

## Appendix 8

### Traffic Impact Assessment Report

Prepared by Sinclair Knight Merz (SKM)

## Mt Emerald Wind Farm



### TRAFFIC IMPACT ASSESSMENT REPORT

- Revision 0
- 8 August 2011



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# **1. Introduction**

## **1.1. Purpose of this Document**

Sinclair Knight Merz (SKM) has been commissioned by Transfield Services Pty Ltd to undertake a traffic impact assessment for the proposed Mt Emerald Wind Farm (MEWF) project at Walkamin.

The purpose of this report is to review the impact that the proposed MEWF development will have on the surrounding road network, including requirements for access to the project site and tourist viewing area during construction and operation.

## **1.2. Background and Current Situation**

The site of the project is situated on the Atherton Tableland within the jurisdiction of the Tablelands Regional Council (TRC) and is broadly located approximately 50 km south-west of the city of Cairns in far north Queensland. More locally, the site is approximately 18 km south of the township of Mareeba, 15 km north of Atherton and 6 km south-west of Walkamin.

The major road adjacent to the proposed site is the Kennedy Highway running generally in a north-south direction and forms part of the planned route for the transport of the wind tower components from their delivery location. This State-Controlled road is a two lane, two-way, sealed road with sealed shoulders, unsealed verges and is a gazetted 23-25 m B-double route.

From the main highway at Walkamin, the recommended (and most viable) route to the proposed MEWF site is via Hansen Road and Springmount Road, while direct access to the site is off Kippen Drive. All of these roads are locally controlled by the TRC and are generally two lane, two-way, sealed roads with unsealed shoulders and verges, except for Kippen Drive which is largely an unbound gravel road/track.

Based on information received from Transfield, a maximum of 80 wind turbines are expected to be constructed on the site and a tourist viewing facility is likely but its location is currently unknown. A plan showing the locality of the planned MEWF site and overall development layout is included in **Appendix A** for reference.

## **1.3. Site Investigation**

A site investigation of the main access and preferred roads to the proposed MEWF development from the Kennedy Highway at Walkamin was undertaken by SKM personnel on Wednesday 6 July 2011. The site investigation included the assessment of:





- Safety issues (sight distances, geometry, signs, lines, etc) at all main access points off Hansen Road and Springmount Road
- General road widths, geometry, condition of pavement and culverts/causeways along all roads to the proposed site access from the Kennedy Highway

Photos taken during the site inspection are included for reference in **Appendix B**.

#### **1.4. Transport Routes**

There were two identified possible routes for the transport of the wind tower components from their eventual delivery point to the Kennedy Highway at Walkamin. The following identified routes comprise roads that have been gazetted for 23-25 m B-double vehicles.

The first of these options (identified as the coastal route) assumes the wind tower components will be delivered at a coastal port and is via the Palmerston Highway which commences at the intersection of the Bruce Highway, approximately five kilometres north of Innisfail. This road traverses the Great Dividing Range for approximately 58 km through mountainous terrain before following Millaa Millaa - Malanda Road north through the Malanda township. Continuing in a north-west direction along Malanda - Atherton Road, the route bypasses Atherton by following Tinaroo Falls Dam Road and Kairi Road before eventually intersecting the Kennedy Highway approximately five kilometres north of Atherton.

The second option (identified as the inland route) assumes the wind tower components will be delivered at an inland location and is via Kennedy Developmental Road and the Kennedy Highway passing through Mt Garnet. This route continues in a north-east direction past Ravenshoe and joins onto East Evelyn Road towards the township of Millaa Millaa. Not dissimilar to the coastal option, this route then follows the same roads to bypass Atherton and intersect the Kennedy Highway approximately five kilometres north of Atherton.

Plans detailing both of the identified routes are included for reference in **Appendix A**. The finalised route will be determined by the equipment supplier, who will ultimately be responsible for performing a detailed investigation of transportation requirements to the proposed MEWF site.



## **2. Traffic and Access**

### **2.1. Existing Traffic Conditions**

For the most part, the Kennedy Highway is posted at 100 km/h, but approaching the intersection with Hansen Road, this speed limit is reduced to 80 km/h. Not dissimilar, Hansen Road and Springmount Road are also generally posted at 100 km/h, but the speed limit is reduced to 80 km/h just prior to the junction with the main highway. The existing traffic conditions around this intersection were observed to be non congestive.

The speed limits on the more significant intersecting roads off Hansen Road (i.e. Chewko Road and Channel Road) are posted at 100 km/h and 80 km/h respectively. Again, the current traffic conditions around this two intersections were observed to be non congestive. No speed limit was observed along the length of Kippen Drive and traffic volumes were considered negligible.

### **2.2. Road Hierarchy**

Direct access to the proposed MEWF site is via locally controlled roads, namely Hansen Road, Springmount Road and Kippen Drive. Hansen Road eventually intersects the Kennedy Highway which is a State Controlled road.

### **2.3. Road Arrangements**

The following roads described below were identified as the preferred route from the Kennedy Highway at Walkamin to the access point of the proposed MEWF site.

#### **2.3.1. Hansen Road and Springmount Road**

Hansen Road and Springmount Road are largely sealed bitumen, two lane, two-way roads with a nominal pavement width between 8.0 m - 8.2 m and comprising only centre line marking delineation. Hansen Road runs from the Kennedy Highway through several minor intersections and property accesses before shifting names to Springmount Road at the Granite Creek causeway.

These two roads have been gazetted for 23-25 m B-double vehicles accessing the Arriga Mill and trucks were observed regularly using the route. For the most part, road edge guide posts (REGP) are present along the road's length and observations made on site revealed that many REGP's located on bends were damaged or knocked over, possibly as a result of large vehicles using the narrow carriageway. The installation of truck warning signs or special signage advising motorists that these local roads form part of a B-double route should ideally be considered for the current situation, and for future operations.



The road's vertical geometry is predominantly flat but sags down at main causeway locations. Several horizontal curves are present along the length of this road that all have acceptable radii except for a bend near the Channel Road intersection. Overall, the majority of horizontal curves encompass pavement widening which is appropriate for their radii.

The two major cross drainage culverts/causeways that were identified along these local roads are detailed below in **Table 1**.

■ **Table 1 – Hansen Road and Springmount Road Culverts/Causeways**

Chainage* (km)	Type	Number / Size (mm)	Span (m)	Comments
3.90	Slab Link Box Culvert (SLBC)	3 / 3000 × 3000	9.0	Structure in good condition. Considerable silting (~1.6 m) observed which is possibly causing overtopping of Hansen Road in major storm events.
5.90	Reinforced Concrete Box Culvert (RCBC)	5 / 2100 × 1500	9.3	Structure in good condition and there were no visible signs of overtopping. Consistent water level flowing through culvert.

\* Distance from the Kennedy Highway

Also worth noting was that overhead power lines crossing Hansen Road at two locations north of the Channel Road intersection were identified that might present possible impacts for the transport of oversized wind tower components. Clearance to these overhanging lines will need to be checked to ensure compliance.

## 2.4. Intersection Arrangements

The following intersections described below were identified along the preferred route from the Kennedy Highway at Walkamin to the proposed MEWF site. All private property and small commercial/agricultural access points along the route were reviewed but not thoroughly investigated and hence are not included in this report.

For diagrams of different types of intersection arrangements and sight distance categories mentioned below refer to **Appendix C**. Subsequently, details regarding the types of signage proposed are included for reference in **Appendix D**.

### 2.4.1. Kennedy Highway and Hansen Road

The junction of Kennedy Highway (through road) and Hansen Road (side street) is a T-intersection, controlled by a Give Way sign (identification number R1-2) on the minor road. For traffic turning from the main road, the intersection comprises a 90 m long Auxiliary Left Turn



(AUL) lane and an 80 m long Channelised Right Turn (CHR) lane. Dedicated bicycle lanes on both sides of the Kennedy Highway are also present through the intersection.

Approaching the Hansen Road intersection from both directions on the Kennedy Highway, Side Road Junction signs (W2-4) are present, including appropriate intersection direction finger board signs (G2-1). Similarly, approaching the Kennedy Highway along Hansen Road there is a T-Junction sign (W2-3) prior to the intersection and a double-sided intersection finger board sign (G2-4) above a sight board (G4-1-1) facing forthcoming motorists.

The section of Kennedy Highway through the intersection is predominantly flat (0.5%) and straight, while the straight Hansen Road approach has a slight positive grade of approximately 2% close to the junction. The required and achievable sight distances for this intersection including any additional comments are provided below in **Table 2**.

■ **Table 2 – Kennedy Highway and Hansen Road Intersection Sight Distances**

Approach	Sight Distance Category	Absolute Minimum*	Desirable**	Achievable	Comment
Kennedy Hwy (from Atherton)	SISD (1.15m to 1.15m)	203 m	215 m	433 m	Meets SISD requirement
Kennedy Hwy (from Mareeba)	SISD (1.15m to 1.15m)	203 m	215 m	555 m	Meets SISD requirement
Hansen Rd (from MEWF)	ASD (1.15m to 0.00m)	124 m	136 m	178 m	Meets ASD requirement

\* Sight distance assuming a reaction time of 2.5 seconds

\*\* Sight distance assuming a reaction time of 2.0 seconds

A review of the sight distances on site reveal that acceptable values are obtainable from all approaches to this intersection, with no further recommendations to upgrade this junction necessary.

