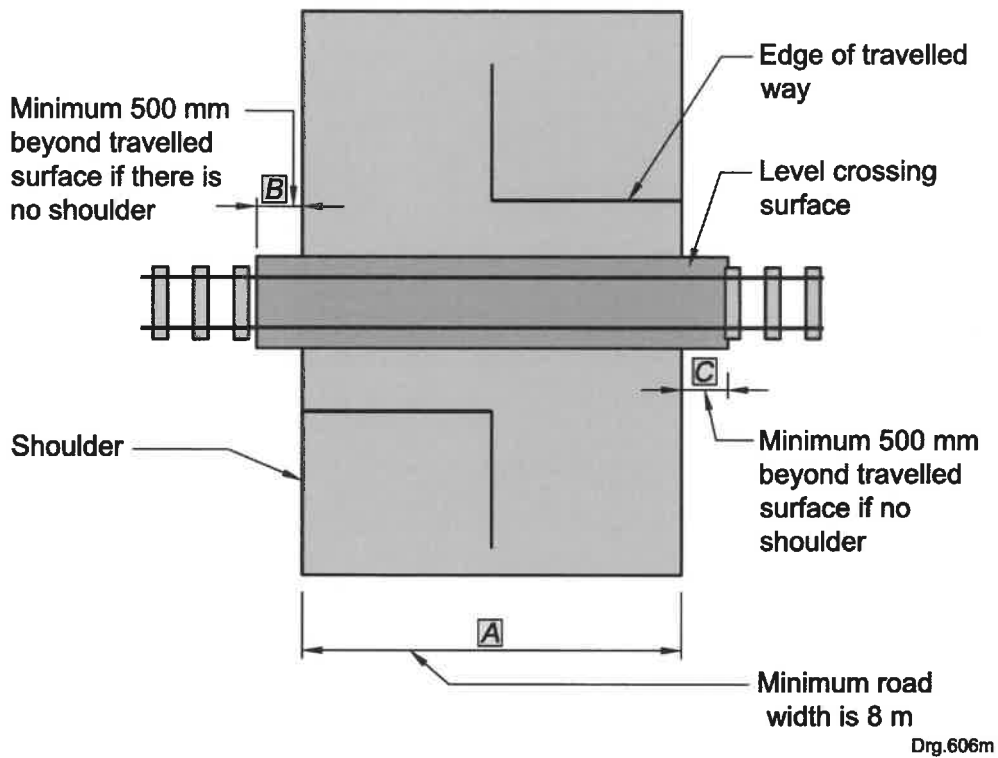


Comments regarding level crossing surface

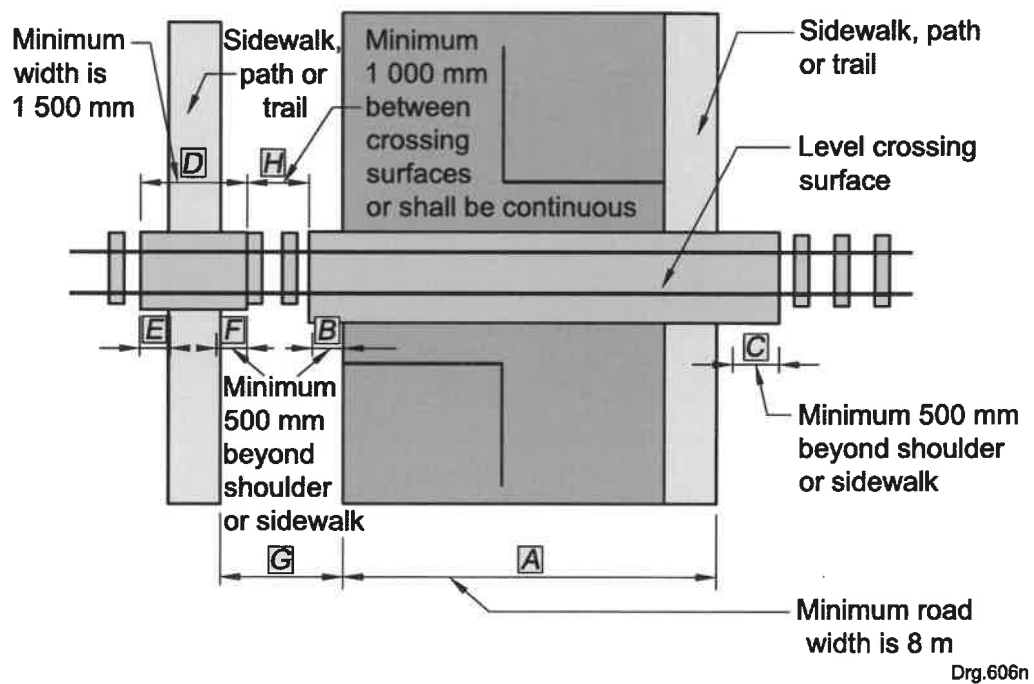
Photo



Road including a path or a shoulder

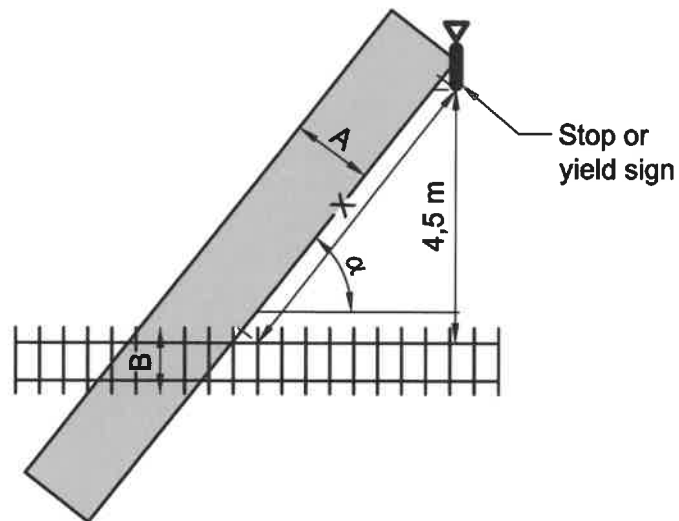


Sidewalk, path or trail alongside a road

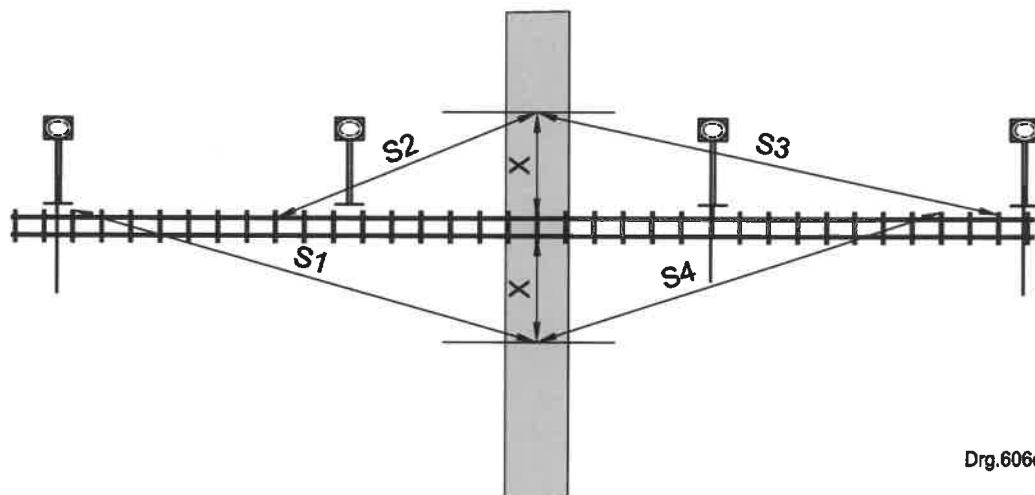


Sheet 7 — Road geometry

Item		Response	
Source	Information required	Road approach 1	Road approach 2
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3		
Sheet 4.2	Safe stopping distance (SSD) in metres (m)	130 / 85	130 / 85
Observation	Are horizontal and vertical alignments smooth and continuous throughout the SSD? [Y/N]	Y	Y
Measure	For what distance, in metres (m), is the horizontal alignment straight beyond the rails?	100	80
Sheet 4.2	Design vehicle length, in metres (m)	22.0 / 5.6	22.0 / 5.6
Measure	What is the width of the road dimension A in metres (m)	9.5	
Measure	What is the width of the rail level crossing itself, dimension B in metres (m)	1.2	1.2
	Grades		
Measure	Slope within 5 m of outer rail, as a percentage (%) (Limits are 1% in urban areas, 2% for cyclists/pedestrians)	LEVEL	LEVEL
Measure	Slope within 8 m of outer rail, as a percentage (%) (max. = 2% = 1 in 160 mm over 8 m)	LEVEL	LEVEL
Measure	Slope between 8 m and 18 m of outer rail, as a percentage (%) (limits are 5% for unrestricted crossing or 10% elsewhere)	LEVEL	LEVEL
Observation	Is the level crossing unprotected (no signage/no flagmen/no gates) [Y/N]	N	
Observation	Is the level crossing used only by cyclists and pedestrians [Y/N]	N	
