

Treatments for High Speed Rural Intersections & T-Intersections

Operational Instruction 2.27

July 2024



Government of South Australia
Department for Infrastructure
and Transport

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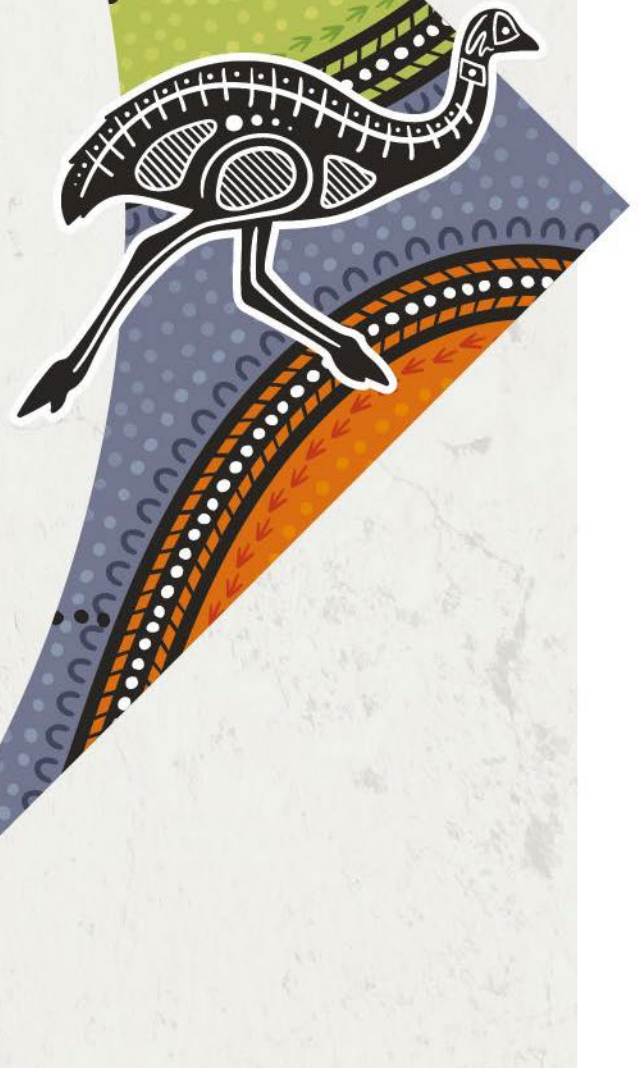
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Approvals record

Approvers	Position	Date	Signature
Stephen Pascale	Manager, Traffic Services	2 July 2024	Digital Approval 37793

We acknowledge the Traditional Custodians of the Country throughout South Australia and recognise their continuing connection to land and waters. We pay our respects to the diversity of cultures, significance of contributions and to Elders past, present and emerging.



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1 Introduction

This Operational Instruction outlines the principles and uses of regulatory signs, advanced warning signs and hazard markers at intersections and T-intersections, and the use of other devices such as advanced directional signing, pavement marking and rumble strips. Although these principles can be used at all intersections and T-intersections this document is aimed at improving road user safety by alerting fatigued drivers on the approaches to intersections in high speed rural environments with speeds greater than 80 km/h.

This document shall be read in conjunction with Australian Standard AS 1742.2 - 2022 Manual of Uniform Traffic Control Devices Part 2: Traffic Control Devices for General Use.

When used in accordance with this Operational Instruction, these traffic control devices may be installed under the Minister's Instrument of General Approval and Delegation to Council, or the Instrument of Authorisation and Delegation to the Unit Manager, Traffic Solutions. Traffic control devices which vary from this Operational Instruction require the separate approval of the Manager, Traffic Services for each location prior to installation.

2 Background

There is a need to ensure road users are aware of approaching road characteristics. Where sight distance to intersections and T-intersections is limited, devices such as advanced direction signs and warning signs can be used to inform road users.

It is important to ensure that the correct messages are sent to road users and the amount of information provided is kept to a minimum. The minimum number of signs should be used to ensure that drivers have time to comprehend the messages and do not become confused. Overuse of individual signs also reduces their long-term credibility.

3 Regulatory Signs

Give Way and Stop signs are used to allocate priority at intersections to traffic on one of the intersecting roads. Refer to AS 1742.2 – 2022 clause 2.5, and DIT's [Code of Technical Requirements](#) Section 5.



Electronic versions of regulatory signs (Refer to AS 1742.1 - 2021 clause 1.6.6.2), or sign elements supplemented with illuminated LEDs may be used to further highlight the sign message at sites with a history of poor compliance where additional visual impact is required.