#### 2.4.2. Hansen Road and Chewko Road

The junction of Hansen Road (through road) and Chewko Road (side street) is a T-intersection, controlled by a Give Way sign (R1-2) on the minor road. No additional pavement widening is provided to accommodate turning traffic from Hansen Road into Chewko Road, but observed traffic conditions provided adequate gaps to safely perform the turning manoeuvre with negligible delay to the through traffic.

Approaching the Chewko Road intersection from both directions on Hansen Road, Side Road Junction signs (W2-4) are present, including an appropriate Street Name sign (G5-1). Similarly, approaching Hansen Road along Chewko Road there is a T Junction sign (W2-3) prior to the intersection and a sight board (G4-1-1) facing forthcoming motorists. It was noted on site that the



Give Way sign was located approximately 10 m prior to its related line marking at the intersection. This situation potentially creates confusion for the driver as to where the actual junction yielding point is and ideally the sign should be relocated adjacent to the corresponding Give Way linemarking.

The section of Hansen Road through the intersection is predominantly flat and straight, while the level Chewko Road approach has a very minor horizontal bend close to the junction of the two roads. The required and achievable sight distances for this intersection including any additional comments are provided below in **Table 3**.

■ **Table 3 – Hansen Road and Chewko Road Intersection Sight Distances**

Approach	Sight Distance Category	Absolute Minimum*	Desirable**	Achievable	Comment
Hansen Rd (from MEWF)	SISD (1.15m to 1.15m)	282 m	297 m	555 m	Meets SISD requirement
Hansen Rd (to MEWF)	SISD (1.15m to 1.15m)	282 m	297 m	255 m	Does not meet SISD requirement
Chewko Rd (from Chewko)	ASD (1.15m to 0.00m)	190 m	205 m	112 m	Does not meet ASD requirement

\* Sight distance assuming a reaction time of 2.5 seconds

\*\* Sight distance assuming a reaction time of 2.0 seconds

The presence of a large tree located close to the road on the north-east corner of the intersection has been identified as hazard near a high speed carriageway and also creates visibility issues for vehicles exiting Chewko Road. It is recommended that this tree be removed to alleviate both concerns.

Although both the desirable and absolute minimum approach sight distances on the Chewko Road approach are not readily met, the presence of a T-Junction advance warning sign and clear visibility to the Give Way sign alleviates the situation. If the Give Way sign was to be moved around the corner adjacent to the corresponding line, then it is recommended to install a Give Way Ahead sign (W3-2) for prior warning to motorists of the upcoming intersection.

#### **2.4.3. Hansen Road and Channel Road**

The junction of Hansen Road (through road) and Channel Road (side street) is a T-intersection, controlled by a Give Way sign (R1-2) on the minor road. Again, no additional pavement widening is provided to accommodate turning traffic from Hansen Road into Channel Road, but observed traffic conditions provided adequate gaps to safely perform the turning manoeuvre with negligible delay to the through traffic.



The junction of Channel Road with Hansen Road occurs on the corner of a significant horizontal bend in the main road's geometry. The section of Hansen Road through the intersection also comprises a steep grade of approximately 6% rising up from the low causeway crossing of Granite Creek, while the straight Channel Road approach has a slight positive grade of 2% close to the junction of the two roads.

Approaching the Channel Road intersection from both directions on Hansen Road, Side Road Junction signs (W2-4) are present, including an appropriate Street Name sign (G5-1). With the side street located on a bend on the main road, it is recommended that the Side Road Junction signs be replaced with more appropriate Side Road Junction on Curve signs (W2-9). Nearing Hansen Road from Channel Road there is a T-Junction sign (W2-3) prior to the intersection and a sight board (G4-1-1) facing approaching motorists. In addition, the inclusion of a Road Subject to Flooding sign (G9-21) on Channel Road just prior to the intersection provides adequate advance warning of the Granite Creek causeway located on Hansen Road. The pavement marking on site was observed to be significantly weathered and faded, ideally requiring an overlay of new paint.

The required and achievable sight distances for this intersection including any additional comments are provided below in **Table 4**.

■ **Table 4 – Hansen Road and Channel Road Intersection Sight Distances**

Approach	Sight Distance Category	Absolute Minimum*	Desirable**	Achievable	Comment
Hansen Rd (from MEWF)	SISD (1.15m to 1.15m)	264 m	279 m	117 m	Does not meet SISD requirement
Hansen Rd (to MEWF)	SISD (1.15m to 1.15m)	307 m	322 m	92 m	Does not meet SISD requirement
Channel Rd (from Walkamin)	ASD (1.15m to 0.00m)	124 m	136 m	112 m	Does not meet ASD requirement

\* Sight distance assuming a reaction time of 2.5 seconds

\*\* Sight distance assuming a reaction time of 2.0 seconds

A review of the sight distances on site reveal that there is severe inadequacy of achieving absolute minimum values on all approaches for the design speeds of the two roads. Although the presence of some suitable warning signs exist on site, this result highlights that some works would be desirable to improve sight distances and bring this intersection up to standard.

#### 2.4.4. Springmount Road and Kippen Drive

The junction of Springmount Road (through road) and Kippen Drive (side street) is a T-intersection, controlled by a Give Way sign (R1-2) on the minor road. Again, no additional



pavement widening has been made to accommodate turning traffic from Springmount Road into Kippen Drive.

The junction of Kippen Drive with Springmount Road occurs on the corner of another significant horizontal bend in the main road's geometry. The section of Springmount Road through the intersection also comprises a relatively steep grade of approximately 4% rising up from a low causeway crossing, while the Kippen Drive approach is predominantly flat (1%) with a minor horizontal bend close to the junction of the two roads.

Approaching the Channel Road intersection from both directions on Springmount Road, Side Road Junction signs (W2-4) are present, including an appropriate Street Name sign (G5-1). With the side road located on a bend in the main road, it is recommended that the Side Road Junction signs be replaced with more appropriate Side Road Junction on Curve signs (W2-9). Approaching Springmount Road from Kippen Drive there is a lack of warning signs of the upcoming intersection apart from the Give Way sign at the junction. The pavement marking on site was observed to be significantly weathered and faded, ideally requiring an overlay of new paint.

The required and achievable sight distances for this intersection including any additional comments are provided below in **Table 5**.

■ **Table 5 – Springmount Road and Kippen Drive Intersection Sight Distances**

Approach	Sight Distance Category	Absolute Minimum*	Desirable**	Achievable	Comment
Springmount Rd (from Arriga)	SISD (1.15m to 1.15m)	298 m	313 m	213 m	Does not meet SISD requirement
Springmount Rd (from Walkamin)	SISD (1.15m to 1.15m)	269 m	284 m	118 m	Does not meet SISD requirement
Kippen Dr (from MEWF)	ASD (1.15m to 0.00m)	47 m	54 m	18 m	Does not meet ASD requirement

\* Sight distance assuming a reaction time of 2.5 seconds

\*\* Sight distance assuming a reaction time of 2.0 seconds

A review of the sight distances on site reveal that there is severe inadequacy of achieving absolute minimum values on all approaches for the design speeds of the two roads. Although the presence of some suitable warning signs exist on site, this result highlights that some works would be desirable to improve sight distances and bring this intersection up to standard.



## 2.5. Access Arrangements

The following road described below was identified as the only route from Springmount Road to the access point of the proposed MEWF site.

### 2.5.1. Kippen Drive

Kippen Drive is largely a rocky unsealed bitumen road/track with a nominal width varying between 3.5 m - 6.0 m. The road runs from the intersection of Springmount Road to the access point of the proposed MEWF development through several creek crossings and also provides direct access to some residential properties. A gate was also encountered on the road, located approximately 200 m from the intersection with Springmount Road.

The road's vertical geometry follows a rolling rural profile around the base of Mt Emerald, sagging down at culverts and main creek crossings with a maximum instantaneous vertical grade of 8.7%. Several horizontal curves are present along the length of this road that all have acceptable radii except for a substandard bend situated approximately 400 m from the proposed MEWF development access.

Some of the road formation comprises longitudinal drainage in the form of shallow table drains and several culverts and causeways were identified along this road which is detailed below in **Table 6**.

■ **Table 6 – Kippen Drive Culverts/Causeways**

Chainage* (km)	Type	Number / Size (mm)	Span (m)	Comments
0.05	Reinforced Concrete Pipe (RCP)	1 / 450	7.0	Structure in good condition. Concrete headwalls present.
0.10	Reinforced Concrete Pipe (RCP)	1 / 600	9.0	Minor disjointment of some cells. Concrete headwalls present.
0.60	Corrugated Steel Helical Pipe (CSHP)	1 / 1050	7.0	Rusted invert. Some deformation of pipe. ~ 800 mm cover.
1.35	Concrete Floodway	25 m × 3.6 m		Silting present upstream
1.40	Rock Floodway	10 m × 3.6 m		Very rocky. Silting present upstream.
2.10	Rock Floodway	15 m × 3.6 m		Rock and gravel repair area
2.20	Corrugated Steel Helical Pipe (CSHP)	1 / 375	3.6	Rusted invert. Minor silting.
2.50	Corrugated Steel Helical Pipe (CSHP)	2 / 1500	7.0	Undermining of cover material. Some deformation of pipe. ~ 500 mm cover.
2.70	Corrugated Steel Helical Pipe (CSHP)	1 / 375	3.6	Rusted invert. Minor silting.