Deducted	General approach grade, as a percentage (%) (max. = ± 5%)	LEVEL	LEVEL
Observation	Are rail tracks superelevated? [Y/N]	N	N
Measure	Superelevation in millimetres (mm)	N/A	N/A
Select	Track gauge in millimetres (mm)	760	760
Deducted	Superelevation in degrees	N/A	N/A
Observation	Does the level crossing have warning systems? [Y/N]	N	N
Measure	What is the angle between the crossing and the roadway? In degrees (see sketch)	90	90
Measure	What is the distance from the outer rail to the stop/yield sign, in metres (m)?	4	4
	Condition of road approaches		
Observation	For example anything that might affect stopping or acceleration [Y/N]	NONE	NONE
Observation	Is there any evidence that "low-bed" trucks have difficulty negotiating the crossing (i.e. might they bottom-out or get stuck)? [Y/N]	N	N
	Visibility along rail line		
Deducted	Train speed	40	
Observation	Type of area urban/rural	RURAL / FARM	
Observation	Type of control yield/stop	STOP	
Deducted	Vehicle speed	60	
Deducted	Distance from outer rail along roadway [X]	5.5	
Measure	Standing at X (see sketch), what is the visibility distance along rail line in metres (m) dimension S1 S4	N/A	N/A
Measure	Standing at X (see sketch), what is the visibility distance along rail line in metres (m) dimension S2 S3	126	N/A
Limits	Standing at X the visibility distance along rail line in metres (m) must be		
Comments			



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Sheet 8 — Line of sight

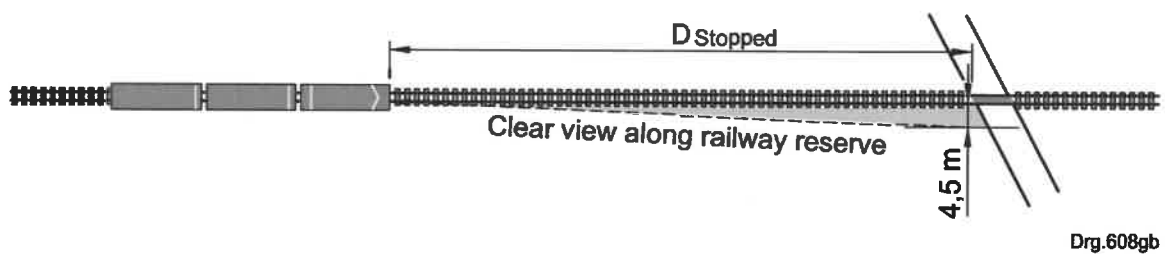
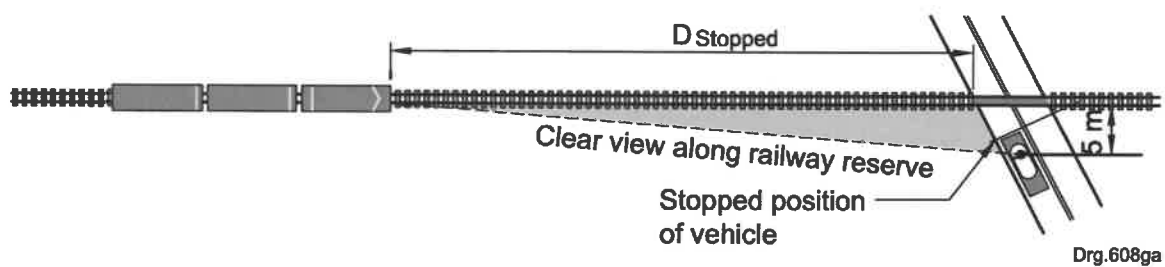
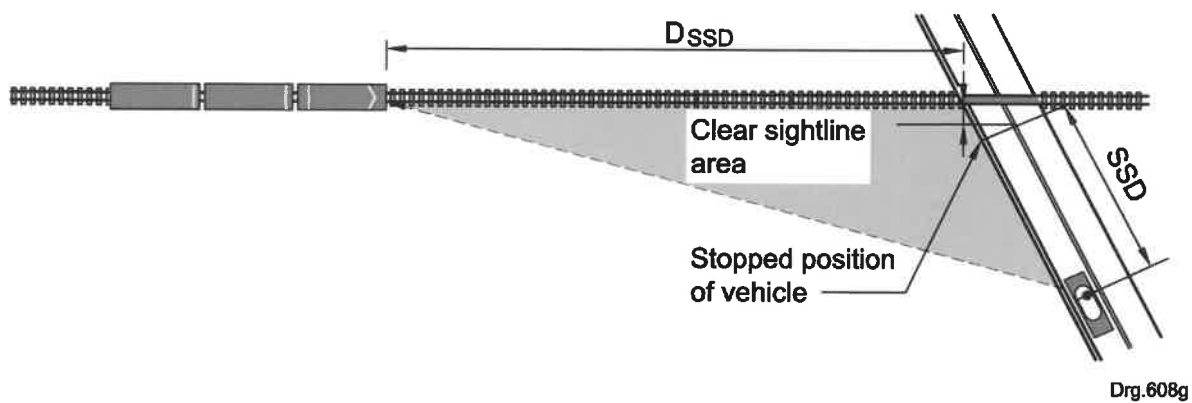
Assumptions

