Traffic Impact Assessment

Project:	Lockier Project Traffic Impact Assessment Intersection 2
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1. Introduction

1.1. Background

Mineral Resources (MRL) are currently investigating two potential intersection locations on Midlands Road, Mount Horner, to allow heavy haulage access to their proposed Lockier Project

Figure 1 shows the location of the two intersections. MRL have proposed a possible access realignment near an existing rural driveway at intersection 1 to improve the intersection approach and enable 90 degrees crossing of the railway and intersection 2 is an existing intersection.

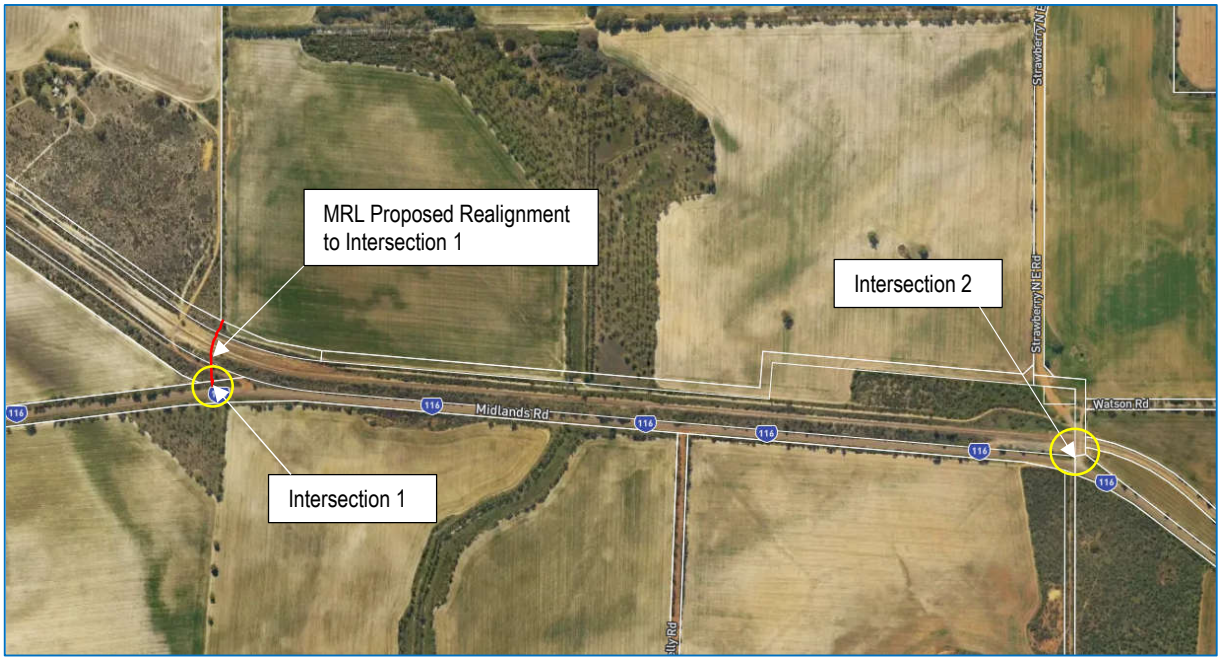


Figure 1: Intersection Locations

1.2. Purpose

Shawmac has been engaged by MRL to prepare a Transport Impact Assessment (TIA) to assess the suitability of each of the proposed intersections.

This TIA will assess Intersection 2 in accordance with the Western Australian Planning Commission's (WAPC) Transport Impact Assessment Guidelines for Developments: Volume 4 – Individual Developments (2016) and specifically includes:

- Document the details of the proposed expansion works.
- Document the existing situation including road network, traffic volumes (MRL and background), crash history, RAV network etc.
- Confirm future traffic generation and trip distribution based on MRL proposed traffic.
- Assess the suitability of intersection 2 in terms of:
    - Conformance to RAV network requirements
    - Intersection configuration/warrants (i.e., whether there is a need for turn pockets)
    - Sight distance
    - Intersection approach alignments
    - Rail crossings
    - Vehicle swept paths.
    - Acceleration lane warrants
    - Site specific issues
- Provide recommendations as required.
- Prepare 2d sketches (general arrangement) of recommended upgrades/intersection configurations based on provided arial imagery.

Intersection 1 has been assessed under a separate TIA document (Shawmac Doc #2309009-TIA-001).

2. Existing Situation

2.1. Road Network

The layout and hierarchy of the existing road network according to the Main Roads WA Road Information Mapping System is shown in **Figure 2**.

Figure 2: Adjacent Road Network

2.2. Carriageway Width and Cross Section

The carriageway and configuration of relevant roads are summarised in **Table 1**.

Table 1: Road Configuration

Road and Location	Road Type	Cross Section	Carriageway Width (Approx.)	Sealed Pavement Width (Approx.)
Midlands Road	Primary Distributor	Two-lane single carriageway	9.0m	7.0m
Strawberry North-East Road	Access Road	Two-lane single carriageway	8-8.5m	NA

2.3. Traffic Volumes

The proposed intersection is at SLK 236.43 of Midlands Road. According to MRWA Traffic map, the nearest traffic count data for Midlands Road is at the 2022/23 count site West of Mingenew Mullewa Road (SLK 251.00).

Data from the Network Performance Site (NPS) traffic count at SLK 223.06 on Midlands Road, shows an average 6% growth from 20/21 period to 23/24 period. As the project mine design life is 15years, a 10-year growth scenario (2033/34) has been allowed for in accordance with WAPC Transport Impact Assessment Guidelines for Developments. A 2% annual compound growth has been adopted for conservatism to estimate the 2023/24 traffic volumes as well as the future 10-year traffic volumes (2033/34).

Traffic data for Strawberry North East Road was not available. Therefore, the traffic data (with annual growth rate of 1%) is assumed based on the similar traffic network in the area. Also, it is assumed that 60% of turning vehicle on to the Strawberry North East Road will be to/from west of Midlands Road.

A summary of this information is provided in **Table 2** and **Table 3**. Detailed traffic count data is attached in **Appendix A – Traffic Counts**.

Table 2: Daily Traffic Volumes

Road	Location	Existing Daily Volume		2033/34 Daily Volume		% HV	Data Source
		EB/NB	WB/SB	EB/NB	WB/SB		
Midlands Road	SLK 251.00	305	363	372	443	33.5%	MRWA 22/23
Strawberry NE Road	NA	33	32	38	37	28%	Assumed

Table 3: Peak Hour Traffic Volumes

Road	Location	Existing Peak Volume				2033/34 Peak Volume			
		EB/NB		WB/SB		EB/NB		WB/SB	
		AM	PM	AM	PM	AM	PM	AM	PM
Midlands Road	SLK 251.00	41	24	31	43	50	30	37	52
Strawberry NE Road	NA	6	4	4	6	7	5	5	7

2.4. RAV Status

As per MRWA HVS network mapping tool:

- Midlands Road is categorised under Tandem Drive RAV 7.3 network and Tri Drive 1.3 network without any conditions.
- Strawberry North East Road is categorised under Tandem Drive RAV 7.1 network and Tri Drive 1.1 with the following conditions:
    - All operators must carry written support from the road manager acknowledging the operator's use of the road.
    - No operation on unsealed road segment when visibly wet, without road owner's approval.
    - Maximum speed 80 km/h.

Figure 3 shows the Tandem Drive and **Figure 4** shows the Tri Drive network for the road network in the local vicinity.

Figure 3: Tandem Drive 7 Network

Figure 4: Tri Drive 1 Network

2.5. Speed Limit

The speed limit of the adjacent road network is shown below in **Figure 5.**

As per MRWA HVS network mapping tool, RAV vehicles approaching Midlands Road from Strawberry North East Road are restricted to 80km/hr.