3.1 Give Way Signs



R1-2

Give way signs (R1-2) and the associated pavement markings shall conform to the design, installation and justification requirements specified in Section 2.5 of *AS 1742.2 MUTCD Part 2: Traffic control devices* for general use except that:

- a) Give Way signs shall not be installed on adjacent approaches of a four-way intersection.
- b) Pavement markings used with Give Way signs shall comply with Section 3 of the “Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices Part 2 - Code of Technical Requirements.”
- c) Give Way signs shall not be installed on slip lanes and expressway type entrances.

3.2 Stop Signs



R1-1

Stop sign (R1-1) indicates to road users who has priority and should not be considered as a standard treatment at intersections or T-intersections. Stop signs shall be used only where warranted in accordance with the requirements of *AS 1742.2 - 2022* clause 2.5.4, and the [Code of Technical Requirements](#) Section 5.2. Overuse of Stop signs reduces their effectiveness and are often ignored by motorists and intentionally violated if used where they are not justified.

At intersections where sight distance is limited to that specified in *AS 1742.2 - 2022* clause 2.5.4, Stop signs shall only be used if the sight distance cannot be improved by the removal of vegetation, buildings, or other obstructions.

The [Code of Technical Requirements](#) allows Stop signs to be used where the road to be controlled meets the intersecting road at an angle of 40 degrees or less.

At intersections with a high crash frequency, a detailed investigation shall be undertaken to determine the contributing factors to the crashes. Treatment, other than by the installation of a Stop sign, is likely to be more beneficial to the reduction of crashes. *AS 1742.2* prohibits the use of Stop signs in situations other than where sight distance is restricted.

Stop signs shall not be supplemented with any other sign.

URL to Code of Technical Requirements: www.dit.sa.gov.au/?a=40255

4 Advance warning signs for intersections and T-intersections

To maintain their effectiveness intersection and T-intersection warning signs shall be limited to those with a greater than general hazard. Intersection and T-intersection warning signs may be used where direction signs (TES signs), other devices or geometric clues (day and night) do not give sufficient information to drivers about the existence of an intersection.



These warning signs may be supplemented with flashing yellow lights (see AS 1742.2 - 2022 Appendix E), which may operate full time or on a vehicle activated basis.

The use of flashing yellow lights should be limited to particularly hazardous locations where a lack of adequate sight distance or visual distractions may detract from the effectiveness of standard warning signs.

For additional treatments beyond the scope of this OI, refer to Operational Instruction 2.48 'Overshoot Signage'. (www.dit.sa.gov.au/?a=1270078)

Figure 4.1 TES 12279

4.1 Side Road approaches



W3-1



W3-2



W2-3

Where advance warning of an intersection is required the appropriate W2 or W3 series (advance warning of traffic control device) sign shall be used (refer to AS 1742.2-2022 clause 2.10).

The cross road sign (W2-1) shall not be used on a side road approach to a controlled intersection.

Advance warning signs shall be used on the minor road approach only when there is no advance direction sign and the stopping sight distance to the intersection or T-intersection is less than the values given in Table 1. An advance direction sign on the approach to intersections provides adequate warning to road users.

Signing for advance warning of a traffic control device indicates to drivers the action that is required at the intersection or T-intersection. This allows the drivers to be focused on the act of stopping for or giving way to vehicles on the main road.

Previously, intersection and T-intersection series warning signs have been used to indicate the intersection type to drivers. By indicating the type of control at the approaching intersection or T-intersection, the emphasis is placed on complying with the regulatory device rather than on letting the driver consider the direction that they would like to travel when they reach the intersection.

T-intersection warning signs (W2-3) shall only be used at T-intersections not controlled by give way or stop signs, if there is no advanced direction sign and if the stopping sight distance to the T-intersection is less than the values given in Table 4.1

Approach Speed (km/h)	Stopping Sight Distance (m)
31 – 40	45
41 – 50	60
51 – 60	80
61 – 70	100
71 – 80	125
81 – 90	150
91 – 100	180
101 – 110	210
111 – 120	240
121 - 130	275

Note: This table has been adapted from Austroads Guide to Road Design Part 3: Geometric Design, 2021 Values given are based on a reaction time of 2.5 sec. The source reference should be consulted where conditions are significantly different from a level sealed pavement.

Table 4.1: Stopping sight distance on level sealed pavements.

4.2 Main Road approaches

There is a tendency to over use side road warning signs on the main road. The main road traffic is not required to give way or take any action for minor road traffic. The responsibility for movements into the intersection or T-intersection is held by the traffic exiting from the minor road.

To maintain their effectiveness, intersection warning signs on the main road shall be limited to intersections where the stopping sight distance to the intersection or T-intersection is less than the values given in Table 4.1.