Chainage* (km)	Type	Number / Size (mm)	Span (m)	Comments
3.10	Corrugated Steel Helical Pipe (CSHP)	1 / 1800	9.0	Rusted invert. Some deformation of pipe.
3.50	Corrugated Steel Helical Pipe (CSHP)	1 / 1650	8.0	Rusted invert. Some deformation of pipe.
3.80	Corrugated Steel Helical Pipe (CSHP)	1 / 375	3.6	Rusted invert. ~ 800 mm cover.
4.00	Corrugated Steel Helical Pipe (CSHP)	1 / 375	3.6	Rusted invert. Possibly undersized due to considerable scouring of road and cover material.
4.10	Corrugated Steel Helical Pipe (CSHP)	1 / 1050	7.0	Rusted invert. ~ 1000 mm cover.

\* Distance from Springmount Road

The majority of the identified culverts comprised minimal cover and hence exhibited signs of minor structural deformation. Several locations were identified where structures were undersized most likely causing the scouring of the road and undermining of the cover material observed on site. An upgrade of the road formation width, including redesign for most of the cross drainage of Kippen Drive will need to be undertaken to cater for the expected construction and operational traffic generated by the proposed MEWF development.

## 2.6. Wind Tower Component Transportation

There will be several varying types of components required for the construction of the wind towers, including tower sections, rotor blade, hubs and generators. These components will be transported to the site by a range of vehicles including low loader trailers, drop base vehicles, semi trailers and adapter vehicles. Traffic control will be required during transport of construction materials and wind tower components.

## 2.7. Existing and Predicted Traffic Volumes

Traffic has been recorded on a section of the Kennedy Highway that includes the intersection with Hansen Road by TMR in 2008. Similarly, another applicable traffic count has been conducted on Hansen Road near the intersection with Chewko Road by TRC in 2010.

The results of these two traffic counts are shown below in **Table 7** and display an Annual Average Daily Traffic (AADT) value expressed as vehicles per day (vpd) and a corresponding percentage of heavy vehicles where applicable.



■ **Table 7 – Existing and Predicted Traffic Volumes**

Road	Location	Count Year	AADT (vpd)	Peak Hour (vph)	Heavy Vehicles (%)	Design Year AADT (vpd)	Design Year Peak Hour (vph)
Kennedy Highway	Hansen Road Intersection	2008	4,891	587	5.9	6,949	834
Hansen Road	Chewko Road Intersection	2010	1,318	159	-	1,798	216

The following assumptions have been made regarding the prediction of peak hour and design year AADT volumes:

- Peak hour traffic generation is 12% of the recorded AADT and is expressed as vehicles per hour (vph)
- 10 year design life making the design traffic year 2022
- Traffic growth of 3% per annum

## 2.8. Traffic Generation and Distribution

Assumptions made regarding the traffic expected to utilise the main access on Kippen Drive is as follows:

- A maximum of six semi-trailers (adapted to carry the propeller blades) per tower during construction. A maximum of 80 wind towers are planned to be constructed, equating to 960 truck movements through the access during the construction phase.
- A maximum of 40 single unit truck trips during construction per tower, equating to 6,400 truck movements through the access during the construction phase
- Eight hour working days with daily traffic volumes during construction not generating typical peak hours but is instead spread equally over this working period
- A maximum of 30 vpd for workers during construction
- A maximum of 8 vpd for residential properties during construction and operation
- Peak hour traffic generation during operation is 12% of the AADT
- Minimal use for maintenance after construction

The construction for this project is expected to occur over a two year period. Based on advice received from Transfield, it is planned to have all civil works completed in the first six months which will include the construction of roadways and earth platforms for the wind towers and



turbines. Subsequently, the transport for the components of all 80 towers will occur over the following 12 months. Commissioning of all 80 towers will then occur over the last six months of the two year construction timeframe. Assuming that the construction period of this project commences in 2012, then the operation phase of the project should begin in 2014.

Using the assumed construction period and maximum expected traffic volumes as a base, the following peak daily traffic movements are estimated during construction:

- AADT (Construction):

$$\begin{aligned} &= \frac{960 \text{ vehicles}}{365 \text{ days}} + \frac{6400 \text{ vehicles}}{365 \text{ days}} + 30 \text{ vpd} + 8 \text{ vpd} \\ &= 59 \text{ vpd} \end{aligned}$$

- Peak Hour (Construction):

$$\begin{aligned} &= \frac{59 \text{ vpd}}{8 \text{ work hours}} \\ &= 8 \text{ vph} \end{aligned}$$

Kippen Drive is also planned to provide access to a viewing area after construction is complete and this will be utilised by some tourist traffic. Based on anecdotal evidence and local knowledge of the existing viewing area at the Windy Hill wind farm, an assumption has been made that 100 vpd will be utilising the proposed viewing area. The following daily traffic movements are estimated during operation:

- AADT (Operation):

$$\begin{aligned} &= 100 \text{ vpd} + 8 \text{ vpd} \\ &= 108 \text{ vpd} \end{aligned}$$

- Peak Hour (Operation):

$$\begin{aligned} &= 108 \text{ vpd} \times 12\% \\ &= 13 \text{ vph} \end{aligned}$$



### **3. Recommendations and Conclusion**

#### **3.1. Recommended Route Configuration**

There were two possible routes identified for the transport of construction materials from their delivery point to the Kennedy Highway at Walkamin. The finalised route will be determined by the equipment supplier, who will ultimately be responsible for performing a detailed investigation of transportation requirements to the site.

From the Kennedy Highway at Walkamin, the assessed and recommended route follows Hansen Road and Springmount Road before turning onto Kippen Drive to access the proposed MEWF development entrance.

As the route along Hansen Road and Springmount Road is gazetted for large vehicles accessing the Arriga Mill, it is recommended that special warning signage (TC1210) be installed to denote that B-doubles are present along these local roads. As a minimum, Trucks Crossing or Entering (W5-22) signs should be provided to warn motorists of the large articulated vehicles regularly using the route. These works should ideally be the responsibility of the TRC.

#### **3.2. Recommended Intersection Configurations**

##### **3.2.1. Kennedy Highway and Hansen Road**

Overall, this intersection was appropriately signed and makes adequate provision to cater for the current and expected future turning traffic. No further recommendations to upgrade this junction have been warranted.

##### **3.2.2. Hansen Road and Chewko Road**

The extra vehicles generated by the proposed MEWF development doesn't directly affect the operation of this intersection however some safety concerns regarding achievable sight distances around this junction and location of signage were identified. It is recommended that the large tree adjacent to the intersection be removed to improve sight distance from Chewko Road and also that the Give Way sign on the minor road be relocated next to the corresponding line marking. In addition, it is advised to install a Give Way Ahead sign on Chewko Road to provide additional prior warning to motorists of the upcoming intersection with Hansen Road. These works should ideally be the responsibility of the TRC.



### **3.2.3. Hansen Road and Channel Road**

Not dissimilar to the intersection with Chewko Road, the extra vehicles generated by the proposed MEWF development doesn't directly affect the operation of this intersection, however some safety concerns regarding achievable sight distances around this junction and types of signage used were also identified. Improving sight distances around this intersection to achieve minimum values would require considerable earthworks to cut back batters. Instead, it is recommended that some signage be altered (namely the Side Road Junction signs) to provide advance warning to motorists of the road environment ahead. Some vegetation clearing on both approaches to Channel Road will also assist in improving visibility at this intersection. These works should ideally be the responsibility of the TRC.

### **3.2.4. Springmount Road and Kippen Drive**

Based on the recommended route configuration from the Kennedy Highway (via Hansen Road and Springmount Road), transportation of all tower components will utilise Kippen Drive by turning left in and right out.

As a result of the 59 vpd (peak 8 vph) expected to be generated during the construction of the proposed MEWF development and the 1398 vpd (peak 168 vph) on Springmount Road, it is warranted to upgrade the Kippen Drive and Springmount Road intersection with BAR and BAL treatments that cater specifically for articulated vehicles. Refer to the Road Planning and Design Manual (RPDM) figures provided in **Appendix C**. However, due to the safety issues concerning the substandard sight distances available at this junction, it is recommended that an AUL treatment be provided in substitute of the BAL. Some minor pavement and seal widening will be required for the BAR/AUL intersection treatments to accommodate the swept path of the turning movement for the typical design vehicles. Refer to **Appendix E** for indicative extents of widening required.

Subsequently, to improve achievable sight distances at this intersection, it is recommended to undertake vegetation clearing for both approaches to Kippen Drive. To provide additional warning to motorists that trucks will be turning out of Kippen Drive onto Springmount Road it is recommended to install Trucks Entering (TC1421) supplementary sign plates underneath the new Side Road Junction on Curve (W2-9A) signs for both intersection approaches.