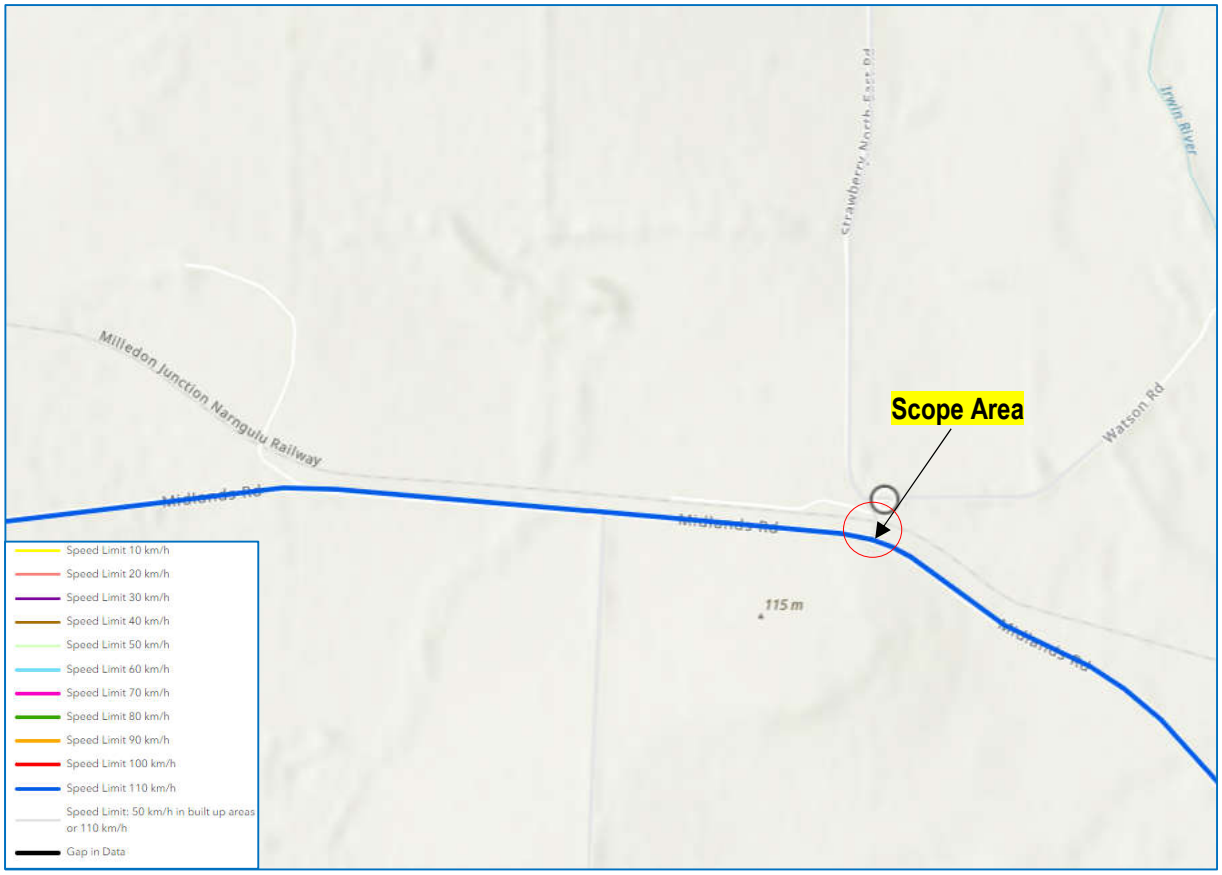


Figure 5: Speed Zoning

2.6. Crash History

Crash data for Midlands Road in the vicinity of Intersection 2 was sourced from MRWA Crash Analysis Reporting System (CARS) for the 5-year period ending 31/12/2022. The report is summarised in **Table 4**.

Table 4: Crash History

Location	Number of Crashes	MR Nature and Location	Severity
Midlands Road SLK 234.69 to SLK 241.75	0	NA	NA

As shown no crashes were reported.

2.7. Changes to Surrounding Transport Networks

There are no known changes to the adjacent road network that have potential to affect this assessment.

3. Transport Logistics

3.1. Proposed Development and Traffic Generation

Table 5 and **Table 6** show the traffic generation during construction and operations phase, as provided by MRL, respectively.

Table 5:Construction Phase Traffic Generation

Item	Daily HVs	Daily LVs
Bulk Earthworks	5 nos. In and out	12 nos. In and out
Pipeline construction	15 nos. In and out	10 nos. In and out

Table 6:Operations Phase Traffic Generation

Item	Daily HVs	Daily LVs
Condensate Loadout and Deliveries	3 nos. In and out	NA
Chemical Top Up	0.04 nos. (1no In and out per month)	NA
Personnel access to CCR/Admin Building	NA	10 nos. In and out

3.2. Operating Hours

Haulage operations will occur 12 hrs a day. There is no defined peak period for the haulage activity and the movements are expected to be evenly distributed throughout the operating hours.

3.3. Proposed Haulage Vehicle

It is proposed to use maximum RAV 7.3/TD 1.3 trucks up to 36.5m long for haulage. Refer **Figure 6** for typical configurations of proposed design vehicles.

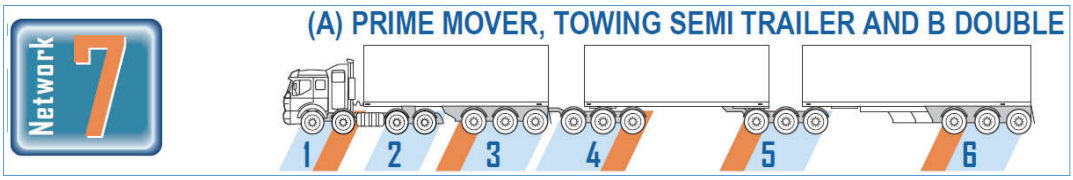


Figure 6: Typical Tandem Drive RAV 7 Trucks

3.4. Haulage Route and truck movements

As per the traffic data provided by MRL, 80% of traffic comes to/from West and 20% comes from east. Also, MRL has advised that majority of LV and bus traffic would occur during shift change where most vehicles would be entering during 5-7am and exiting during 5-7pm.

For the purposes of assessing the peak period impacts, the following assumptions have been made:

- 100% of haulage vehicles are to/from the west.
- Truck deliveries occur over a 12-hour period, and 10% of all daily truck volumes are received within a peak hour.
- Chemicals top up traffic is not included in the assessment as it is only 1 per month.

Figure 7 and **Figure 8** shows the daily and peak hour traffic volumes during construction and operations phase as provided by MRL, respectively.

Figure 7:Traffic Distribution AADT/AM Peak Hour (2023) Volumes-Construction Phase

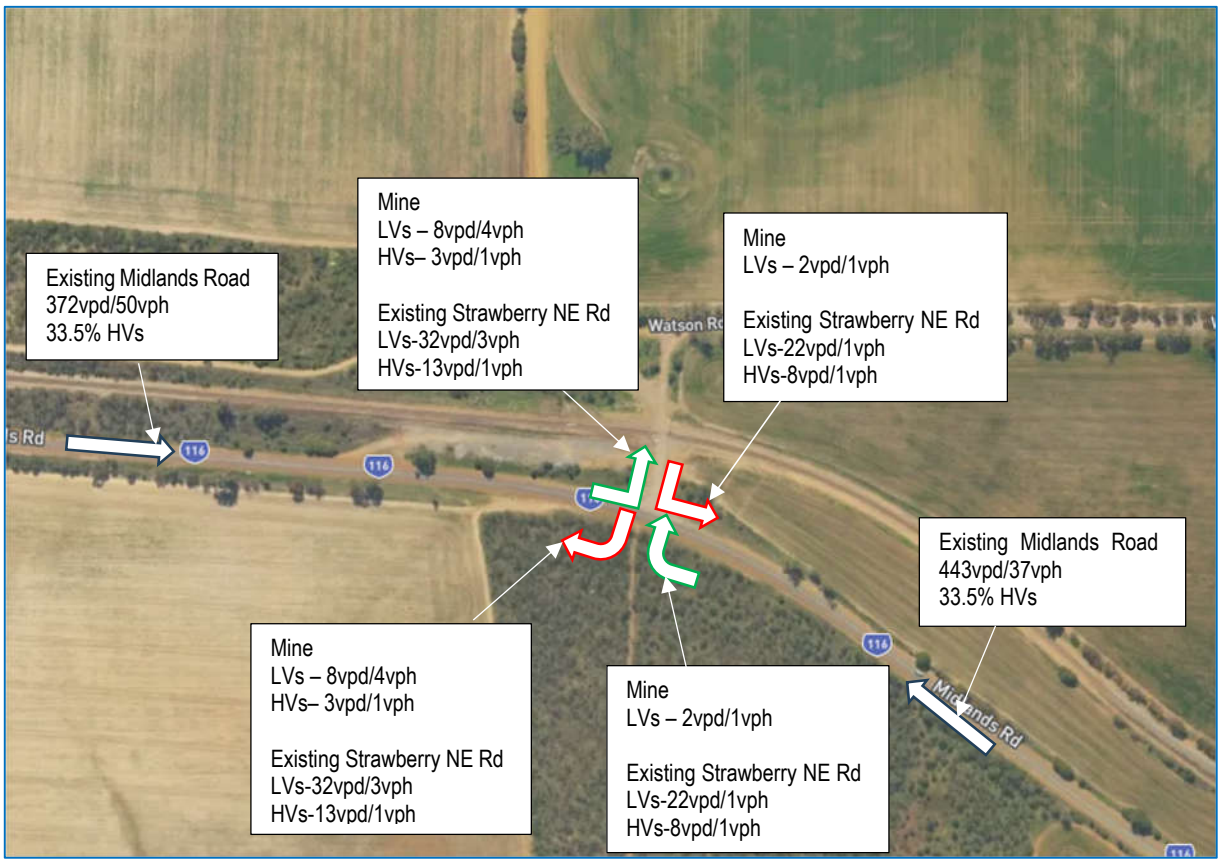


Figure 8:Traffic Distribution AADT/AM Peak Hour (2033) Volumes-Operations Phase

4. Traffic Impact Assessment

4.1. Assessment Years

The development is assessed based on current network condition (2023) and 10-year scenario (2033) in accordance with WAPC Transport Impact Assessment Guidelines for Developments.