Where advanced direction signs are installed on the approach to a side road, side road warning signs shall not be used. The cross road sign shall not be used on a side road approach to a controlled intersection.



W2-1



W2-4

4.3 Rural Intersection Active Warning System (RIAWS / RJAWS)

The Rural Intersection Active Warning System (also referred to as Rural Junction Active Warning System (RJAWS)) is a road safety treatment which aims to reduce fatal and serious injury crashes at rural intersections by:

- alerting drivers to the presence of vehicles on the side road
- slowing motorists on major road intersection approaches and thus reducing crash likelihood (effectively increasing available stopping distance) and severity (less energy on impact)
- increasing driver awareness and therefore preparing motorists for a possible event (effectively reducing reaction time)
- increasing the gaps between potentially colliding vehicles
- improving Safe Intersection Sight Distance (SISD)

Refer to the [DIT Speed Limit Guideline for South Australia](#) (Sections 6.3 and 7.12) for further guidance on installation and signage.

4.4 Rural Junction Active Warning System (RJAWS) Lite

Rural Junction Active Warning System (RJAWS) Lite intersection safety treatment is also available. RJAWS Lite aims at reducing both the likelihood and severity of crashes at non-signalised intersections along high-speed roads in regional and remote areas.

This is achieved with two safety systems:

- a major road speed advisory, and
- a minor road run-through avoidance.



Figure 4.2

Dependent on the needs of a particular location, the two systems can be installed together, or one system may be installed without the other.

The major road speed advisory is provided via flashing lights that illuminate when a minor road vehicle is detected as approaching the intersection (Figure 4.2). This alert is provided for all vehicles on the major road, given the presence of a minor road vehicle.

The minor road run-through avoidance is used to alert drivers that they are approaching the intersection along the minor road at a higher than appropriate speed and is provided via flashing lights around the control sign (Figure 4.3).



Figure 4.3

RJAWS Lite was developed with the goals of lowering the cost and reducing the time and complexity required to install the system. To achieve these goals, off-grid power and mobile network communications were utilised.

- Solar as a power source as it is low cost, simple, and the ease of adaptation.
- Mobile network communication was chosen for connection between the different parts of the system, and to allow for back-to-base communications.
- Radar in place of inductive loops to detect traffic, to avoid the need for installation of physical sensors in the road surface.

The additional system, named the '*Minor Road run-through avoidance*', utilises the same power, communication and vehicle detection equipment while providing the additional benefit of reducing the risk of run-through crashes, which can be a common occurrence at regional and remote intersections.

Considerations for installation of RJAWS Lite include traffic volumes, sign location, road geometry and sight lines and evaluation of crash data. RJAWS Lite may be installed on one or both approaches to the side road intersection.