## **3.3. Recommended Access Configurations**

An upgrade of the road formation width, including assessment and possible redesign for most of the cross drainage of Kippen Drive will need to be undertaken to cater for the expected construction and operational traffic generated by the proposed MEWF development. Provision will also need to be made to maintain appropriate access to the residential properties that utilise this easement.



## 4. References

- Queensland Department of Transport and Main Roads (2006) *Road Planning and Design Manual – Chapter 13: Intersection at Grade*
- Queensland Department of Transport and Main Roads (2004) *Road Planning and Design Manual – Chapter 7: Cross Section*
- Queensland Department of Transport and Main Roads (2002) *Road Planning and Design Manual – Chapter 9: Sight Distance*



## Appendix A Locality Plan



## Appendix B Site Photos





■ Figure 1 – ASD travelling east along Hansen Road approaching the Kennedy Highway



■ Figure 2 – SISD looking south on the Kennedy Highway from Hansen Road



■ Figure 3 – SISD looking north on the Kennedy Highway from Hansen Road



■ Figure 4 – ASD travelling south along Chewko Road approaching Hansen Road

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■ Figure 5 – SISD looking west on Hansen Road from Chewko Road



■ Figure 6 – SISD looking east on Hansen Road from Chewko Road





■ Figure 7 – ASD travelling north-east along Channel Road approaching Hansen Road



■ Figure 8 – SISD looking north-east on Hansen Road from Channel Road



■ Figure 9 – SISD looking south-west on Hansen Road from Channel Road



■ Figure 10 – ASD travelling north along Kippen Drive approaching Springmount Road





■ Figure 11 – SISD looking west on Springmount Road from Kippen Drive



■ Figure 12 – SISD looking east on Springmount Road from Kippen Drive

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■ Figure 13 – Typical cross section of Kippen Drive (unsealed 6 m wide gravel road)



■ Figure 14 – Typical cross section of Kippen Drive (unsealed 4 m wide gravel track)





■ Figure 15 – Typical cross section of Kippen Drive (unsealed 3.5 m wide gravel track)

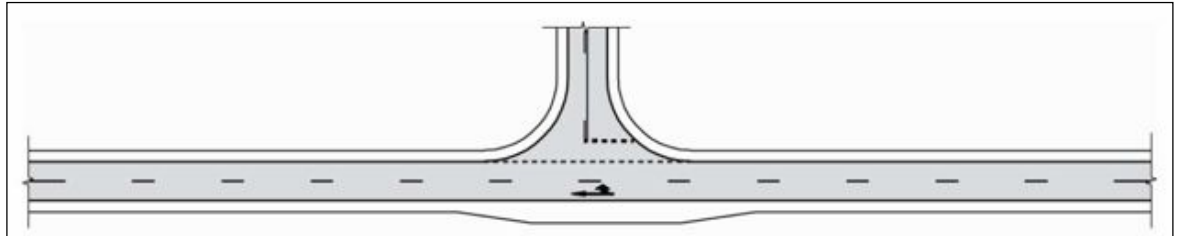


■ Figure 16 – Direct access point to proposed MEWF site from Kippen Drive

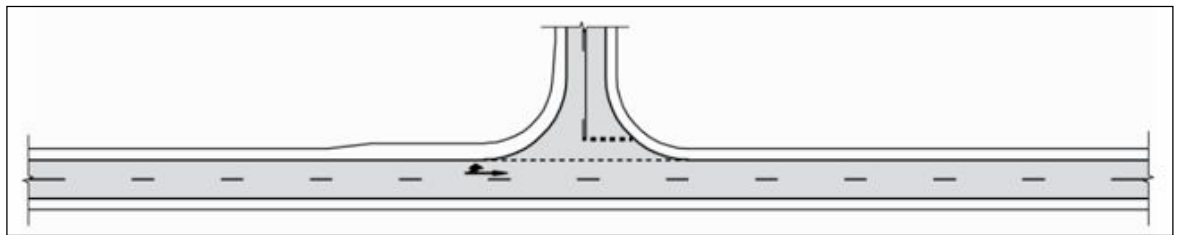




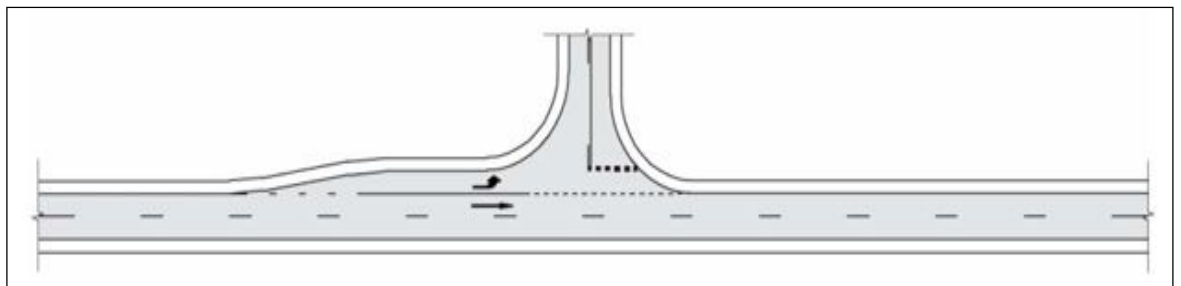
## Appendix C RPDM References



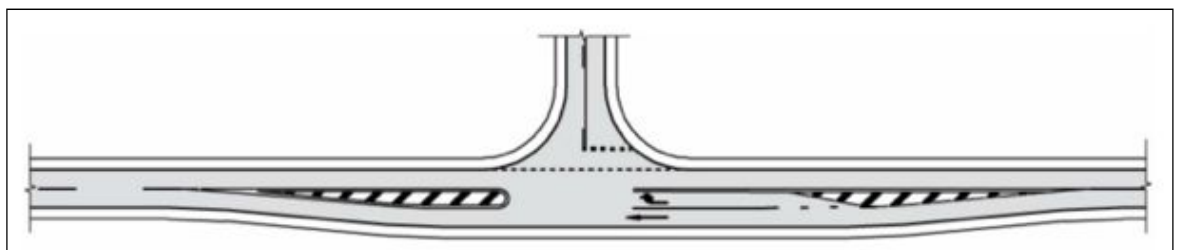
■ Figure 17 – Basic Right Turn (BAR) on the Major Road



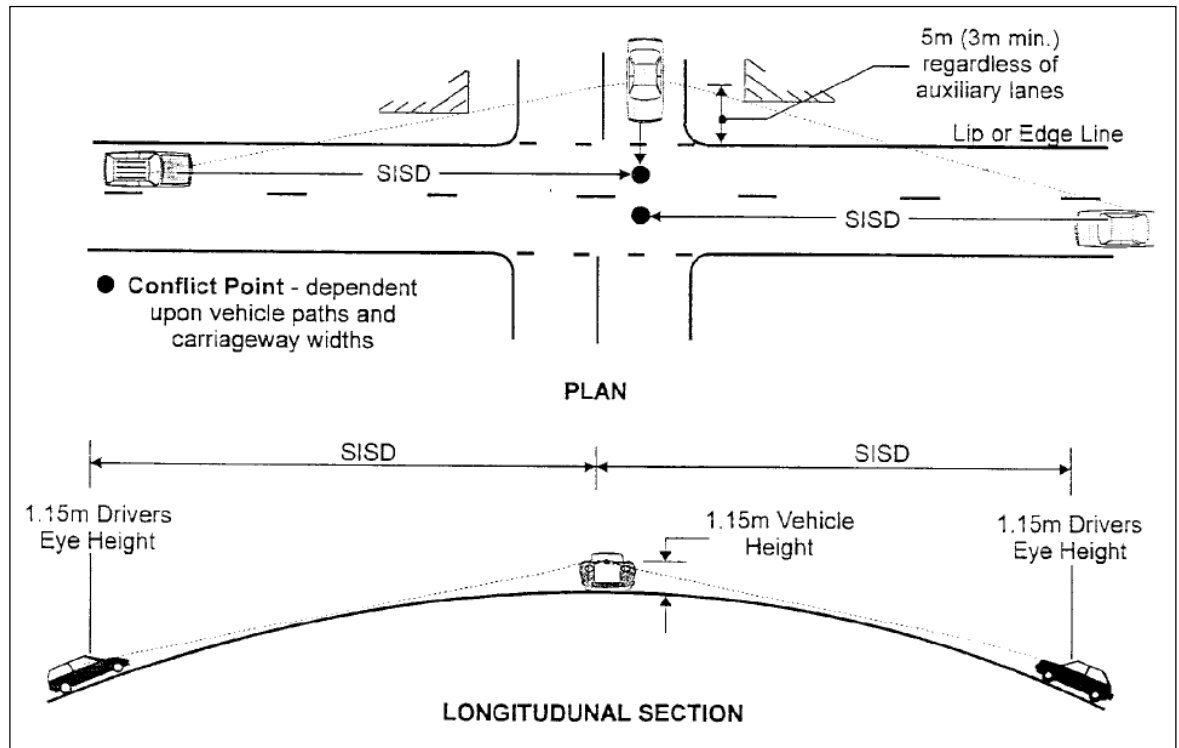
■ Figure 18 – Basic Left Turn (BAL) on the Major Road