4.2. Impact on Roads

4.2.1. Road Minimum Widths

The sealed and carriageway widths of Midlands Road was checked against the rural road minimum widths in accordance with Appendix A of the MRWA RAV assessment guideline. The comparison is shown below in **Table 7**.

Table 7: Rural Road Minimum Width

Road	Background / Proposed AADT 2023	Background / Proposed AADT 2033	Speed (RAV) (km/hr)	RAV Status	Existing / Required Min Seal Width (m)	Existing / Required Min Carriageway Width (m)
Midlands Road	668/ 752	814/ 840	100	RAV 7.3	7.0 / 6.5	9.0 / 8.3
Strawberry NE Road	65/149	75/ 101	80*	RAV 7.1	NA	8-8.5 / 8.0

* As per the MRWA HVS network mapping tool, RAV vehicles approaching Midlands Road from Strawberry NE Road are restricted to 80km/hr.

As shown above, the existing road seal widths comply with the minimum requirements.

As per MRWA RAV Guidelines, a road should be sealed if the AADT is over 150. Therefore, Strawberry NE Road can remain unsealed as AADT is less than 150.

4.2.2. Road Safety

The crash history of the adjacent road network (as previously outlined in **Section 2.6**) does not suggest any particular safety issues in the existing road network.

4.3. Safe Intersection Sight Distance

The Safe Intersection Sight Distance (SISD) is the minimum distance which should be provided on the major road at any intersection. SISD provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle on a minor road approach moving into a collision situation (e.g., in the worst case, stalling across the traffic lanes) and to decelerate to a stop before reaching the collision point.

The SISD is assessed based on the following parameters:

- An observation time of 3 seconds as per Austroads Part 3;
- A reaction time of 2.5 seconds;
- Deceleration coefficients for the purpose of SISD calculations are 0.36 for light vehicles and 0.28 for heavy vehicles (Road Train Type 1/ RAV 7 equivalent);
- Driver eye height is 2.4m for trucks and 1.1m for cars;
- Object height of 1.25m; and
- Sight distance offset 3-5m from edge of proposed holding line.

The results are summarised in **Table 8**.

Table 8: SISD at Proposed Intersection 2

Location	Vehicle Type	Design Speed (km/h) (WB / EB)	Coefficient of Deceleration	Decision Time (s)	Longitudinal Grade (EB / WB) *	Required SISD for EB / WB Traffic (m)	Available SISD (m)	
							EB	WB
Intersection 2	Trucks	110 / 110	0.28	3.0+2.5	0.8% / 1.4%	333 / 330	+350	+350
	Cars	110 / 110	0.36	3.0+2.5	0.8% / 1.4%	298 / 295	+350	+350

*Positive for through traffic travelling uphill and negative for through traffic travelling downhill. Grades are estimated based on the google earth only.

As shown, the SISD is sufficient to achieve the minimum requirements in accordance with the Austroads Guide to Road Design Part 4A. However, there are existing vegetation within the road reserve towards the east direction that with will need to be monitored and trimmed/pruned as required to ensure sight distances and maintained.

The measurement of the SISD is shown in **Figure 9.** The line-of-sight street view at the intersection location are shown in **Figure 10** and **Figure 11**.

Figure 9: Sight Distance Measurement at Intersection 2

Figure 10: Midlands Road Looking East

Figure 11: Midlands Road Looking West

4.3.1. Approach Sight Distances

The Approach Sight Distance (ASD) is required to ensure that drivers of trucks and light vehicles approaching the intersection from the minor road at the 85th percentile operating speed are able to see the intersection and stop at the holding line.

The ASD is assessed based on the following parameters:

- A reaction time of 2.5 seconds;
- Deceleration coefficients for the purpose of ASD calculations are 0.36 for light vehicles and 0.28 for haulage trucks;
- Driver eye height is 2.4m for trucks and 1.1m for cars; and
- Object height of 0.0m at the holding line.

The required and available ASD at the intersection has been determined from Austroads Part 4A Equation 2 as summarised in **Table 9**.

Table 9: Approach Sight Distance Assessment

Location	Vehicle Type	Design Speed (km/h)	Coefficient of Deceleration (unsealed)	Reaction Time (s)	Longitudinal Grade*	Required ASD (m)	Available ASD (m)
Existing Driveway	Trucks	40**	0.28	2.5	2	49	56
	Cars	40**	0.36	2.5	2	44	56

*Positive for traffic travelling uphill and negative for through traffic travelling downhill. Grades are estimated based on google earth only.
** The speed along Strawberry NE Road is assumed as 40km/hr as vehicles have to stop at railway line.

The measurement of ASD is shown in **Figure 12** and line of sight from Midlands Road is shown in **Figure 13**.

As shown, the ASD is sufficient to achieve the minimum requirement as per Austroads Part 4A Equation 2.

Figure 12:Approach Sight Distance Measurement

Figure 13:Approach Line of Sight from Midlands Road

4.4. Intersection Volumes

For the purpose of auxiliary lane assessment, the development peak hour is shown in **Figure 14.**