Driver eye height =	1,05 m passenger vehicles, pedestrians, cyclists and assistive devices 1,80 m buses and trucks 2,10 m large trucks and semi-trailers
Target height =	1,20 m above rails

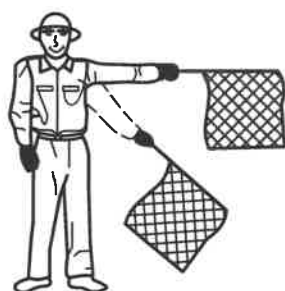
Approaches 1 and 2 are as defined in sketches A, B and C

Item		
Source	Information required	Response
Observation	Is the visibility within the rail reserve clear of bushes/vegetation; 15 m on each side of the track? [Y/N]	
Observation	Is the visibility within the rail reserve clear of bushes/vegetation; 30 m along the track, on each side of the crossing? [Y/N]	
Observation	Is the visibility on the road reserve within 15 m of the rail crossing clear of bushes/vegetation – approach 1? [Y/N]	
Observation	Is the visibility on the road reserve within 15 m of the rail crossing clear of bushes/vegetation – approach 2? [Y/N]	
Sheet 4.2	SSD minimum in metres (m)	
Measure	SSD actual: approach 1 in metres (m)	
Measure	SSD actual: approach 2 in metres (m)	
Sheet 4.1	V_t	
Sheet 4.2	Road operating speed V	
Sheet 4.2	$L + cd$	
Deduct	T_{ssd} is the greater of: $[(SSD + cd + L)/0,278 V] \rightarrow V = \text{max. road operating speed in kilometres per hour (km/h) or } 10 \text{ s}$	
Deduct	D_{SSD} minimum in metres (m) = $0,278 V_t \times T_{SSD}$, where V_t is from sheet 4	
	D_{SSD} actual:	
Measure	approach 1 in metres (m) (to driver's left)	
Measure	approach 1 in metres (m) (to driver's right)	
Measure	approach 2 in metres (m) (to driver's left)	
Measure	approach 2 in metres (m) (to driver's right)	
Sheet 4.2	T_d	
Deduct	$D_{STOPPED}$ minimum in metres (m) = $0,278 V_t \times T_d$, with T_d from sheet 4	
	$D_{STOPPED}$ actual:	
Measure	approach 1 in metres (m) (to driver's left)	
Measure	approach 1 in metres (m) (to driver's right)	
Measure	approach 2 in metres (m) (to driver's left)	
Measure	approach 2 in metres (m) (to driver's right)	
Sheet 4.2	T_p	
Deduct	Pedestrian/cyclist $D_{STOPPED}$, in metres (m) using sheet 4.1 and T_p (from sheet 4)	
	Pedestrian/cyclist $D_{STOPPED}$ actual:	
Measure	approach 1 in metres (m) (to cyclist's left)	
Measure	approach 1 in metres (m) (to cyclist's right)	
Measure	approach 2 in metres (m) (to cyclist's left)	
Measure	approach 2 in metres (m) (to cyclist's right)	
	Are there any obstacles within the sight triangles other than traffic signs/utility poles that might affect visibility? [Y/N]	
Observation	Approaching the level crossing – approach 1	
Observation	Approaching the level crossing – approach 2	
Observation	Vehicles stopped at the level crossing – approach 1	
Observation	Vehicles stopped at the level crossing – approach 2	
Observation	Pedestrians or cyclists stopped at the level crossing – approach 1	
Observation	Pedestrians or cyclists stopped at the level crossing – approach 2	
Comments		

Minimum lines of sight — Level crossing without an active warning system



Sheet 9 — Class 1 level crossing protection



Slow down



Stop



Proceed

Drg.606p

Class	2A: Yield R2 and W318	
Check	Is a flagman used at this level crossing? [Y/N]	N
Continue?	Respond to the check statement please	N/A

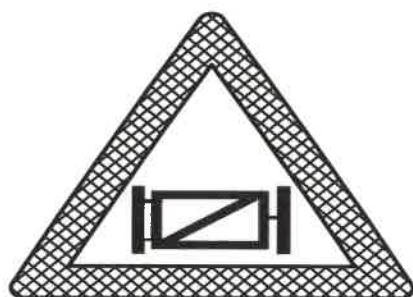
Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Observation	Flagman present		
Observation	Flagman present appropriately positioned and visible		
Observation	Clothing and flag in accordance with requirements?		
Observation	Correct flag signals SS2?		
Observation	Does shunting at night occur?		
Observation	Other warning signs or systems?		
Observation	WM1 number-of-tracks sign present?		
Comments			

Sheet 9.1 — Class 2 level crossing protection

Class	2A: Yield R2 and W318	
Check	Is this level crossing controlled by means of a gate? [Y/N]	N
Continue?	Respond to the check statement please	N/A