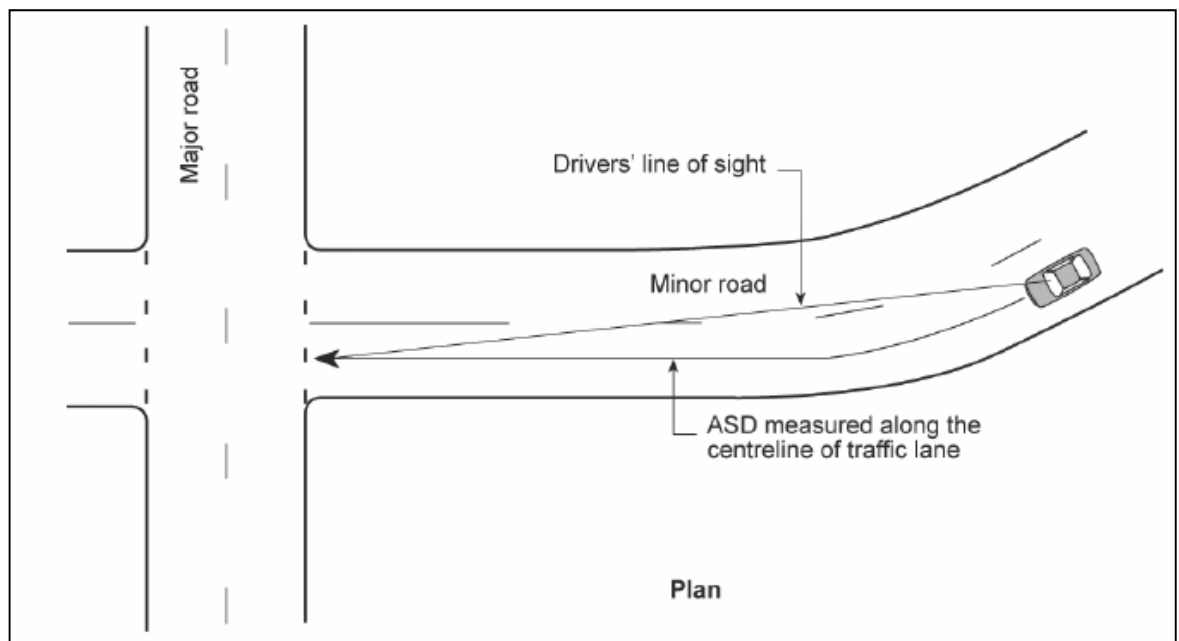
■ Figure 19 – Auxiliary Left Turn (AUL) on the Major Road



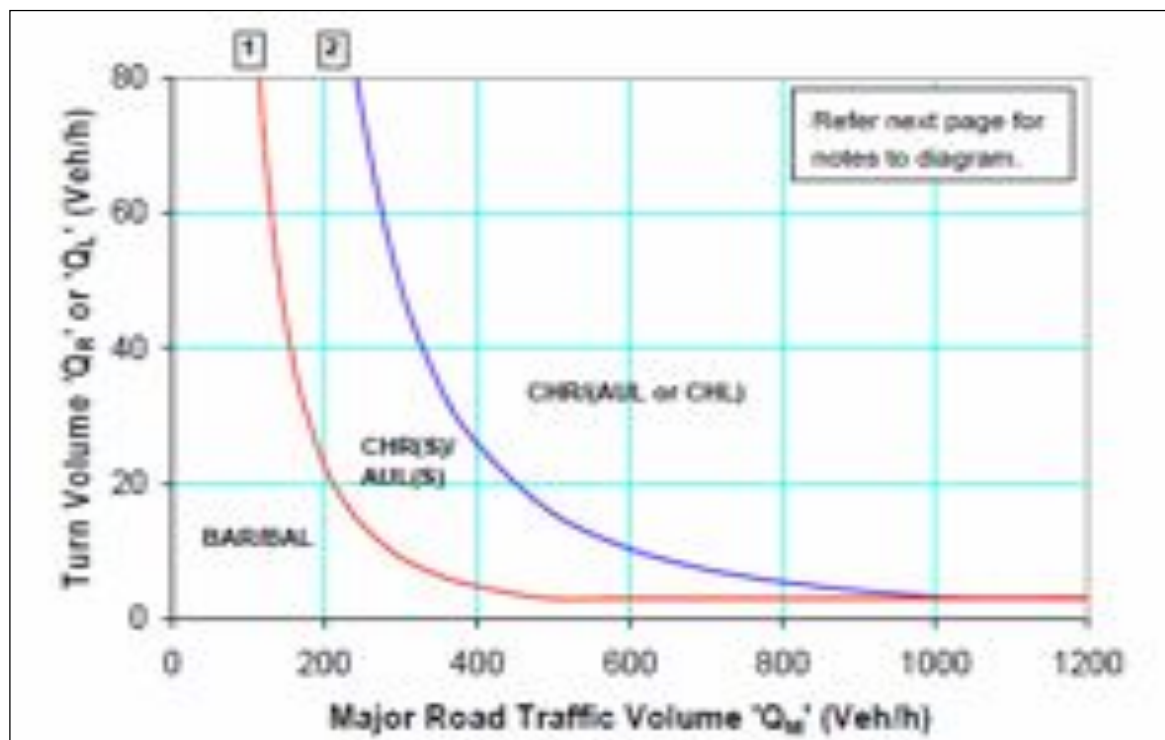
■ Figure 20 – Channelised Right Turn (CHR) on the Major Road



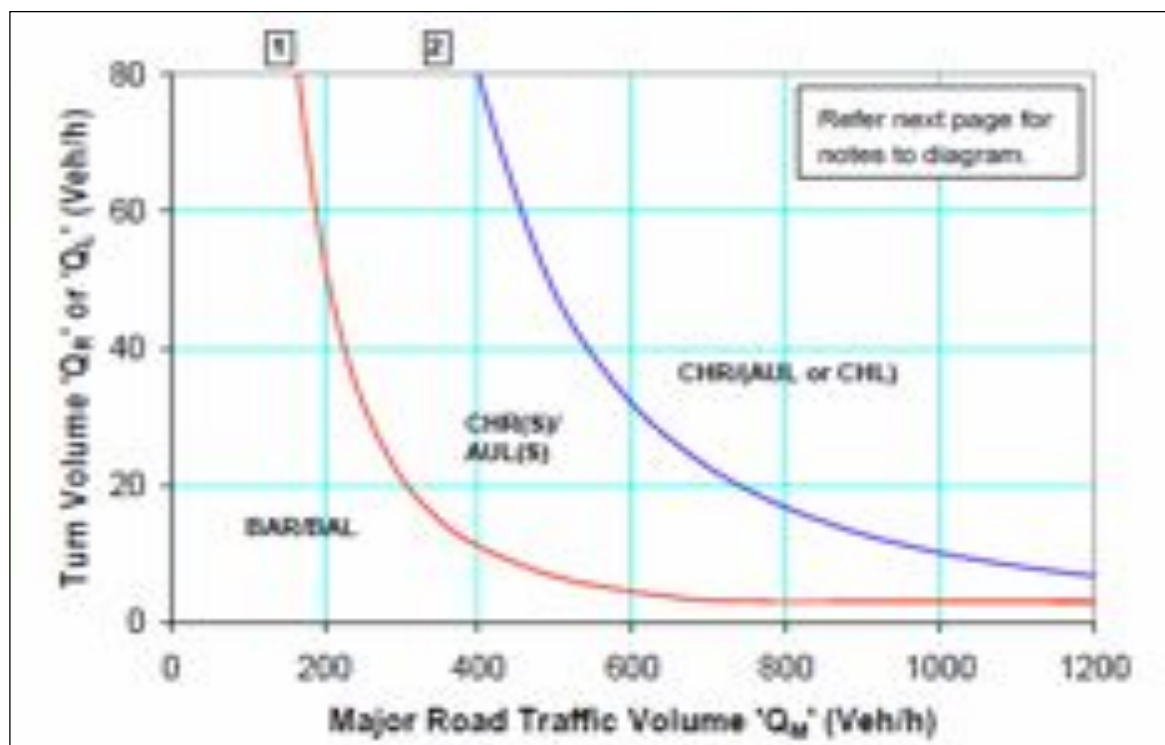
■ Figure 21 – Safe Intersection Sight Distance (SISD)