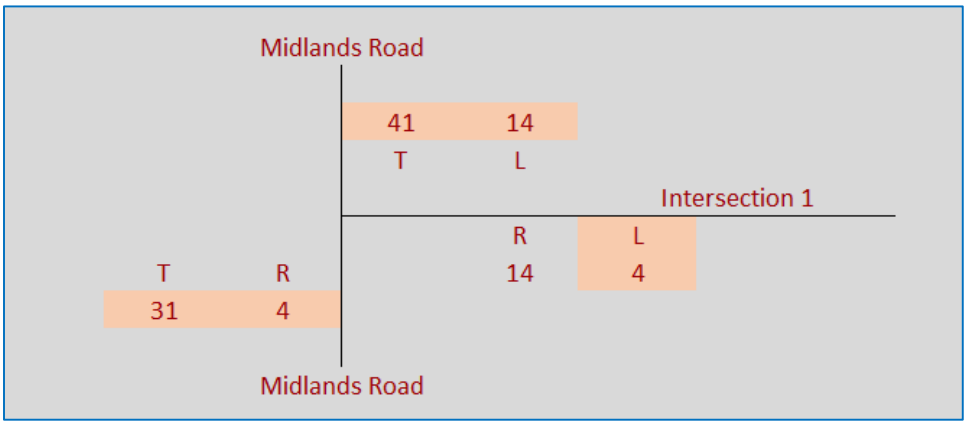


Figure 14:Intersection AM Peak Hour (2023) Volumes-Construction Phase

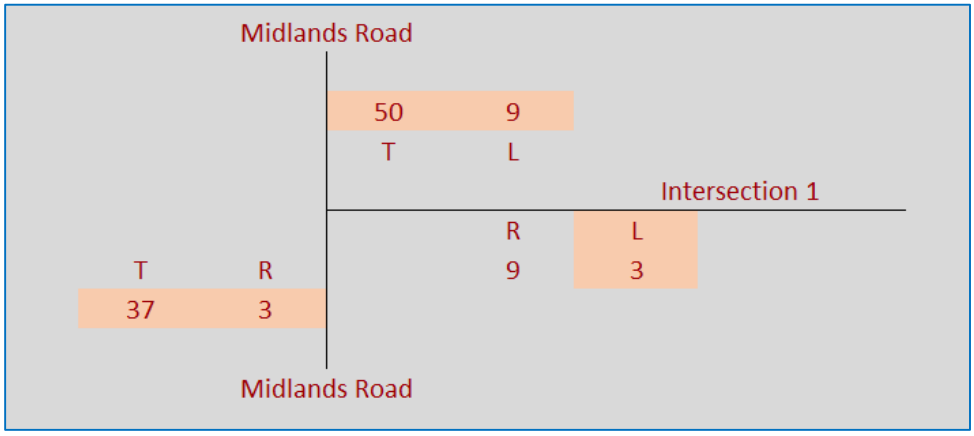
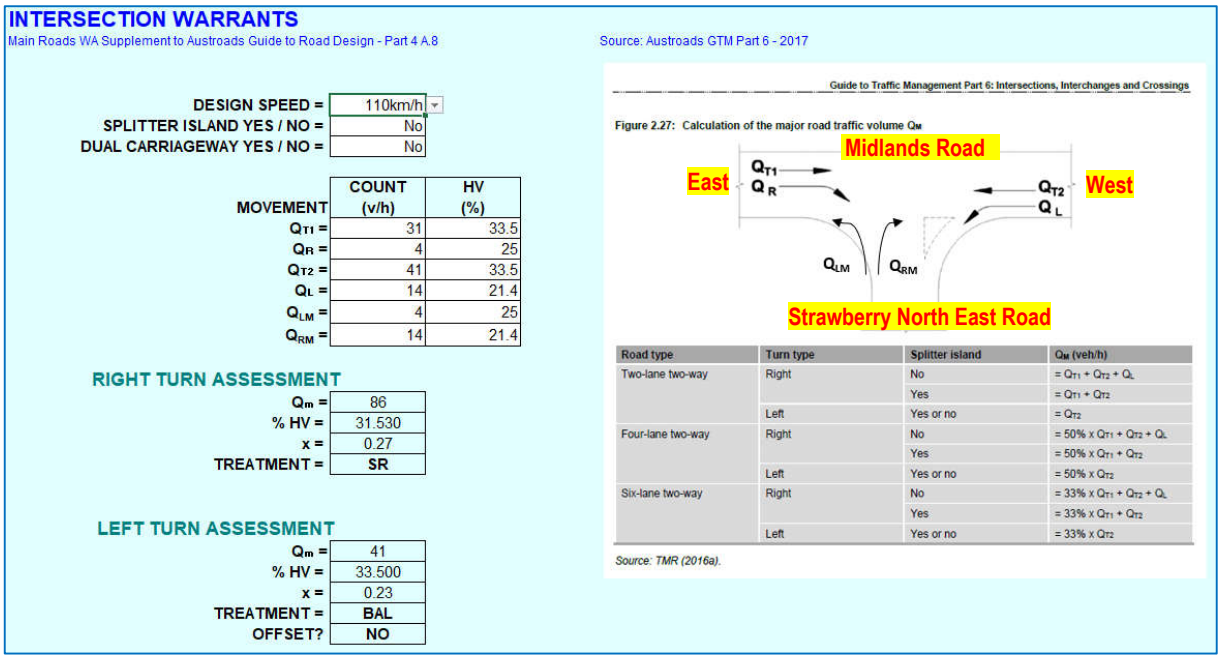


Figure 15:Intersection AM Peak Hour (2033) Volumes-Operations Phase

4.5. Auxiliary Lanes

The requirement for turning treatments was calculated using the Intersection Warrants calculator provided in Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8. The results of the assessment are shown in **Figure 16** and **Figure 17**.



INTERSECTION WARRANTS

Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8

Source: Austroads GTM Part 6 - 2017

DESIGN SPEED =	110km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	31	33.5
Q_R =	4	25
Q_{T2} =	41	33.5
Q_L =	14	21.4
Q_{LM} =	4	25
Q_{RM} =	14	21.4

RIGHT TURN ASSESSMENT

Q_m =	86
% HV =	31.530
x =	0.27
TREATMENT =	SR

LEFT TURN ASSESSMENT

Q_m =	41
% HV =	33.500
x =	0.23
TREATMENT =	BAL
OFFSET?	NO

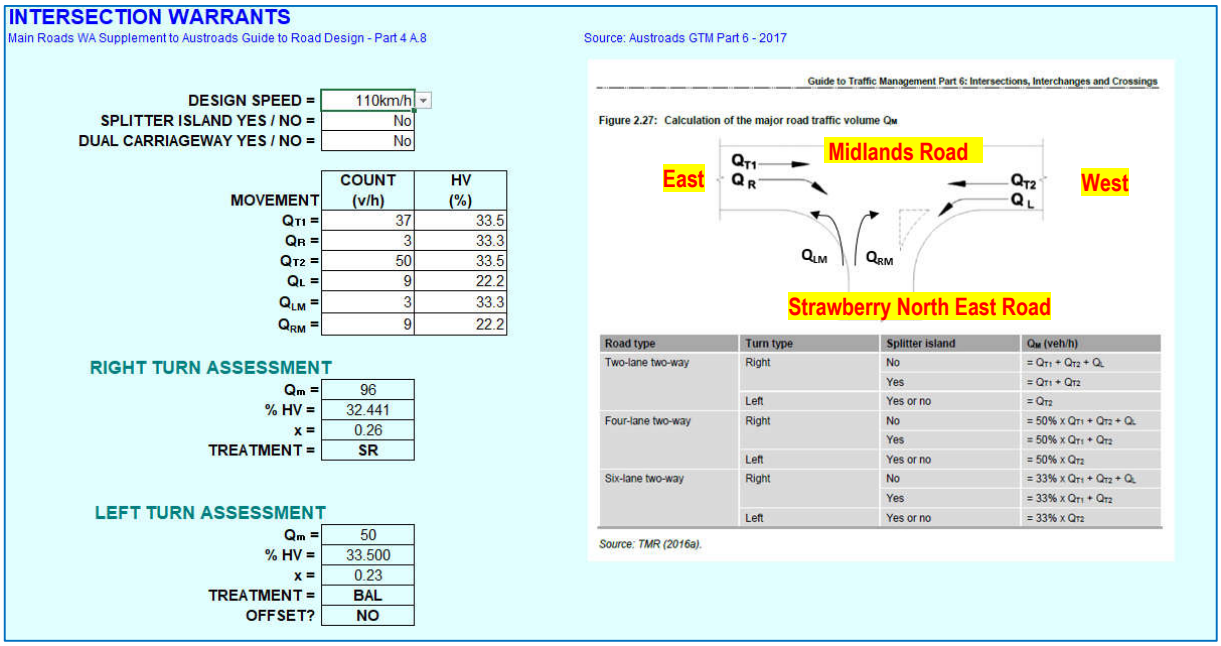
Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Figure 2.27: Calculation of the major road traffic volume Q_M

Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a).

Figure 16: Construction Phase Warrants for Turn Treatments–AM Peak (2023)



INTERSECTION WARRANTS

Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8

Source: Austroads GTM Part 6 - 2017

DESIGN SPEED =	110km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	37	33.5
Q_R =	3	33.3
Q_{T2} =	50	33.5
Q_L =	9	22.2
Q_{LM} =	3	33.3
Q_{RM} =	9	22.2

RIGHT TURN ASSESSMENT

Q_m =	96
% HV =	32.441
x =	0.26
TREATMENT =	SR

LEFT TURN ASSESSMENT

Q_m =	50
% HV =	33.500
x =	0.23
TREATMENT =	BAL
OFFSET?	NO

Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Figure 2.27: Calculation of the major road traffic volume Q_M

Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a).

Figure 17: Operations Phase Warrants for Turn Treatments–AM Peak (2033)

As shown, the required left-turn and right turn treatments for the proposed intersection are a Simple Right Turn (SR) and Basic Left Turn (BAL) treatment.

As per MRWA Guideline drawing 202231-0008, a Simple Right turn does not need require any upgrades or sealed shoulders at the proposed intersection (refer **Figure 18** for extract).