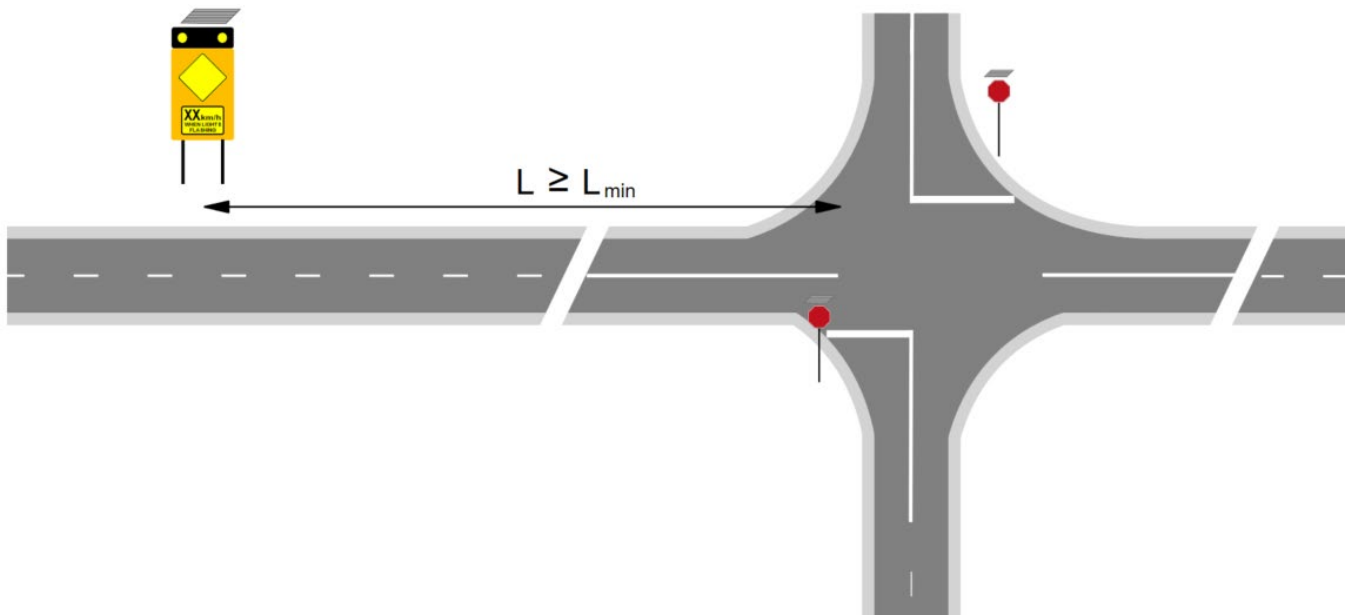


Figure 4.4 - The major road speed advisory sign should be placed at a distance (L) from the intersection.

L_{min} is the minimum distance that the major road speed advisory sign should be placed from the intersection. L_{min} is dependent on the rate of deceleration of the major road vehicle.

$$L_{min} = \frac{V_1^2 - V_2^2}{254(d + 0.01a)}$$

L_{min} is the braking distance; V_1 = initial speed; V_2 = target speed, 'd' is the coefficient of deceleration; and 'a' is the longitudinal grade (%).

Refer to Appendix B for a table of L_{min} values.



Figure 4.5: Approved sign designs for major road speed advisory signs

The TES 19975 and 19976 signs as shown in Figure 4.5 are for 80 km/h and 100 km/h speed limit applications respectively. These sign incorporate a modified advisory speed sign, a Side Road Intersection or Cross Road warning sign, a target board, and a TES 18580 flashing light assembly.

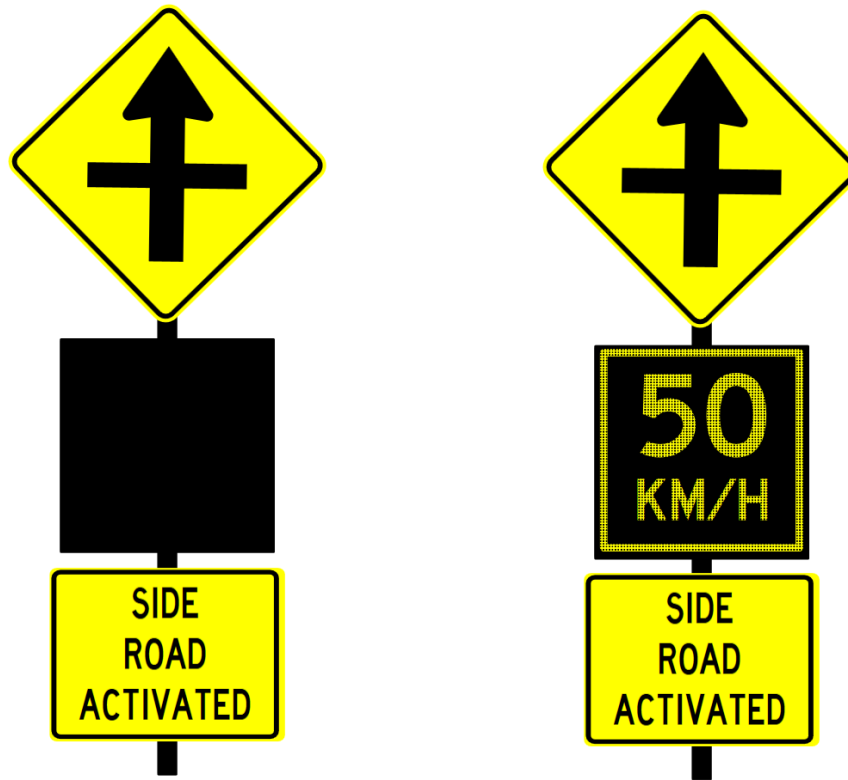


Figure 4.6: Alternative approved major road speed advisory sign assembly with dot matrix speed advisory

As an alternative, the sign configuration shown in Figure 4.6 may be used. The speed advisory display shall be yellow text on black background in accordance with the requirements for electronic signs in AS 1742.2 (2022) clause 1.7.2.7(a). The border shall also be yellow and may flash when the advisory speed is displayed. The advisory speed shown to drivers is 30 km/h below the speed limit.

Refer to TES 20289 for sign specification details of the “Side Road Activated” supplementary plate.

5 Hazard Markers and Guide Posts

Hazard markers are used to indicate the presence of a T-intersection, to delineate traffic islands, to identify a hazard close to the carriageway or to indicate the presence of a low bridge or structure (refer to AS 1742.2 - 2022 clause 2.12.1).