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Observation	Are the gates provided in good condition and locked?		
Enquire	How many farms make use of this level crossing?		
Enquire	How many vehicles make use of this level crossing?		
Enquire	How many pedestrians make use of this level crossing?		
Observation	Road surface – gravel? [Y/N]	Asphalt	Asphalt
Observation	Is a W314-gate-ahead warning sign present? [Y/N]		
Observation	Overhead power lines [Y/N]		
Observation	Are the W361-electrical-shock warning signs provided on both approaches? [Y/N]		
Observation	Any other warning signs or systems [Y/N]		

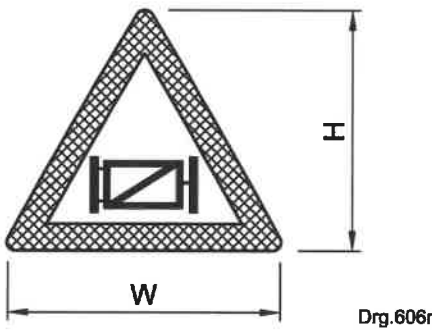
W314-gate-ahead warning sign



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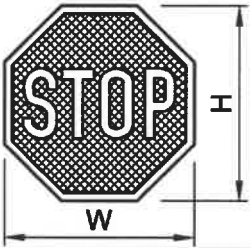
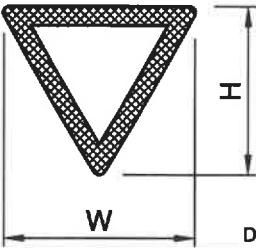
Comments	
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Sheet 9.2 — W314-gate-ahead warning sign

Speed V (km/h)		Minimum	
		H (mm)	W (mm)
$V \leq 60$		600	450
$60 > V > 100$		900	675
$V \geq 100$		1 200	900
$V = 0$		450	340
Overhead sign		1 600	1 200
Class	2A: Yield R2 and W318	600	
Check	Is this level crossing controlled by means of a gate? [Y/N] <i>N</i>	0	450
Continue?	Respond to the check statement on sheet9.3		Distance D2 Norm (m)
Control item	Road operating speed (km/h)		120

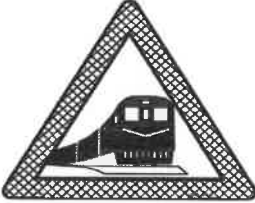
Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking in metres (m)?		
Measure	What is the distance from the edge of the road to the sign in metres (m)?		
Measure	What is the size of the sign, width, w in millimetres (mm)?		
Measure	What is the size of the sign, length, L in millimetres (mm)?		
Measure	What is the size of the sign, height, H in millimetres (mm)?		
Measure	Retro-reflectivity at night		
Observation	Are signs orientated correctly? [Y/N]		
Observation	Type of sign supports		
Observation	Condition of sign supports		
Observation	General condition of the sign		
Observation	Manufacturing date of the sign [yy/mm/dd]		
Observation	Installation date of the sign [yy/mm/dd]		
Observation	Is the message correct for road users? [Y/N]		
Observation	Are the signs clearly visible? [Y/N]		
Comments	Condition of sign supports		

Sheet 9.3 — R1 stop sign and R2 yield sign

Speed V (km/h)	R1 stop sign  R2 yield sign  Drg. 606s	Minimum	
		H (mm)	W (mm)
$V \leq 60$		600	450
$60 > V > 100$		900	675
$V \geq 100$		1 200	900
$V = 0$		450	340
Overhead sign		1 600	1 200
Class	2A: Yield R2 and W318	600	
Check	Which control sign is used, R1 or R2? <u>R1</u>	R1	450
Continue?	Complete the form		Distance D2 Norm (m)
Control item	Road operating speed km/h <u>60</u>		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?	4	4
Measure	What is the distance from the edge of the road to the sign, in metres (m)?	3.2	3.0
Measure	What is the size of the sign, width, w in millimetres (mm)?	900	900
Measure	What is the size of the sign, length, L in millimetres (mm)?	3300	3300
Measure	What is the size of the sign, height, H in millimetres (mm)?	900	900
Measure	Retro-reflectivity at night	N	N
Observation	Are signs orientated correctly? [Y/N]	Y	Y
Observation	Type of sign supports	RAIL TRACK	RAIL TRACK
Observation	Condition of sign supports	AVERAGE	AVERAGE
Observation	General condition of the sign	POOR	POOR
Observation	Manufacturing date of the sign [yy/mm/dd]	UNKNOWN	UNKNOWN
Observation	Installation date of the sign [yy/mm/dd]	UNKNOWN	UNKNOWN
Observation	Is the message correct? [Y/N]	Y	Y
Observation	Are the signs clearly visible? [Y/N]	Y	Y
Lookup/measure	Visibility appropriate for R1 or R2 control	Y	Y
Comments			