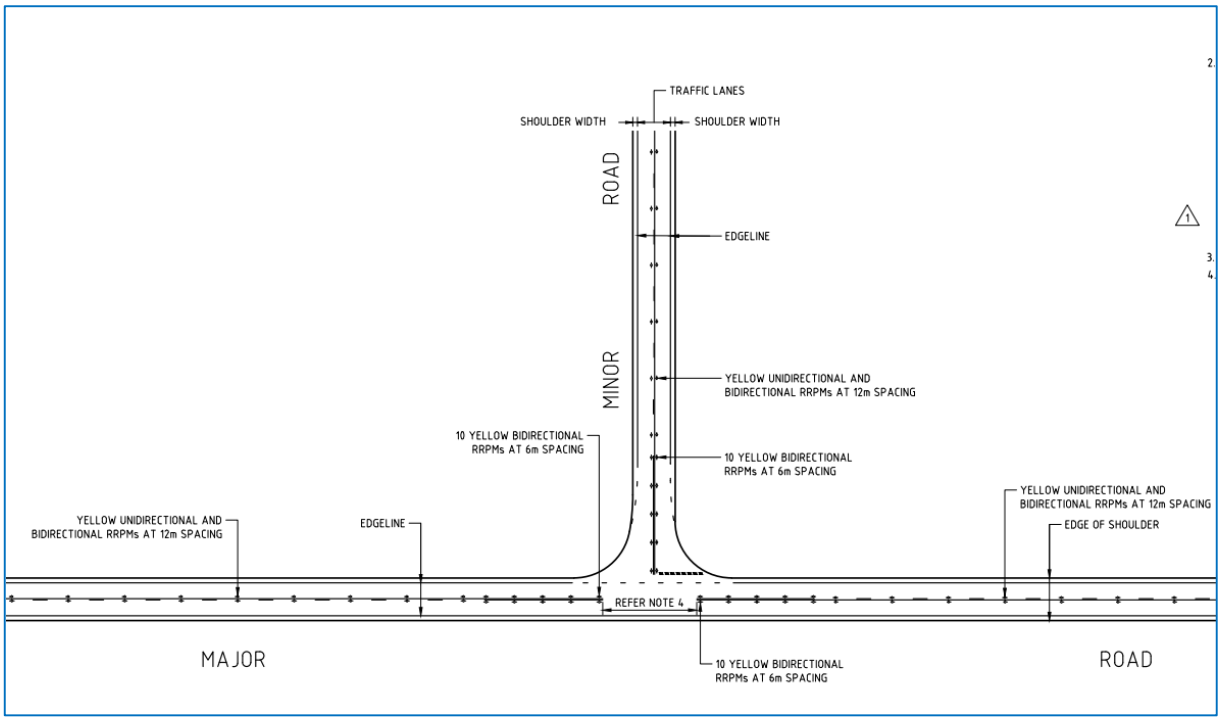


Figure 18: MRWA Guideline Drawing 202231-0008 Extract – SR/SL

As per MRWA Guideline drawing 202231-0007, a BAL treatment will require widening sealed shoulder turn treatments to be installed at the existing intersection (refer **Figure 19** for extract).

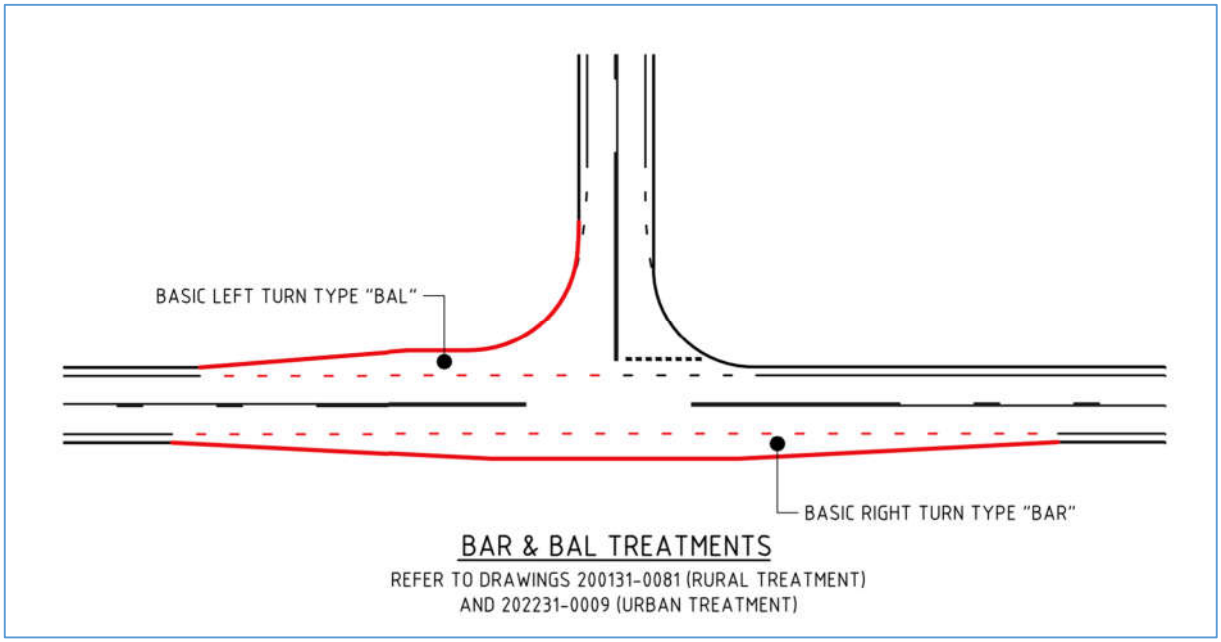


Figure 19: MRWA Guideline Drawing 202231-0007 Extract – BAR/BAL

4.6. Acceleration Lane

The RAV guideline provides the following advice with regards to acceleration lanes:

> *To assist in ensuring network performance levels are maintained, the assessor needs to identify if the acceleration lanes and turn pockets are present at intersections and the length of these treatments. Capturing this information in the assessment will assist in determining if network improvements are necessary, in consultation with the road manager.*

Note 11 on the MRWA T-Intersection guideline drawing (201431-0001) provides the following advice with regards to acceleration lanes:

> *Provide 600m long acceleration lane (or lanes) when the AADT on the through road exceeds 600 with at least 2 road trains per hour on the terminating leg.*
>
> *Consideration could be given to extending the acceleration lane length to 1500m (min) and line marking as an overtaking opportunity.*

AGRD04 notes that:

> *There are no simple numerical warrants for the provision of acceleration lanes. However, an auxiliary lane may be added on the departure side of a left turn or right turn if traffic is unable to join safely and/or efficiently with the adjacent through traffic flow by selecting a gap in the traffic stream.*
>
> *Acceleration lanes may be provided at major intersections depending on traffic analysis. However, they are usually provided only where:*
>
> - *insufficient gaps exist for vehicles to enter a traffic stream.*
> - *turning volumes are high (e.g. > 300 vph).*
> - *the observation angle falls below the requirements of the minimum gap sight distance model (for example, inside of horizontal curves).*
> - *heavy vehicles pulling into the traffic stream would cause excessive slowing of major road vehicles.*

The requirement for acceleration lanes has been assessed against the Austroads and Main Roads WA guidelines as detailed in **Table 10**.

Table 10: Acceleration Lane Warrants - Northbound

Note	Assessment
MRWA – To assist in ensuring network performance levels are maintained, the assessor needs to identify if the acceleration lanes and turn pockets are present at intersections and the length of these treatments. Capturing this information in the assessment will assist in determining if network improvements are necessary, in consultation with the road manager.	Due to the low volumes of traffic turning into and out of Strawberry NE Road, the level of service of the access is expected to be acceptable.
MRWA - Provide 600m long acceleration lane (or lanes) when the AADT on the through road exceeds 600 with at least 2 road trains (36.5m long) per hour on the terminating leg.	The AADT on the through road (Midlands Road) exceeds 600. Even though peak hour traffic during construction phase is 2 road trains per hour, it is expected that there will be only less than 1 haulage road train per hour during the operations phase on the terminating leg entering Midlands Road during peak hour. In addition, it is expected that construction phase trucks would be empty when entering Midlands Road. Since construction phase will only last for 12 months, and as construction delivery trucks would be empty when entering Midlands Road, the requirements to provide for a 600m acceleration lane have not been met. NOTE: As this drawing is a guideline only, the requirement of an acceleration lane is to be considered (when considering all other aspects) and is technically not mandatory).
Austroads - Acceleration lanes may be provided at major intersections depending on traffic analysis. However, they are usually provided only where: • *Insufficient gaps exist for vehicles to enter a traffic stream.*	For the 2033/34 scenario the background traffic during AM peak hour in eastbound direction is 50 vehicles per hour which equates to about 0.83 vehicles per minute and in westbound direction is 37 vehicles per hour which equates to about 0.61 vehicles per minute (1 vehicle every 41 seconds in either direction). Therefore, it is considered that there are sufficient gaps for trucks to enter a traffic stream.
Austroads continued: • *Turning volumes are high (e.g. > 300 vph).*	Turning volumes at the intersection during the peak hour is expected to be <300 vph.
Austroads continued: • *The observation angle falls below the requirements of the minimum gap sight distance model (for example, inside of horizontal curves).*	The intersection has good sight distances and observation angle.
Austroads continued: • *Heavy vehicles pulling into the traffic stream would cause excessive slowing of major road vehicles.*	For the 2033/34 scenario the background traffic during AM peak hour in eastbound direction is 50 vehicles per hour which equates to about 0.83 vehicles per minute and in westbound direction is 37 vehicles per hour which equates to about 0.61 vehicles per minute (1 vehicle every 41 seconds in either direction), which is considered frequently having gaps for RAV 7 trucks turning out of intersection. Trucks departing from the intersection have good sight distance towards both direction and therefore be able to pull into through traffic without causing excessive slowing.