Hazard markers shall be installed at the stem of a T-intersection where the speed limit on the terminating road is 80 km/h or greater.

Hazard markers can be omitted at T-intersections if there is a two way Intersection Direction sign or two stacked single Intersection Direction signs (TES signs). Refer to Figure 5.1.

Hazard markers shall be centred on the prolongation of the approaching lane, not on the centre of the intersection. Refer to Figures 5.1, 5.2 and 5.3.

NOTE: Hazard markers used by DIT have different dimensions to those specified by the Australian Standard.

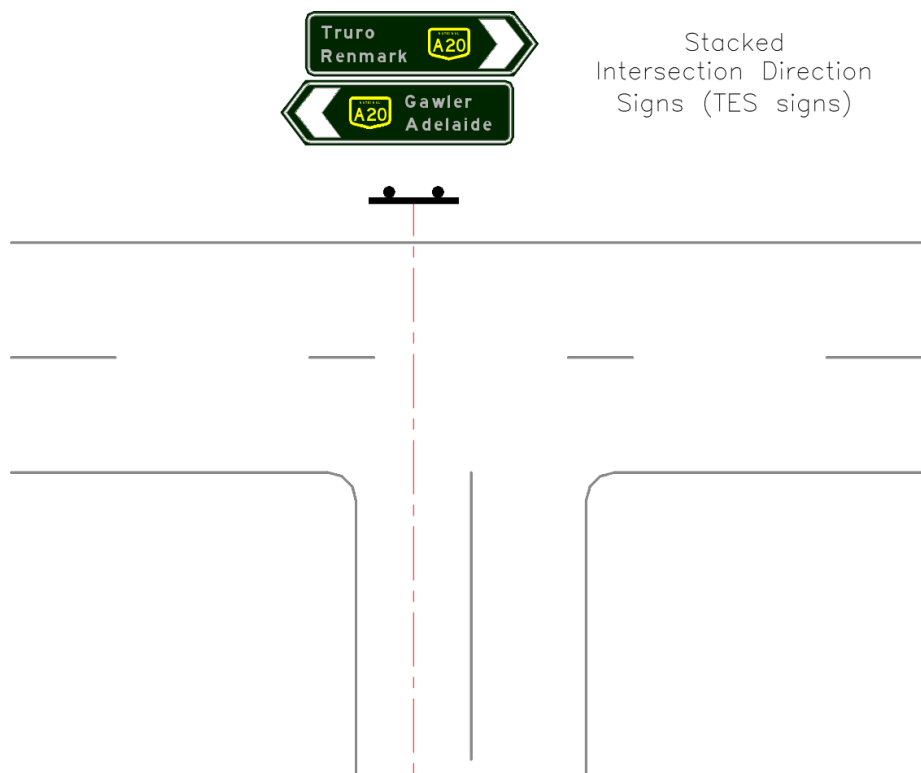


Figure 5.1: Intersection Direction (TES) signs alone indicate the options to road users.

5.1 Single Lane approach

At T-intersections where the side road has a single lane approach D4-SA2-1 Bi-directional Hazard marker is normally adequate.