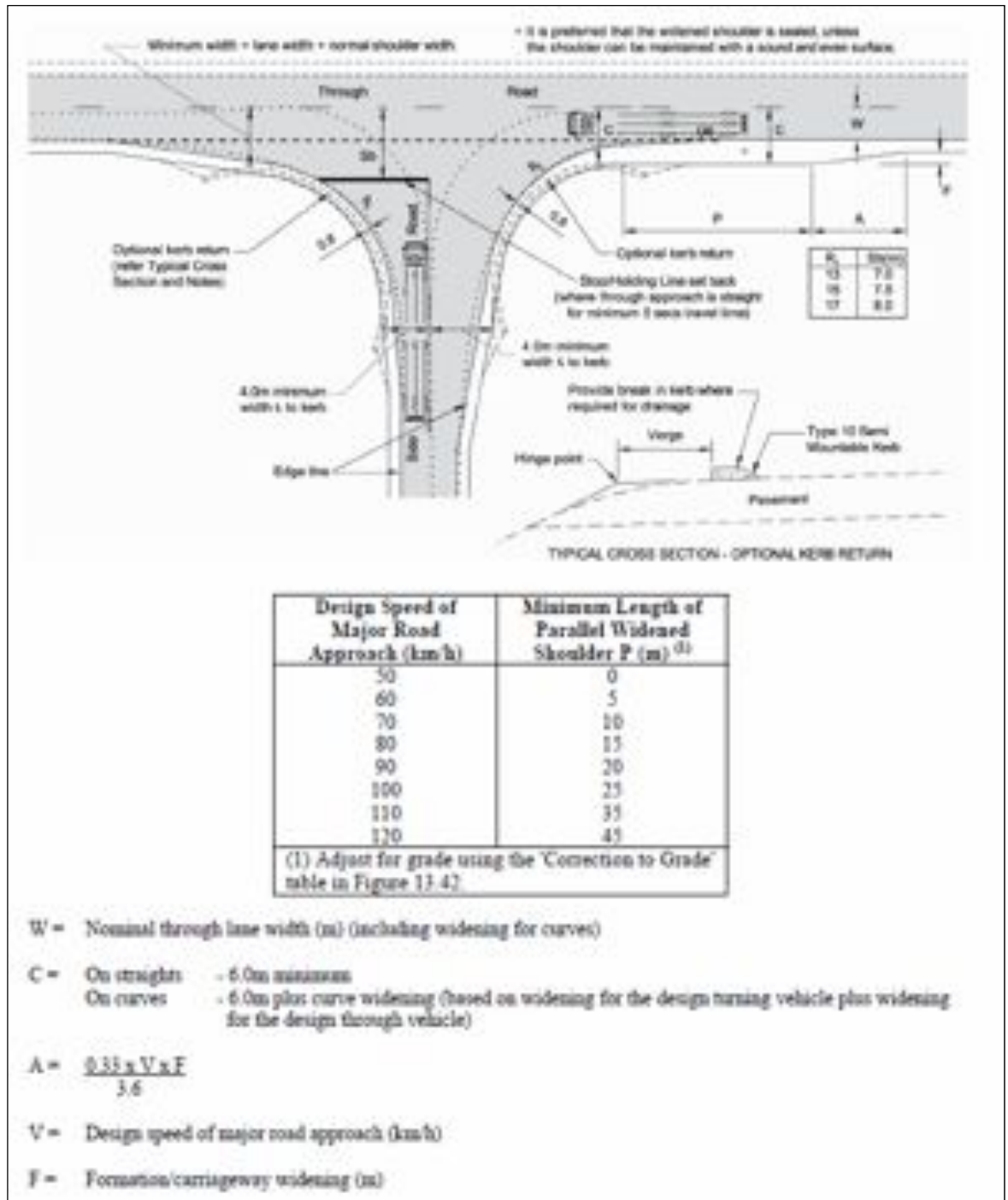
■ Figure 22 – Approach Sight Distance (ASD)



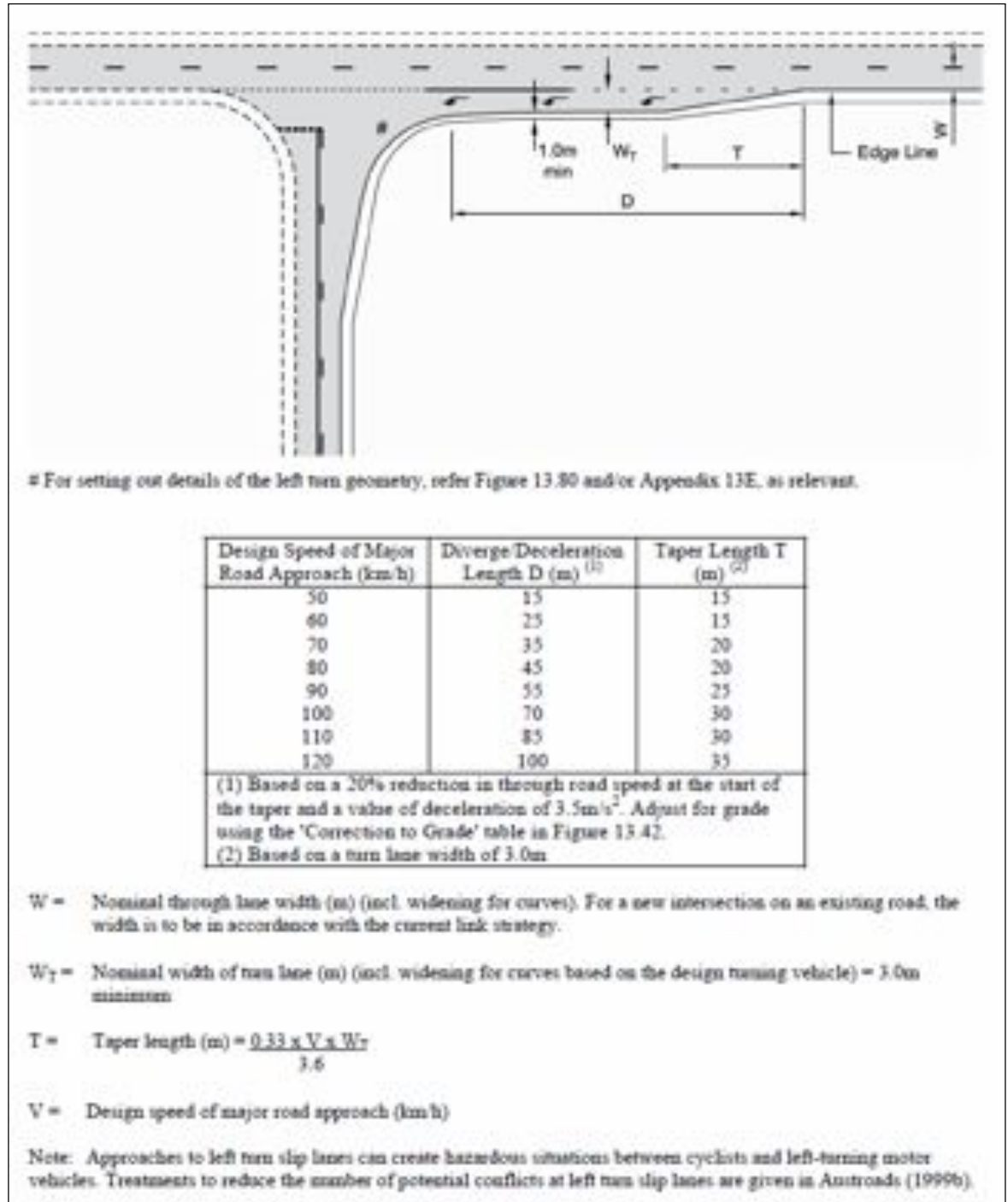
■ Figure 23 – Warrants for Turn Treatments on Roads with Design Speed  $\geq 100$  km/h