Based on the above assessment an acceleration lane is not considered to be warranted by the proposed haulage traffic.

4.7. Swept Path Assessment

A swept path analysis on aerial photos for a Tri-Drive 36.5m MRWA RAV 5-7 vehicle template (20m turning radius) was completed to determine if the existing intersection geometry is sufficient to accommodate the proposed RAV vehicle movements.

Refer **Figure 20** for swept path analysis.

The analysis indicates that the existing intersection is not wide enough to cater for lane correct RAV7 (20m) vehicles for the left in and left out movements.

Figure 20:Intersection 2 Swept path Analysis

4.8. Railway Crossings

4.8.1. Railway Approach Sight Distance

As per MRWA's RAV Route Assessment Guidelines, the driver of a RAV approaching a give way or stop sign-controlled rail crossing must be able to see the crossing from a distance conforming to Appendix D of the guidelines. In this situation, the required sight distance is 170m on approach from Strawberry North-East Road, 46m on approach from Midlands Road (assuming maximum 80km/hr operating speed and 2% grade for Strawberry North-East Road and 30 km/hr turning speed from Midlands Road into Intersection 2).

Figure 21 and **Figure 22** show the sight lines and street view for the rail crossing. As shown, adequate sight distance is available.

Figure 21:Approach Sight Distance Measurement

Figure 22: Rail Crossing Looking from Midlands Road

4.8.2. Railway Sight Distance

The Main Roads WA *Standard Restricted Access Vehicle Route Assessment Guidelines* (RAV Guidelines) outlines the sight distance requirements for the driver of a RAV, after having stopped at a railway crossing with a Give way or Stop sign. It is outlined in Australian Standard AS1742.7 (2016) – Manual of Uniform Traffic Control Device = Part 7: Railway Crossing formula S3.

The S3 formula determines the minimum distance required for the driver of a vehicle stopped at the railway crossing to be able to see an oncoming train to safely cross. Confirmation of the train speed along the railway has not yet been obtained.

Train speeds have been estimated from the ARC Infrastructure: General Operational Instructions v1.7 website which confirms an empty train speed of 80km/hr for the Mingenew to Strawberry rail line and Strawberry to Irwin rail line (refer **Figure 23** for extract).

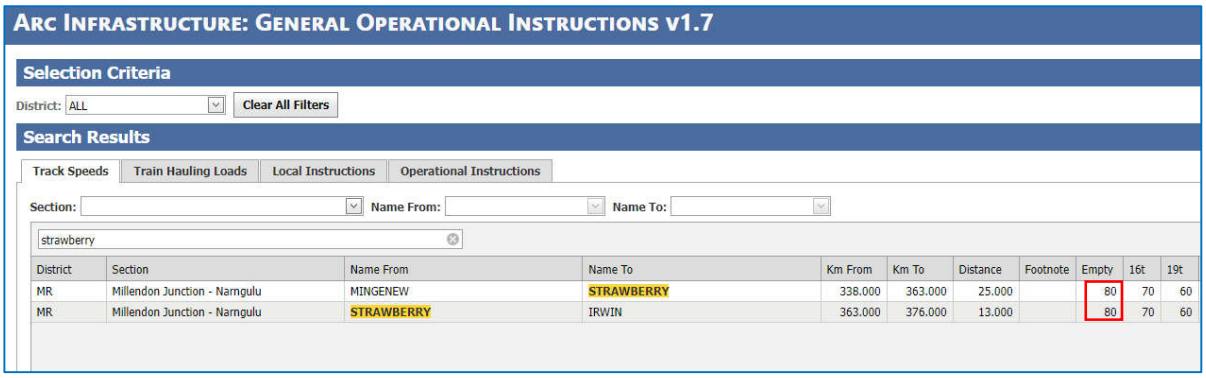


Figure 23:Rail Speed

Below are the following assumptions to determine S3.

- Railway speed (Vt) (Empty) - 80km/h
- RAV 7Truck (L) – 36.5m Length
- Driver eye height is 2.4m for Trucks.
- Sum of the perception time and time to depress clutch (J) – 2.5 s
- Width of Road Carriage way (Wr) – 8.0m
- Width of outer railway track (Wt) – 1.3m
- Angle between railed track and road (Z) – 90 degrees
- Clearance from the stop line to the nearest rail (Cv) – 3.5m
- Clearance from the stop line on the departure side of the crossing (Ct) – 5m
- Average acceleration of RAV 7– 0.29m/s^2

Based on the sight distance parameters above, **Table 11** shows the required minimum sight distance.

Table 11: Railway Sight Distance

Location	Design Speed Vt	J (s)	Gs	Wr/Wt (m)	Angle	Cv / Ct (m)	Length of design vehicle (RAV 5/6)	Average acceleration of RAV 5/6 m.s^{-2}	Required SD (m)	Available SD (m)	
										West	East
Intersecti on 2	80	2.5	1	9.0/1.3	90	3.5 / 5	36.5m	0.29	466m	+470m	466m

As shown, the available sight distance exceeds the minimum requirement. However, although the sight distance is assessed as conforming in the east direction, it is recommended that the sight lines are checked on site as sight distances could potentially be restricted by vegetation and/or existing terrain.

Figure 24 shows the available sight distance along the railway line.

Figure 24:Railway Sight Distance measurement

4.8.3. Stacking Distance

As per MRWA's RAV Route Assessment Guideline the following stacking distance is required:

- **Approach** to the rail: at least the length of the vehicle plus 3m is required between the rail holding line and the through traffic edge line i.e., 36.5m + 3m = 39.5m(based on RAV 7)
- **Departure** from the rail: at least the length of the vehicle between the rail holding line and the intersection holding line i.e., 36.5m (based on a RAV 7).

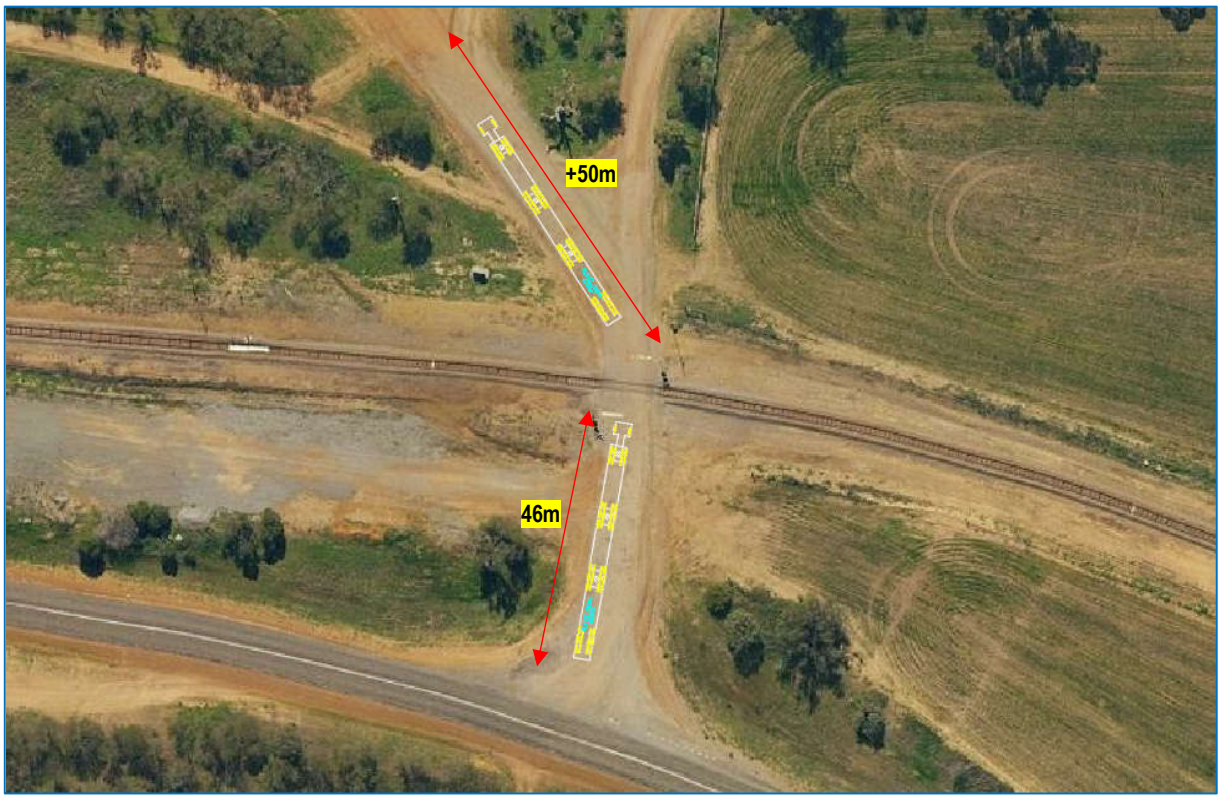


Figure 25: Stacking Distance

As shown in **Figure 25** there is more than minimum stacking distance available on the approach side and departure side for the intersection 2.