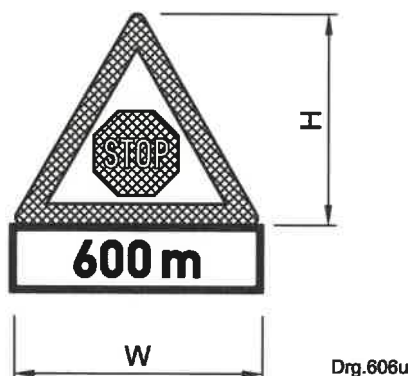
Sheet 9.4 — W318 railway crossing

Speed V (km/h)	 Drg.822na	Minimum	
		H (mm)	W (mm)
$V \leq 60$		600	450
$60 > V > 100$		900	675
$V \geq 100$		1 200	900
$V = 0$		450	340
Overhead sign		1 600	1 200
Class	2A: Yield R2 and W318	600	
Check	Is this sign being used? [Y/N] <u>Y</u>		450
Continue?	Respond to the check statement		Distance D2 Norm (m)
Control item	Road operating speed km/h <u>60</u>		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?	<u>80</u>	<u>80</u>
Measure	What is the distance from the edge of the road to the sign, in metres (m)?	<u>3.0</u>	<u>3.0</u>
Measure	What is the size of the sign, width, w in millimetres (mm)?	<u>900</u>	<u>900</u>
Measure	What is the size of the sign, length, L in millimetres (mm)?	<u>3.0</u>	<u>3.0</u>
Measure	What is the size of the sign, height, H in millimetres (mm)?	<u>900</u>	<u>900</u>
Measure	Retro-reflectivity at night	<u>N</u>	<u>N</u>
Observation	Are signs orientated correctly? [Y/N]	<u>N</u>	<u>Y</u>
Observation	Type of sign supports	<u>STEEL POLE</u>	<u>STEEL POLE</u>
Observation	Condition of sign supports	<u>AVERAGE</u>	<u>AVERAGE</u>
Observation	General condition of the sign	<u>AVERAGE</u>	<u>AVERAGE</u>
Observation	Manufacturing date of the sign [yy/mm/dd]	<u>UNKNOWN</u>	<u>UNKNOWN</u>
Observation	Installation date of the sign [yy/mm/dd]	<u>UNKNOWN</u>	<u>UNKNOWN</u>
Observation	Is the message correct? [Y/N]	<u>Y</u>	<u>Y</u>
Observation	Are the signs clearly visible? [Y/N]	<u>N</u>	<u>Y</u>
Comments			

Sheet 9.5 — W302 traffic control stop ahead

Speed V (km/h)
$V \leq 60$
$60 > V > 100$
$V \geq 100$
$V = 0$
Overhead sign



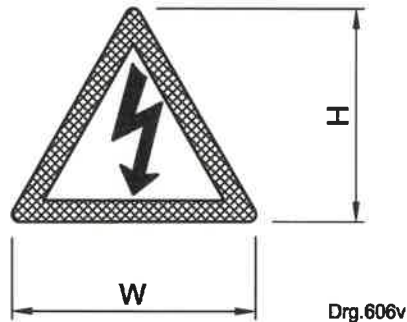
Minimum	
H (mm)	W (mm)
600	450
900	675
1 200	900
450	340
1 600	1 200

Class	2A: Yield R2 and W318	600	
Check	Is this sign being used? [Y/N]	<i>N</i>	450
Continue?	Respond to the check statement	<i>N/A</i>	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?		
Measure	What is the distance from the edge of the road to the sign, in metres (m)?		
Measure	What is the size of the sign, width, w in millimetres (mm)?		
Measure	What is the size of the sign, length, L in millimetres (mm)?		
Measure	What is the size of the sign, height, H in millimetres (mm)?		
Measure	Retro-reflectivity at night		
Observation	Are signs orientated correctly? [Y/N]		
Observation	Type of sign supports		
Observation	Condition of sign supports		
Observation	Manufacturing date of the sign [yy/mm/dd]		
Observation	Installation date of the sign [yy/mm/dd]		
Observation	Is the message correct? [Y/N]		
Observation	Are the signs clearly visible? [Y/N]		
Comments			

Sheet 9.6 — W361-electrical-shock warning sign

Speed V (km/h)
$V \leq 60$
$60 > V > 100$
$V \geq 100$
$V = 0$
Overhead sign

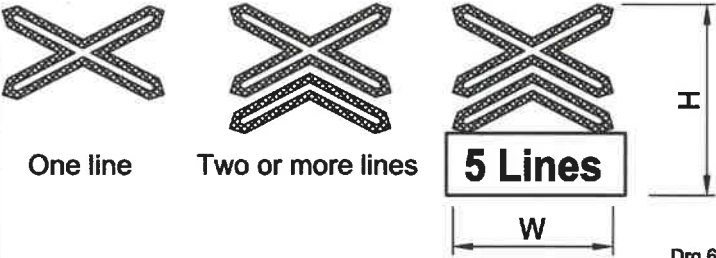


Minimum	
H (mm)	W (mm)
600	450
900	675
1 200	900
450	340
1 600	1 200

Class	2A: Yield R2 and W318	600	
Check	Is this sign being used? [Y/N]	N	450
Continue?	Respond to the check statement	N/A	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?		
Measure	What is the distance from the edge of the road to the sign, in metres (m)?		
Measure	What is the size of the sign, width, w in millimetres (mm)?		
Measure	What is the size of the sign, length, L in millimetres (mm)?		
Measure	What is the size of the sign, height, H in millimetres (mm)?		
Measure	Retro-reflectivity at night		
Observation	Are signs orientated correctly? [Y/N]		
Observation	Type of sign supports		
Observation	Condition of sign supports		
Observation	General condition of the sign		
Observation	Manufacturing date of the sign [yy/mm/dd]		
Observation	Installation date of the sign [yy/mm/dd]		
Observation	Is the message correct? [Y/N]		
Observation	Are the signs clearly visible? [Y/N]		
Comments			

Sheet 9.7 — W403/W404 railway crossing

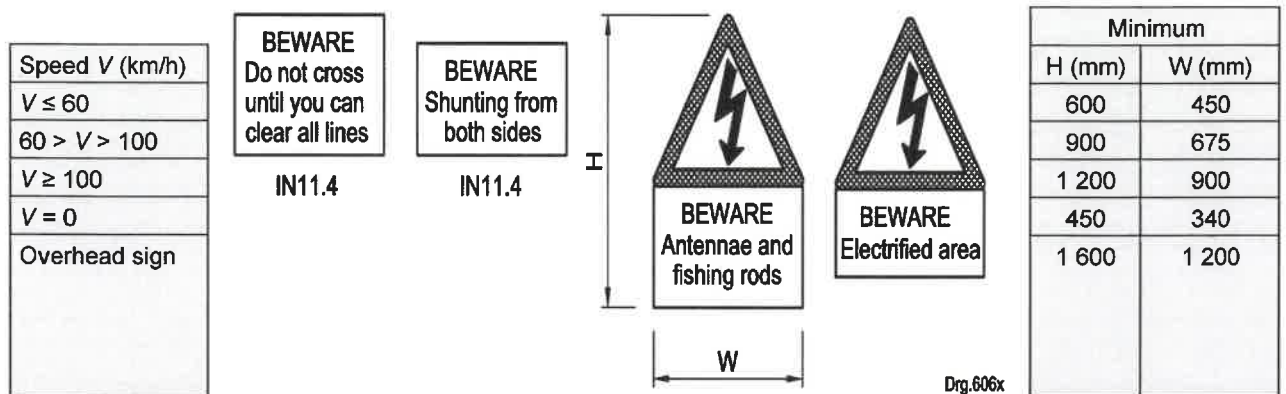
Speed V (km/h)		Minimum	
$V \leq 60$		H (mm)	W (mm)
$60 > V > 100$		600	450
$V \geq 100$		900	675
$V = 0$		1 200	900
Overhead sign		450	340
		1 600	1 200