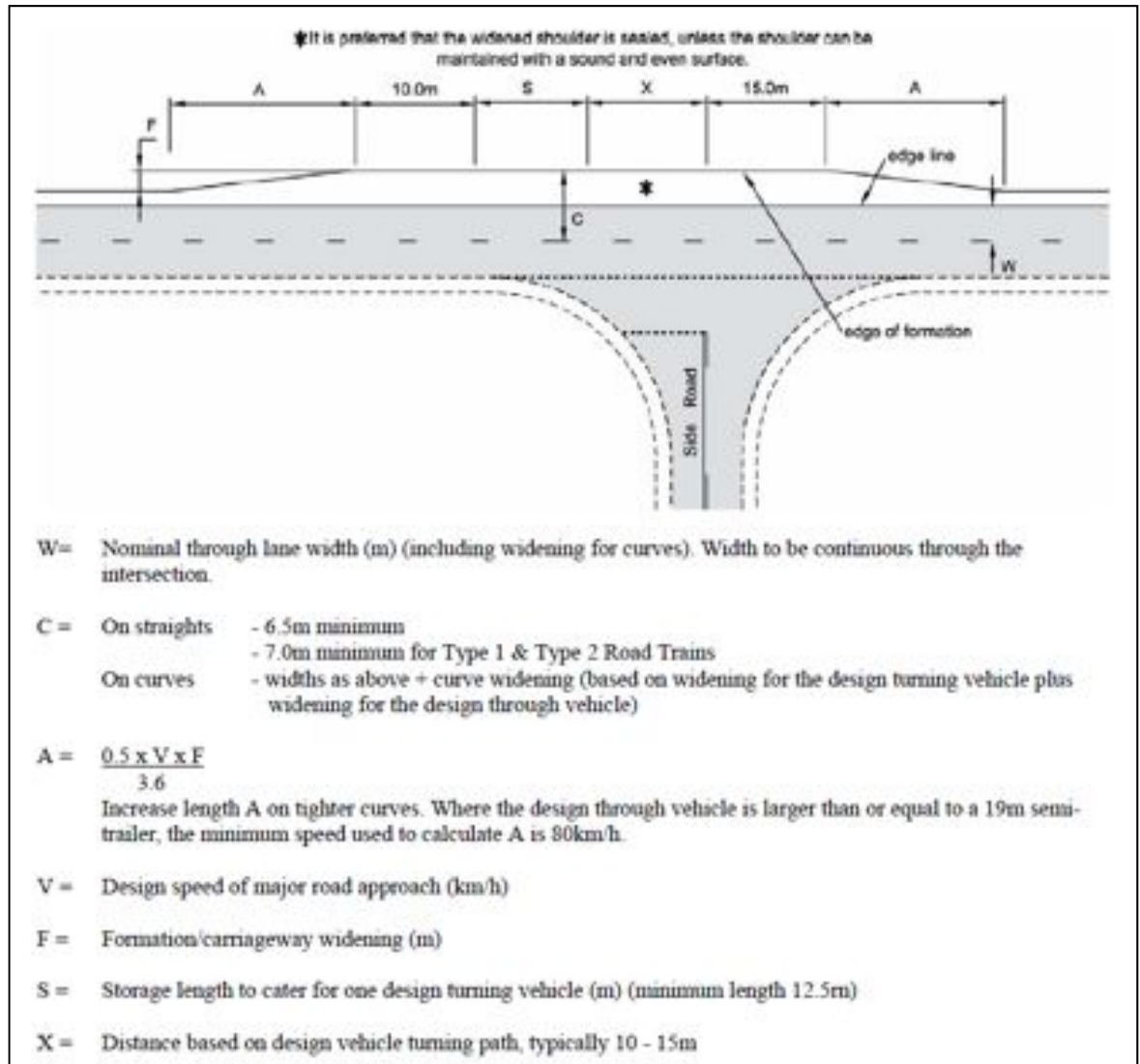
■ Figure 24 – Warrants for Turn Treatments on Roads with Design Speed  $< 100$  km/h



■ Figure 25 – Basic Left Turn (BAL) on a Rural Road specifically for Articulated Vehicles



■ Figure 26 – Auxiliary Left Turn Treatment with Short Turn Slot AUL(S) on a Rural Road