5. Intersection Concept Designs

5.1. General

Based on the outcomes of this assessment, a 2d concept design has been prepared for the recommended intersection upgrade (refer to **Appendix B – 2d Concept Design**).

6. Conclusions

This Transport Impact Statement has concluded the following:

- The estimated traffic generation can be accommodated within the predicted capacity of road network.
- The additional traffic generated by the proposed development is not considered likely to increase the likelihood of crashes to unacceptable levels.
- Midlands Road and Strawberry NE Road has the appropriate RAV7 network for proposed operation at present to allow the proposed haulage access onto the roads.
- There are sufficient sight distances at the Strawberry NE Road exit onto Midlands Road.
- Based on the predicted traffic volume, the existing Strawberry NE Road/Midlands Road intersection need upgrade to have Simple Right Turn (SR) and Basic Left Turn (BAL) treatment.
- An acceleration lane is not considered warranted towards both direction of Strawberry NE Road/Midlands Road intersection.
- The swept path analysis indicates the existing intersection need to be widened enough to cater for lane correct RAV7 (20m) vehicles for the left in and left out movements; and
- The Strawberry NE Road Railway Crossing has appropriate sight and stacking distances. However, the sight distance is assessed as confirming in the east direction, it is recommended that the sight lines are checked on site as sight distances could potentially be restricted by vegetation and/or existing terrain.

Appendix A – Traffic Counts

mainroads WESTERN AUSTRALIA

SITE 18337

Hourly Volume

Midlands Rd (M028)

East of Tabletop Rd (SLK 251.00)

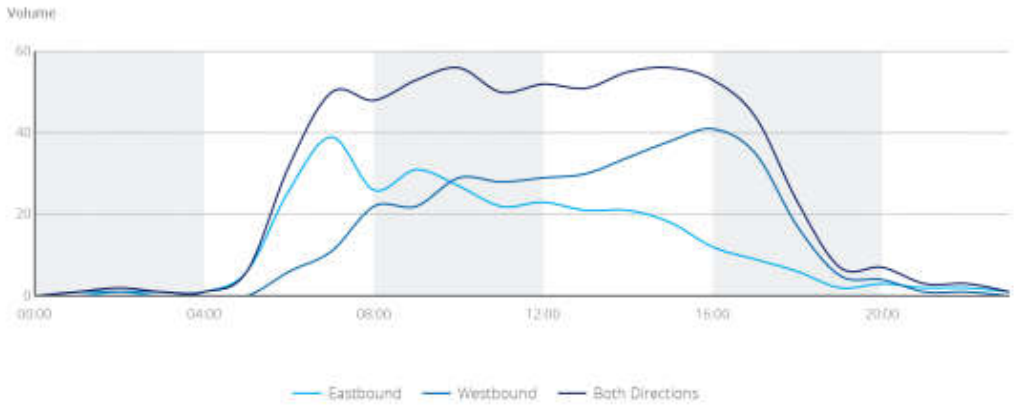
2022/23

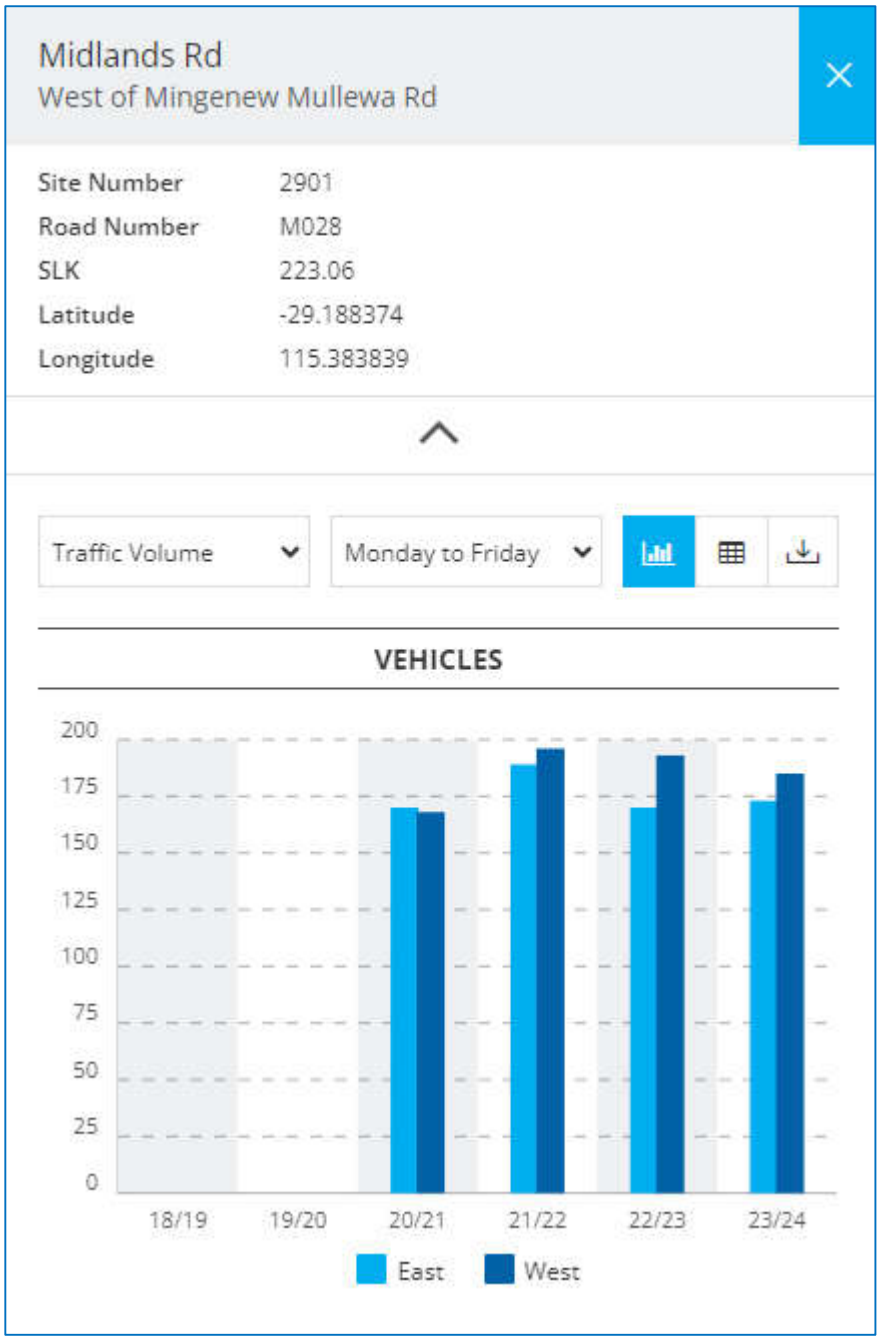
Monday to Friday

	All Vehicles			Heavy Vehicles			
	EB	WB	Both	EB	WB	Both	%
00:00	0	0	0	0	0	0	0.0
01:00	0	1	1	0	1	1	100.0
02:00	1	1	2	1	1	2	100.0
03:00	0	1	1	0	0	0	0.0
04:00	1	0	1	1	0	1	100.0
05:00	6	0	6	4	0	4	66.7
06:00	26	6	32	21	2	23	71.9
07:00	39	11	50	28	4	32	64.0
08:00	26	22	48	14	10	24	50.0
09:00	31	22	53	15	10	25	47.2
10:00	27	29	56	12	12	24	42.9
11:00	22	28	50	13	12	25	50.0
12:00	23	29	52	13	11	24	46.2
13:00	21	30	51	11	14	25	49.0
14:00	21	34	55	10	12	22	40.0
15:00	18	38	56	11	10	21	37.5
16:00	12	41	53	6	10	16	30.2
17:00	9	35	44	5	9	14	31.8
18:00	6	17	23	3	4	7	30.4
19:00	2	5	7	1	2	3	42.9
20:00	3	4	7	1	2	3	42.9
21:00	2	1	3	1	0	1	33.3
22:00	2	1	3	2	0	2	66.7
23:00	1	0	1	1	0	1	100.0
TOTAL	299	356	655	174	126	300	45.8