Drg.606w

Class	2A: Yield R2 and W318	600	
Check	Is this sign being used? [Y/N]	Y	450
Continue?	Respond to the check statement		Distance D2 Norm (m)
Control item	Road operating speed km/h	60	120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?	4	4
Measure	What is the distance from the edge of the road to the sign, in metres (m)?	3.2	3.0
Measure	What is the size of the sign, width, w in millimetres (mm)?	1200	1200
Measure	What is the size of the sign, length, L in millimetres (mm)?	2300	2300
Measure	What is the size of the sign, height, H in millimetres (mm)?	900	900
Measure	Retro-reflectivity at night	N	N
Observation	Are signs orientated correctly? [Y/N]	Y	Y
Observation	Type of sign supports	RAIL TRACK	RAIL TRACK
Observation	Condition of sign supports	AVERAGE	AVERAGE
Observation	General condition of the sign	AVERAGE	AVERAGE
Observation	Manufacturing date of the sign [yy/mm/dd]	UNKNOWN	UNKNOWN
Observation	Installation date of the sign [yy/mm/dd]	UNKNOWN	UNKNOWN
Observation	Is the message correct? [Y/N]	Y	Y
Observation	Are the signs clearly visible? [Y/N]	Y	Y
Comments			

Sheet 9.8 — IN11 supplementary plates

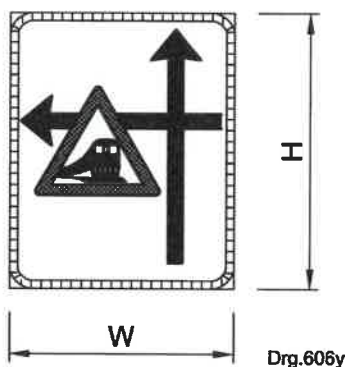


Class	2A: Yield R2 and W318	600	
Check	Are any of these signs being used? [Y/N]	N	450
Continue?	Respond to the check statement	N/A	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?		
Measure	What is the distance from the edge of the road to the sign, in metres (m)?		
Measure	What is the size of the sign, width, w in millimetres (mm)?		
Measure	What is the size of the sign, length, L in millimetres (mm)		
Measure	What is the size of the sign, height, H in (mm)?		
Measure	Retro-reflectivity at night		
Observation	Are signs orientated correctly? [Y/N]		
Observation	Type of sign supports		
Observation	Condition of sign supports		
Observation	General condition of the sign		
Observation	Manufacturing date of the sign [yy/mm/dd]		
Observation	Installation date of the sign [yy/mm/dd]		
Observation	Is the message correct? [Y/N]		
Comments			

Sheet 9.9 — GS901 diagrammatic sign

Speed V (km/h)
$V \leq 60$
$60 > V > 100$
$V \geq 100$
$V = 0$
Overhead sign



Minimum	
H (mm)	W (mm)
600	450
900	675
1 200	900
450	340
1 600	1 200

Class	2A: Yield R2 and W318	600	
Check	Is this sign being used? [Y / N]	N	450
Continue?	Respond to the check statement	N/A	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?	0	0
Measure	What is the distance from the edge of the road to the sign, in metres (m)?	0	0
Measure	What is the size of the sign, width, w in millimetres (mm)?	0	0
Measure	What is the size of the sign, length, L in (mm)?	0	0
Measure	What is the size of the sign, height, H in millimetres (mm)?	0	0
Measure	Retro-reflectivity at night		
Observation	Are signs orientated correctly? [Y/N]		
Observation	Type of sign supports		
Observation	Condition of sign supports		
Observation	General condition of the sign		
Observation	Manufacturing date of the sign [yy/mm/dd]		
Observation	Installation date of the sign [yy/mm/dd]		
Observation	Is the message correct? [Y/N]		
Comments			

Sheet 9.10 — Other warning and regulatory signs

Speed V (km/h)
$V \leq 60$
$60 > V > 100$
$V \geq 100$
$V = 0$
Overhead sign

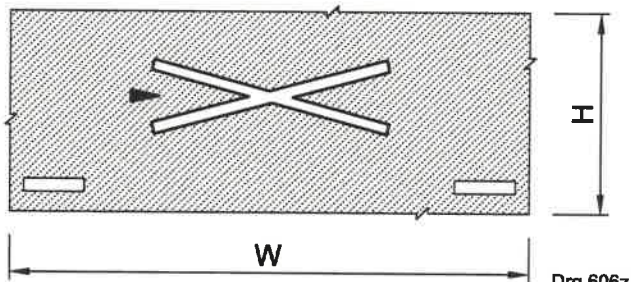
Minimum	
H (mm)	W (mm)
600	450
900	675
1 200	900
450	340
1 600	1 200

Class	2A: Yield R2 and W318	600	
Check	Is this sign being used? [Y/N]	N	450
Continue?	Respond to the check statement	N/A	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?	0	0
Measure	What is the distance from the edge of the road to the sign, in metres (m)?	0	0
Measure	What is the size of the sign, width, w in millimetres (mm)?	0	0
Measure	What is the size of the sign, length, L in millimetres (mm)?	0	0
Measure	What is the size of the sign, height, H in millimetres (mm)?	0	0
Measure	Retro-reflectivity at night		
Observation	Are signs orientated correctly? [Y/N]		
Observation	Type of sign supports		
Observation	Condition of sign supports		
Observation	General condition of the sign		
Observation	Manufacturing date of the sign [yy/mm/dd]		
Observation	Installation date of the sign [yy/mm/dd]		

Insert photograph of sign

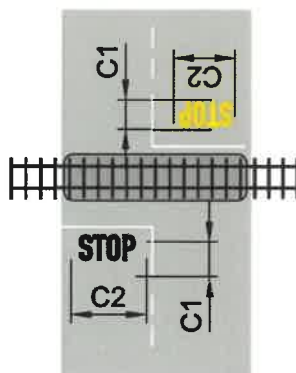
Sheet 10 — WM1 road surface sign

Speed V (km/h)		C1	C2
120		250	400
100		180	300
80		125	200
60		90	150
40		90	150

Class	2A: Yield R2 and W318		600
Check	Is this sign being used? [Y/N]	N	450
Continue?	Respond to the check statement	C1	90
Control item	Road operating speed km/h		60
		C2	150