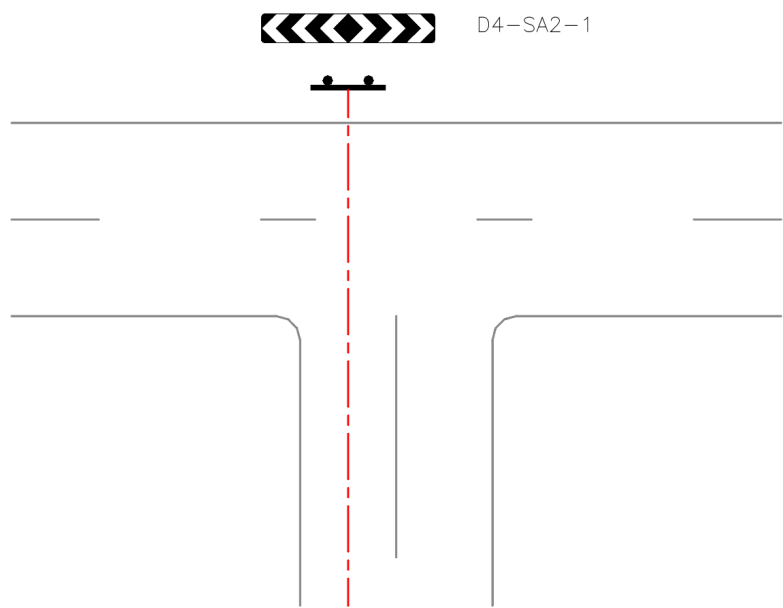


Figure 5.2: Typical T-intersection

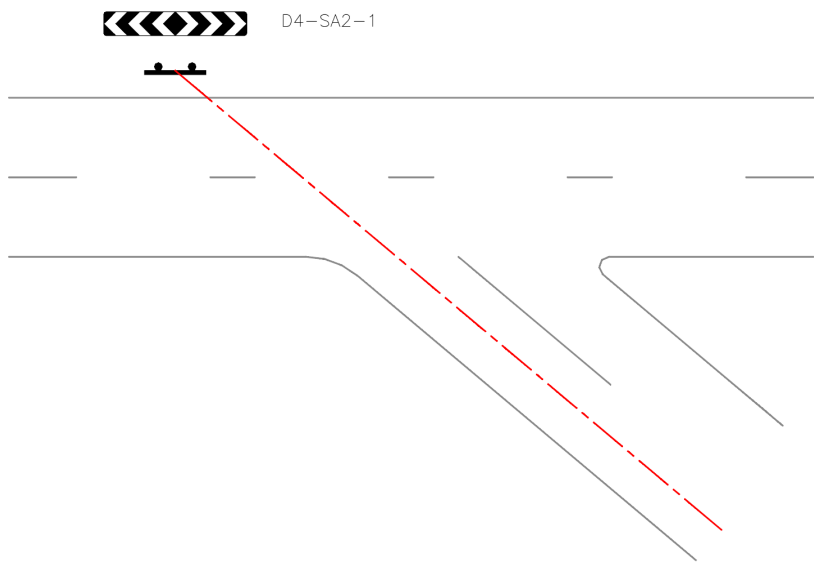


Figure 5.3: Placement of hazard marker at T-intersection of less than 90 degrees

5.2 Multi-laned approach

Where the side road is a non-channelled multi lane approach (designated left and right turn lanes) or a wide single lane approach two D4-SA1-1 may be used back-to-back.

In rare circumstances more than two D4-SA1-1 hazard markers may be used to give prominence to the T-intersection where:

- traffic volumes are high on the side road.
- sight restrictions exist due to a curve or crest preceding the T-intersection.

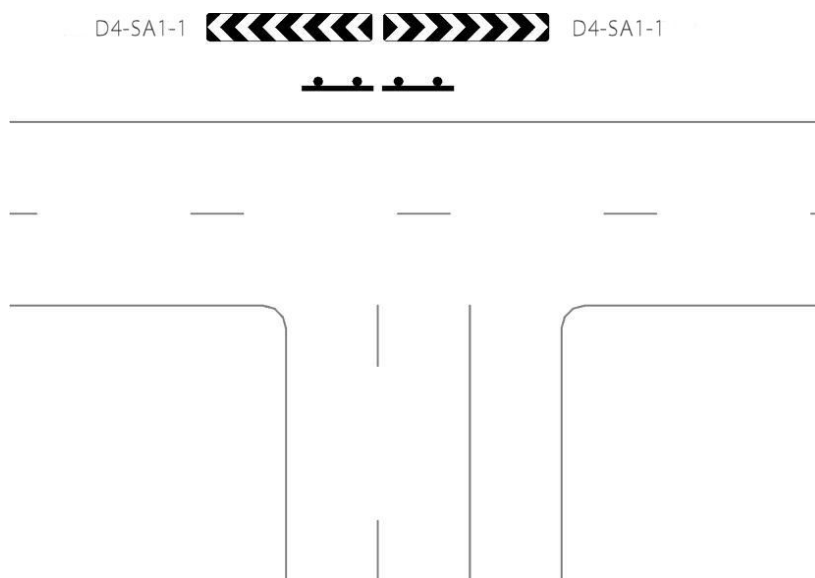


Figure 5.4: Unchannelised multi-laned approach

5.3 Hazard marker height

Where the road level on the approach to the T-intersection is generally flat or has a minor slope, the hazard marker shall be installed so that the distance between the top of the marker and the projected line of the pavement where the side road vehicle approaches the T-intersection is 1.3 m (refer to [DIT Master Specifications RD-LM-C4 Appendix 5](#)). The height is selected to reflect passenger vehicle headlights and be in a horizontal line with the driver's line of sight. Refer to Figure 5.5.

Where the side road approaches the T-intersection at a high angle an additional row of hazard markers may be necessary to alert motorists of the approaching T-intersection as soon as possible.

Hazard markers shall be placed 600 mm behind the line of guide posts. Where guide posts are not present, hazard markers shall be placed 600 mm behind the edge of the seal, or 600 mm behind the windrow for unsealed roads. Consideration should be given to the location of hazard markers so as to not obstruct sight distances from driveways.