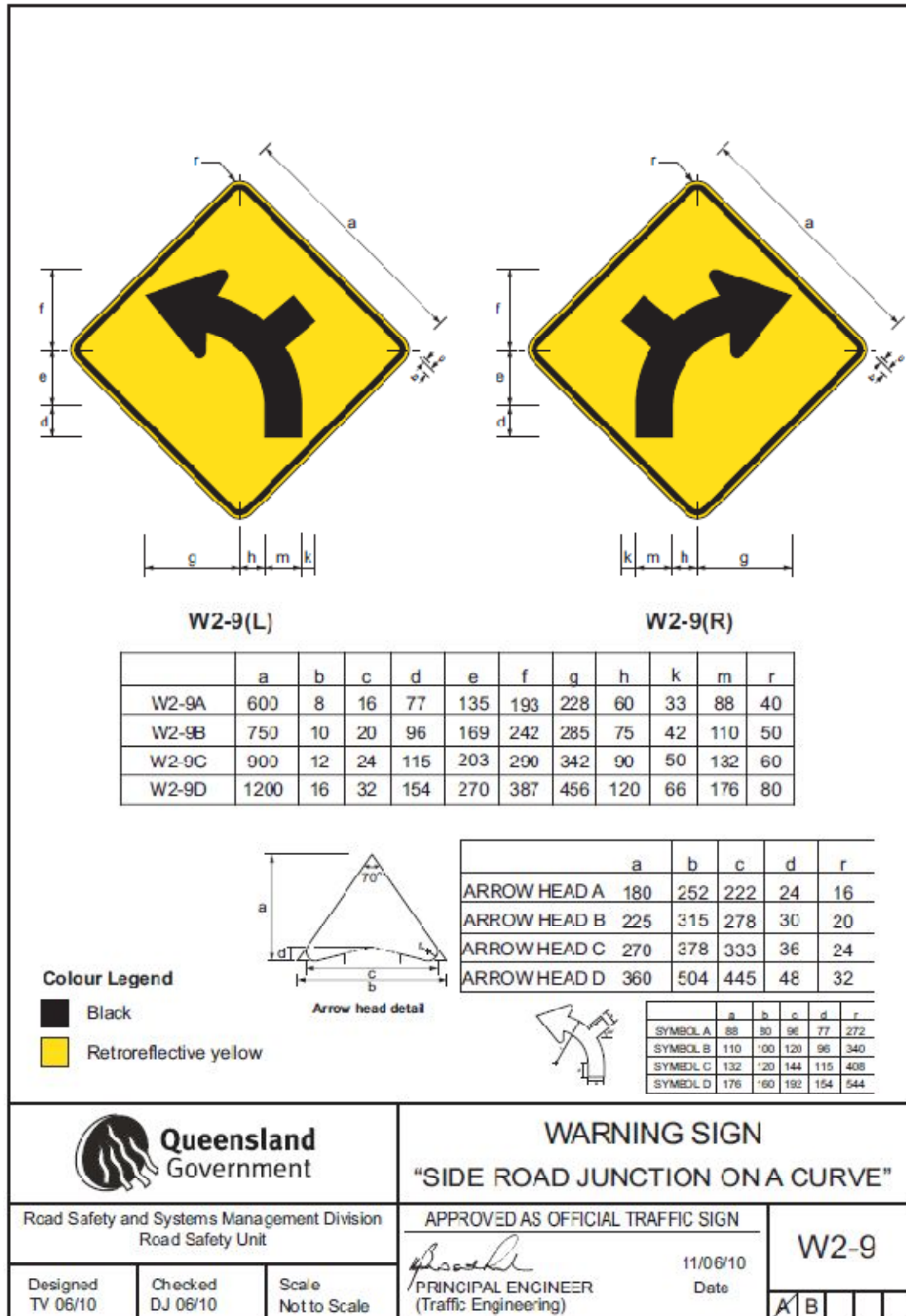


■ Figure 27 – Basic Right Turn Treatment (BAR) on a Two Lane Rural Road

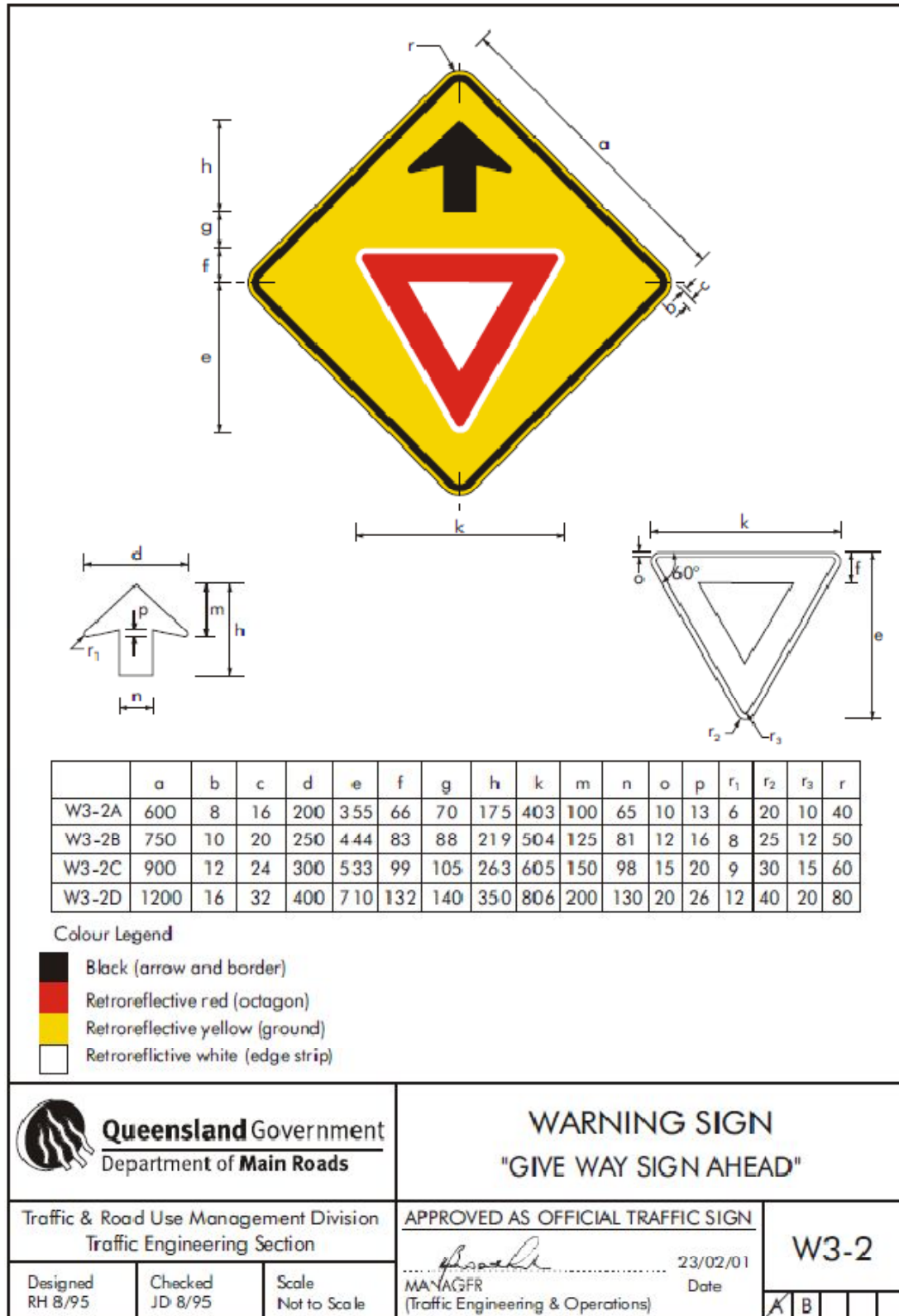


## Appendix D Signage References

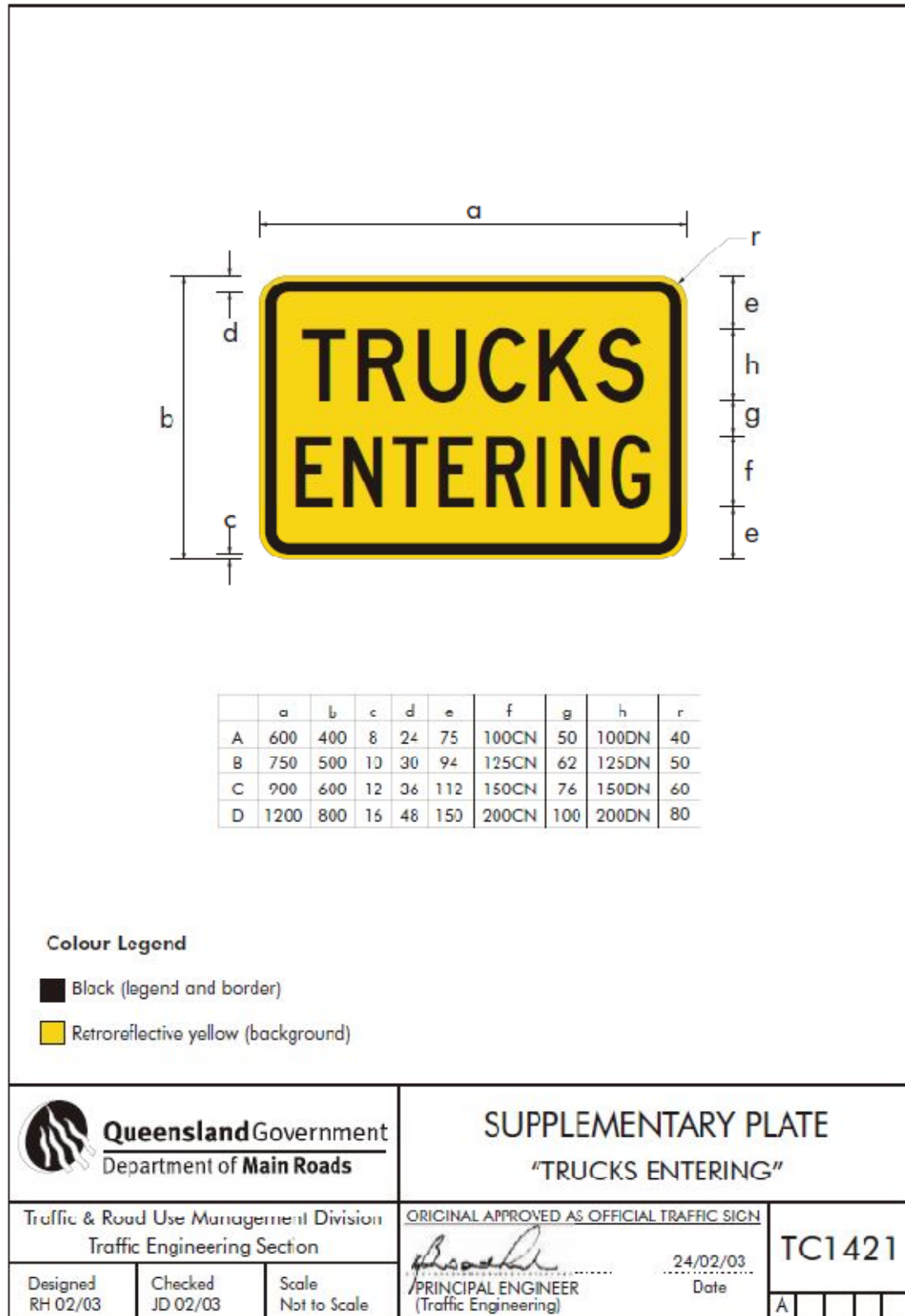




■ Figure 28 – Side Junction on a Curve (W2-9) Sign Design

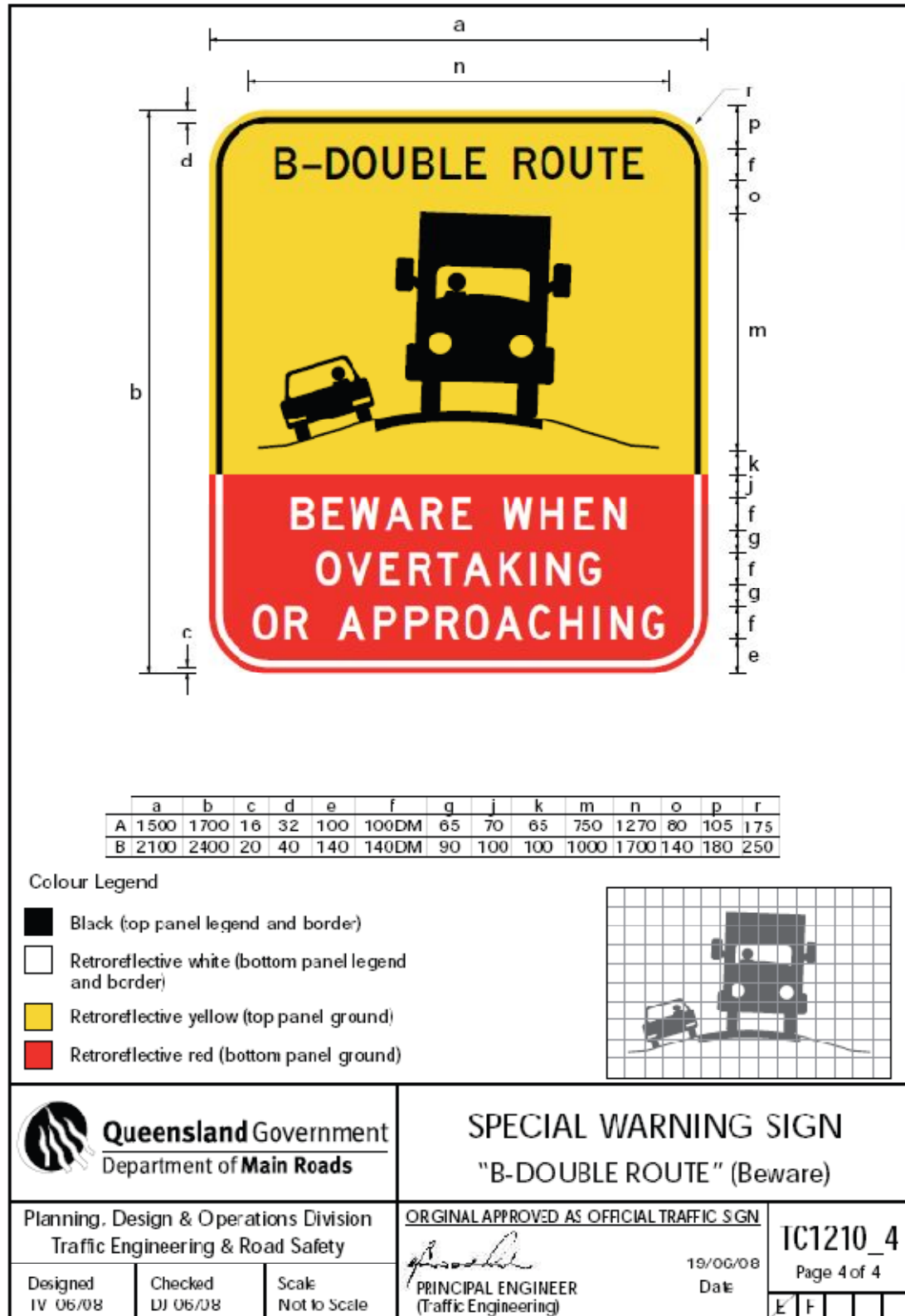


■ Figure 29 – Give Way Sign Ahead (W3-2) Sign Design



■ Figure 30 – Trucks Entering (TC1421) Sign Design

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■ Figure 31 – B-Double Route (TC1210) Sign Design



## **Appendix E Intersection and Access Figures**