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, C1, in metres (m)?		
Measure	What is the distance from the outer rail to the road marking, C2, in metres (m)?		
Measure	What is the size of the marking, width, W in above sketch in millimetres (mm)?		
Measure	What is the size of the marking, length, H in above sketch in millimetres (mm)?		
Observation	General condition of the markings		
Observation	Are the centre lines/lane markings present? [Y/N]		
Observation	Is the sign in the middle of the road lane? [Y/N]		
Measure	Retro-reflectivity at night		
Comments			

Sheet 10.1 — WM5/GM7-road-surface-stop-ahead warning



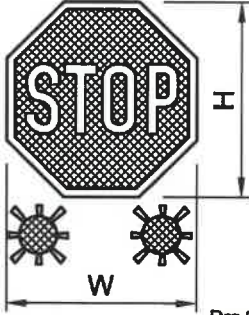
Drg.905

Urban /Rural	
C1 (mm)	C2 (mm)
1 238	4 000
1 250	5 500
Area (m ²)	
4,95	
6,88	

Class	2A: Yield R2 and W318		600
Check	Is this sign being used? [Y/N]	N	450
Continue?	Respond to the check statement	N/A	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Observation	What colour is used for the stop sign?		
Measure	What is the size of the marking, width, C ₁ in above sketch in millimetres (mm)?	0	0
Measure	What is the size of the marking, length, C ₂ in above sketch in millimetres (mm)?	0	0
Observation	General condition of the markings		
Observation	Are the centre lines/lane markings present? [Y/N]		
Measure	Retro-reflectivity at night		
Comments			

Sheet 11 — Flashing red disk signals

Speed V (km/h)		Minimum	
$V \leq 60$		H (mm)	W (mm)
$60 > V > 100$		600	450
$V \geq 100$		900	675
$V = 0$		1 200	900
Overhead sign		450	340
		1 600	1 200

Class	2A: Yield R2 and W318		600
Check	Is this sign being used? [Y/N]	N	450
Continue?	Respond to the check statement	N/A	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?		
Measure	What is the distance from the edge of the road to the sign, in metres (m)?		
Measure	What is the size of the sign, width, w in millimetres (mm)?		
Measure	What is the size of the sign, length, L in millimetres (mm)?		
Measure	What is the size of the sign, height, H in millimetres (mm)?		
Measure	Retro-reflectivity at night		
Measure	Advance warning, in seconds (s). for approaching trains		
Observation	Approach 1 – alignment of signal correct [Y/N]		
Observation	Type of signal support		
Observation	Condition of the signal supports		
Observation	Is the system working effectively? [Y/N]		
Observation	Manufacturing date of the sign [yy/mm/dd]		
Observation	Installation date of the sign [yy/mm/dd]		
Measure	Clearance time of rail traffic before light stops, in seconds (s)		
Comments			

Sheet 11.1 — Booms (gates)



Drg.905b

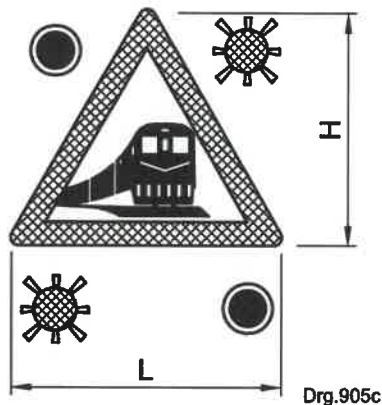
W411 railway crossing boom barricade

Class	2A: Yield R2 and W318		600
Check	Is a boom being used? [Y/N]	N	450
Continue?	Respond to the check statement	N/A	Distance D2 Norm (m)
Control item	Road operating speed km/h	60	120

Item		
Source	Information required	Response
Observation	General condition	
Measure	Advance warning, in seconds (s), for approaching trains	
Measure	Is the warning system at least 5 m from the travelled way? [Y/N]	
Measure	Is the warning system at least 5 m from the nearest rail? [Y/N]	
Observation	Type of construction of boom and supports	
Observation	Condition of the boom and supports	
Observation	Is the system working effectively? [Y/N]	
Rail	Repair/replace requirements per year	
Deduct	Gate arm clearance times, in seconds (s)	
Deduct	Effect of grade	
Lookup	Specified gate arm delay time, in seconds (s)	
Measure	Actual gate arm delay time, in seconds (s)	
Observation	Do gates comply with standards?	
Measure	Gate ascent, in seconds (s) (6 s to 12 s)	
Measure	Gate descent, in seconds (s) (10 s to 15 s)	
Comments		

Sheet 11.2 — Flashing yellow warning lights

Speed V (km/h)
$V \leq 60$
$60 > V > 100$
$V \geq 100$
$V = 0$
Overhead sign



Minimum	
H (mm)	W (mm)
600	450
900	675
1 200	900
450	340
1 600	1 200

Class	2A: Yield R2 and W318	600	
Check	Is this sign being used? [Y/N]	<i>N</i>	450
Continue?	Respond to the check statement	<i>N/A</i>	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

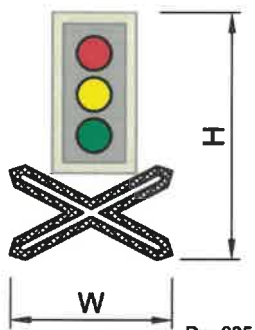
Item			
Source	Information required	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?		
Measure	What is the distance from the edge of the road to the sign, in metres (m)?		
Measure	What is the size of the sign, width, w in millimetres (mm)?		
Measure	What is the size of the sign, length, L in millimetres (mm)?		
Measure	What is the size of the sign, height, H in millimetres (mm)		
Measure	Retro-reflectivity at night		
Observation	Condition of sign support		
Observation	Is the system (lights) working effectively? [Y/N]		
Observation	Approach 1 – are the lights aligned correctly? [Y/N]		
Observation	Approach 2 – are the lights aligned correctly? [Y/N]		
Observation	Type of sign support		
Observation	Condition of sign support		
Observation	With which warning sign is the lights installed?		
Comments			

Sheet 11.3 — Bells

Item		
Source	Information required	Response
Observation	General condition	
Measure	Advance warning, in seconds (s), for approaching trains	
Measure	Is the warning system at least 8 m from the travelled way? [Y/N]	
Measure	Is the warning system at least 8 m from the nearest rail? [Y/N]	
Observation	Type of construction housing the system	
Observation	Condition of the construction	
Observation	Is the system working effectively? [Y/N]	
Comments		