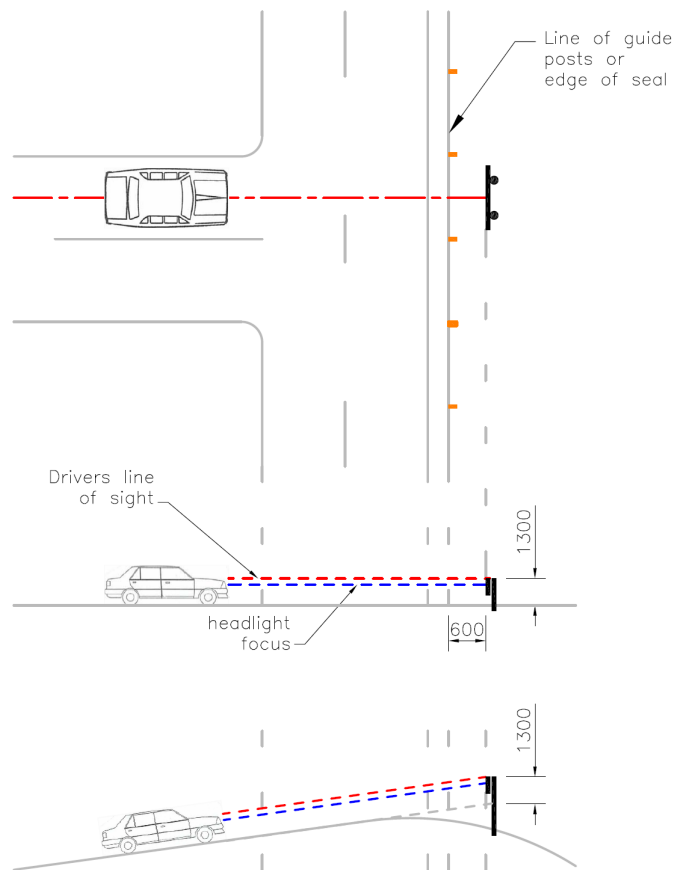
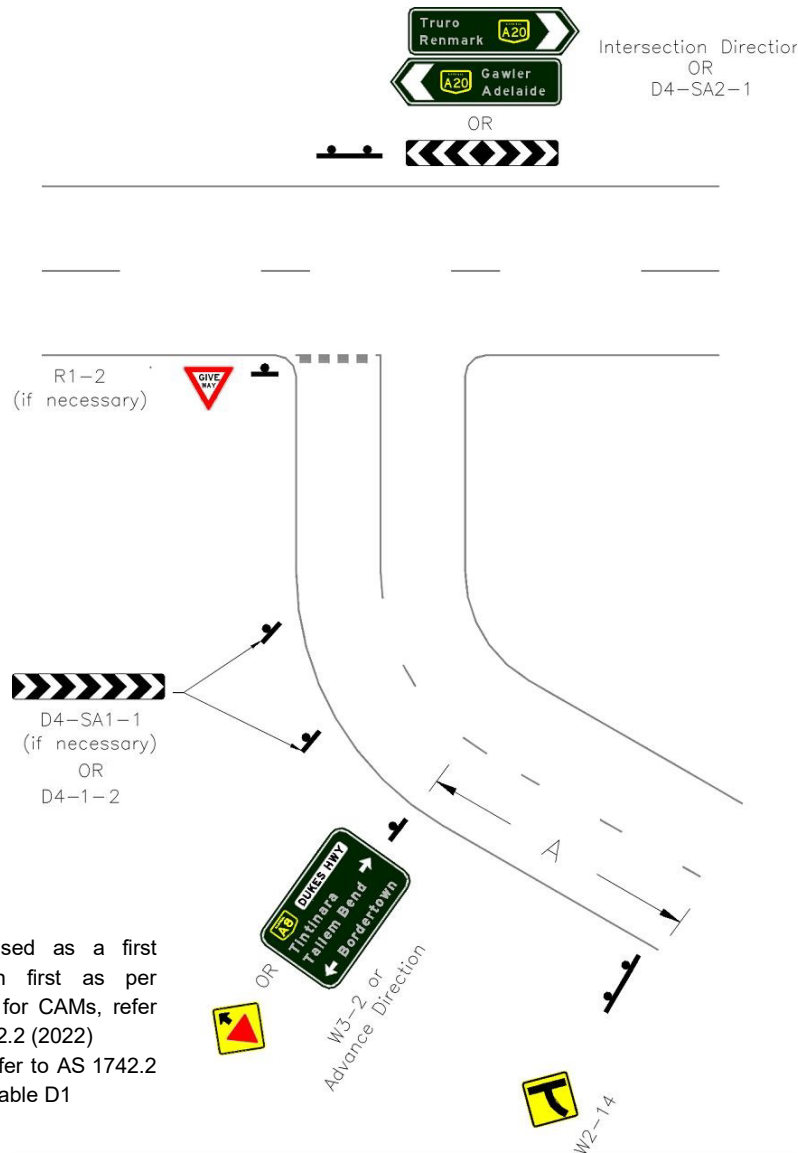