Peak Statistics

AM	TIME	07:15	09:45	09:30	06:30	09:15	07:15
	VOL	40	30	61	29	13	39
PM	TIME	12:30	15:45	15:15	12:45	12:45	12:45
	VOL	24	42	60	14	15	29




Midlands Rd
West of Mingenew Mullewa Rd
Site Number 2901
Road Number M028
SLK 223.06
Latitude -29.188374
Longitude 115.383839
Traffic Volume
Monday to Friday
VEHICLES
200
175
150
125
100
75
50
25
0
18/19
19/20
20/21
21/22
22/23
23/24
East
West

Appendix B – 2d Concept Design

NOTES:

1. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS NOTED OTHERWISE
2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ALL UNDERGROUND SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION

PLAN
1:500

LEGEND

- EXISTING CADASTRAL BOUNDARY
- EXISTING LINE MARKING
- EXISTING ROAD CENTRELINE
- EXISTING COMMS
- CONCEPT CARRIAGEWAY EDGE

SCALE 1:500

A1

REV	DATE	REVISION DESCRIPTION	CHK	APP	DRG No.	REFERENCE DRAWING TITLE
A	13.10.23	ISSUED FOR INFORMATION	NB	JB		

CLIENT: MINERAL RESOURCES

SCALE @A1
HORIZ: 1:500

PROJ. DATUM
HORIZONTAL: -
VERTICAL: -

LOCAL AUTHORITY
SHIRE OF IRWIN

SHAWMAC

INFORMATION ONLY

PROJECT INFORMATION	
DESIGNED BY:	NB
DRAWN BY:	AC
PROJECT No.	2309009
PROJ. MANAGER	-

LOCKIER PROJECT
MIDLANDS ROAD ACCESS ASSESSMENT
INTERSECTION 2
GENERAL ARRANGEMENT

DRAWING NUMBER: 2309009-SK003

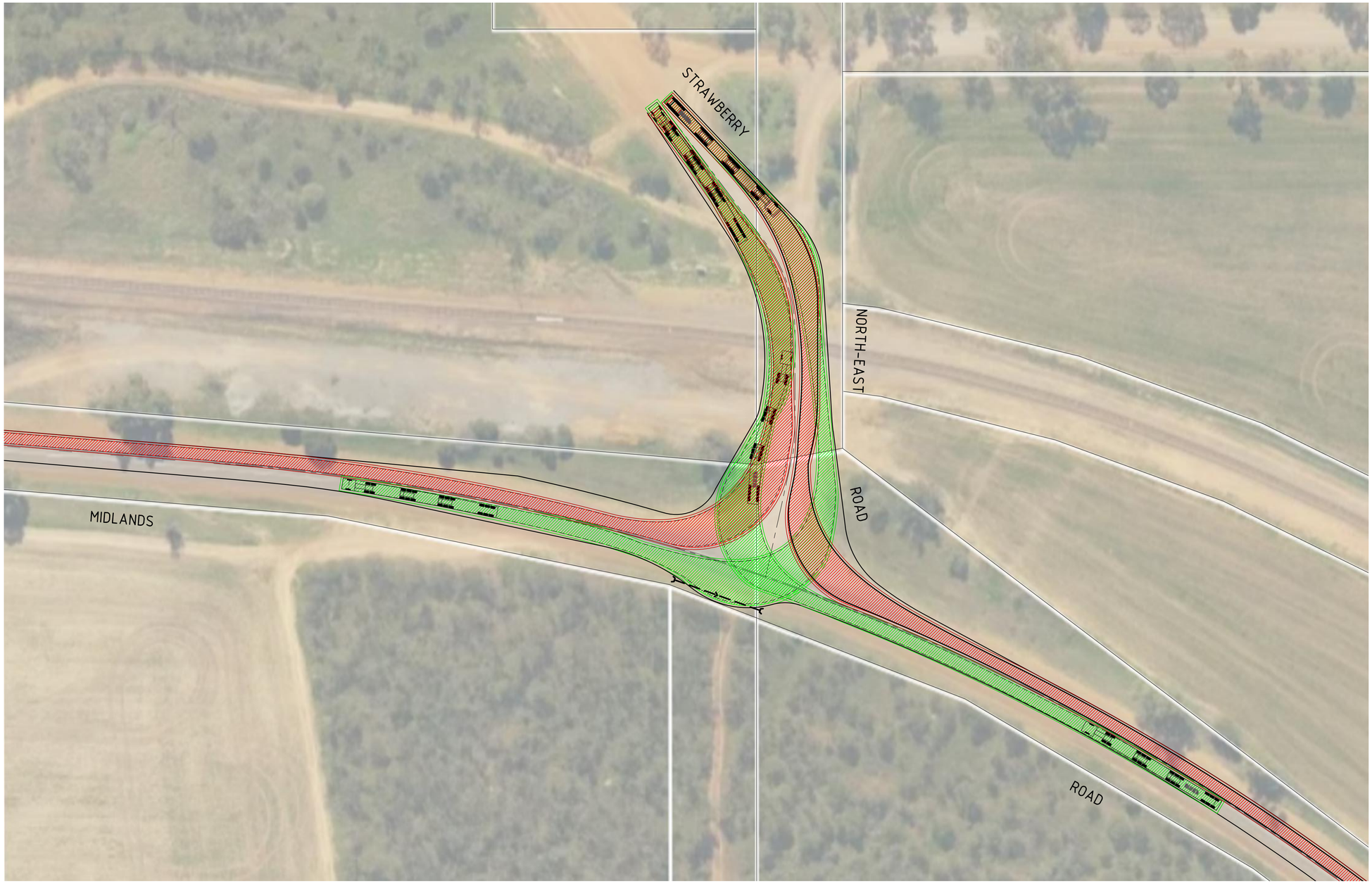
REV.: A

FILE REF: Y:\Jobs Active 2023\CE -Roads & Drainage\MRL_Lockier Project TIA_2309009\4. Drawings\4.5 Sketches\2309009 SK003 & SK004

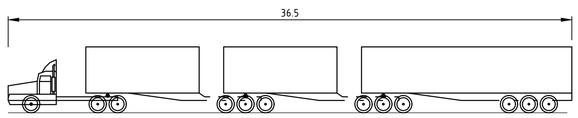
LAST SAVED BY: Adrien DATE: 13 October 2023 1:13 PM

NOTES:

1. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS NOTED OTHERWISE
2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ALL UNDERGROUND SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION



PLAN
1:500



MRWA RAV 6 B(20m)

OVERALL LENGTH	36.5m
OVERALL WIDTH	2.5m
OVERALL BODY HEIGHT	4.3m
MIN BODY GROUND CLEARANCE	0.54m
TRACK WIDTH	2.5m
LOCK-TO-LOCK TIME	6.00sec
TURNING RADIUS TO OUTSIDE FRONT WHEEL	20.0m

LEGEND

- EXISTING CADASTRAL BOUNDARY
- EXISTING LINE MARKING
- EXISTING ROAD CENTRELINE
- CONCEPT CARRIAGEWAY EDGE
- RAV 6 36.5m TURNING TEMPLATE LEFT TURN MOVEMENT
- RAV 6 36.5m TURNING TEMPLATE RIGHT TURN MOVEMENT

SCALE 1:500

A1

REV	DATE	REVISION DESCRIPTION	CHK	APP	DRG No.	REFERENCE DRAWING TITLE
A	13.10.23	ISSUED FOR INFORMATION	NB	AC		

CLIENT: MINERAL RESOURCES

SCALE @A1
HORIZ: 1:500

PROJ. DATUM
HORIZONTAL: -
VERTICAL: -

LOCAL AUTHORITY
SHIRE OF IRWIN

SHAWMAC

INFORMATION ONLY

PROJECT INFORMATION	
DESIGNED BY:	NB
DRAWN BY:	AC
PROJECT No.	2309009
PROJ. MANAGER	-

LOCKIER PROJECT
MIDLANDS ROAD ACCESS ASSESSMENT
INTERSECTION 2
TURNING TEMPLATES

DRAWING NUMBER: 2309009-SK004

REV.: A

FILE REF: Y:\Jobs Active 2023\CE -Roads & Drainage\MRL_Lockier Project TIA_2309009\4. Drawings\4.5 Sketches\2309009 SK003 & SK004

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