Sheet 11.4 — Traffic signal

Speed V (km/h)			
$V \leq 60$			
$60 > V > 100$			
$V \geq 100$			
$V = 0$			
Overhead sign			



Drg.905d

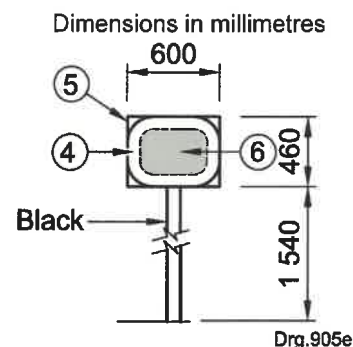
Minimum	
H (mm)	W (mm)
600	450
900	675
1 200	900
450	340
1 600	1 200

Class		600	
Check	Is this sign being used? [Y/N]	<i>N</i>	450
Continue?	Respond to the check statement	<i>N/A</i>	Distance D2 Norm (m)
Control item	Road operating speed km/h		120

Item			
Source	Information required	Approach 1	Approach 2
Measure	What is the distance from the outer rail to the road marking, in metres (m)?		
Measure	What is the distance from the edge of the road to the sign, in metres (m)?		
Measure	What is the size of the sign, width, w in millimetres (mm)?		
Measure	What is the size of the sign, length, L in millimetres (mm)?		
Measure	What is the size of the sign, height, H in millimetres (mm)?		
Measure	Retro-reflectivity at night		
Observation	Condition of sign support		
Observation	Is the system (lights) working effectively? [Y/N]		
Observation	Approach 1 – are the lights aligned correctly? [Y/N]		
Observation	Approach 2 – are the lights aligned correctly? [Y/N]		
Observation	Type of sign support		
Observation	Condition of sign support		
Observation	With which warning sign is the lights installed?		
Comments			

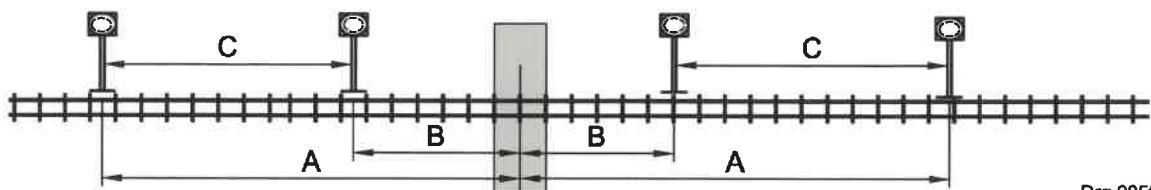
Sheet 12 — Whistle board

- 4 = Reflective white border 75 mm
5 = Dove grey chromadex reverse side
6 = Pigmented white



Class	2A: Yield R2 and W318		460	H W
Check	Is this sign being used? [Y/N]	Y	600	
Continue?	Respond to the check statement	A	375	
Control item	Whistle board placement in millimetres (minimum) B C	125	250	

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	What is the distance, in metres (m), from the geometric centre of the level crossing surface to the 125 m sign along the rail approach?	125	NO SIGN
Measure	What is the distance, in metres (m), from the geometric centre of the level crossing surface to the 375 m sign along the rail approach?	375	NO SIGN
Observation	Are the signs visible? [Y/N]	Y N	N/A N/A
Measure	Sign height above ground, in millimetres (mm) – 125 m	1700	N/A
Measure	Sign height above ground in millimetres (mm) – 375 m	1500	N/A
Observation	Are the signs orientated correctly? [Y/N] – 125 m	Y	N/A
Observation	Are the signs orientated correctly? [Y/N] – 375m	Y	N/A
Measure	Reflectivity of the signs –125m	N	N/A
Measure	Reflectivity of the signs – 375m	N	N/A
Observation	Type of sign support	RAIL TRACK	N/A
Observation	Condition of sign support	AVERAGE	N/A
Observation	Condition of sign	AVERAGE-POOR	N/A
Comments			



Sheet 13 — Overhead lines and protection

R204 Applicable signs

W401 Danger plates



Drg.905h

W361

Danger plates



Drg.905g

Electrical hazard WW7

Height limit W320

Class	2A: Yield R2 and W318		
Check	Are any of the signs being used? [Y/N]	N	
Continue?	Respond to the check statement	N/A	
Control item	Condition of signs		

Item			
Source	Information required	Response	
	Approaches 1 and 2 are as defined in the scene sketch of sheet 3	Approach 1	Approach 2
Measure	The height of the contact wire above the railway lines, in millimetres (mm)		
Rail	What voltage is applicable for the contact wires?		
Measure	The height of the gauge wire above the highest point of the road surface under the gauge wire, in millimetres (mm)		
Observation	Are all signs installed on the gauge wires, wire supports and advance warning signs applicable to the power lines?		
Observation	Are the correct signs installed in accordance with sketch including WW7 and W320 or R204		
Observation	Type of sign supports?		
Observation	Condition of sign supports?		
Observation	Oldest manufacturing date of signs?		
Observation	Condition of signs?		
Comments			

Sheet 14 — Train illumination

Item		
Source	Information required	Response
Sheet 7	Unrestricted level crossing [Y/N]	
Sheet 4.2	Road speed limit, in kilometres per hour (km/h)	
Observation	Rail equipment stops at night [Y/N]	
Observation	Are train headlights on (day and night)? [Y/N]	
Observation	Is illumination required? [Y/N]	
Observation	Is illumination present? [Y/N]	
Observation	State of illumination – Visible at night? [Y/N]	
Observation	State of illumination – Appropriately orientated? [Y/N]	
Observation	Is there adjacent commercial lighting? [Y/N]	
Comments		

Annexure E

Photos



Photo 1: B6 - Eastern Approach – B6 / D1527 intersection



Photo 2: D1527 – Northern Approach – B6 / D1527 Intersection



Photo 3: B6 - Western Approach – B6 / D1527 intersection



Photo 4: B6 – Eastern Approach – B6 / Gemsbok Street



Photo 5: Gemsbok Street – Northbound Approach – B6 / Gemsbok Street Int.



Photo 6: B6 – Western Approach – B6 / Gemsbok Street Intersection



Photo 7: Southbound View along D1527 – Road-Rail Level-Crossing



Photo 8: Northbound View along D1527 – Road-Rail Level-Crossing