Figure 5.5: Hazard marker installation height

5.4 Curves on the approach to a T-Intersection

Unidirectional hazard markers (D4-SA1-1) shall be installed on curves which are closely followed by a T-intersection. Advisory speed signs shall not be used under these circumstances. Advanced intersection warning shall only be used where the sight distance from the start of the curve to the intersection is less than the stopping sight distance given in Table 4.1 (refer to AS 1742.2 - 2022 clause 2.9.4(b)).

Where there is no advanced direction sign and an advanced warning is required due to limited sight distance at a controlled intersection, the relevant W3-1 (Stop Sign Ahead) or W3-2 (Give Way Sign Ahead) sign shall be used (refer to AS 1742.2 - 2022 clause 2.10.3). Warning signs for T-intersections shall not be combined with curve warning signs for substandard curves. Where it is necessary to warn of a horizontal curve and an uncontrolled T-intersection at or near the same location a W2-14 (T-intersection beyond curve) sign shall be used. An advisory speed sign shall not be used in conjunction with this sign.



NOTE:

1. D4-SA1-1 to be used as a first preference. Position first as per Australian Standard for CAMs, refer Figure 4.3 in AS 1742.2 (2022)
2. For Dimension A, refer to AS 1742.2 (2022) Appendix D Table D1

Figure 5.6: T-intersection beyond a curve

5.5 Divided Carriageway

If there are no intersection direction (TES) signs, unidirectional hazard boards (D4-SA1-1) shall be installed at all T-intersections formed by a high speed rural road and a divided road, regardless of the median width. For further information regarding divided carriageway signage refer to Section 7.

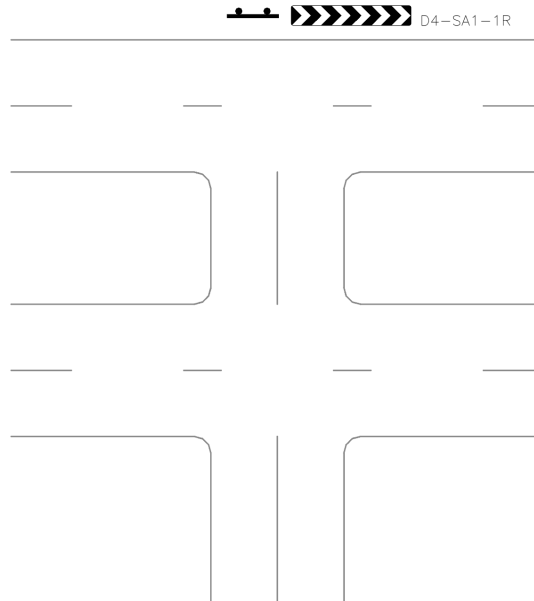


Figure 5.7: Divided carriageway use a unidirectional hazard board (D4-SA1-1(R))

Where a side road joins a divided carriageway, but motorists must turn left because there is no break in the median a One Way sign (R2-2) sign is adequate. Refer to Figure 5.8.

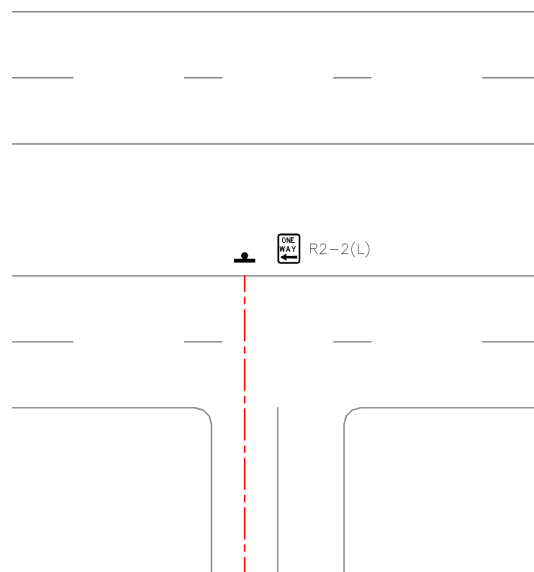


Figure 5.8: Divided carriageway with unbroken median use One Way sign (R2-2)

5.6 Bidirectional Hazard Markers

Bidirectional hazard markers should not be used where they restrict drivers' sight distance while exiting from a side road.

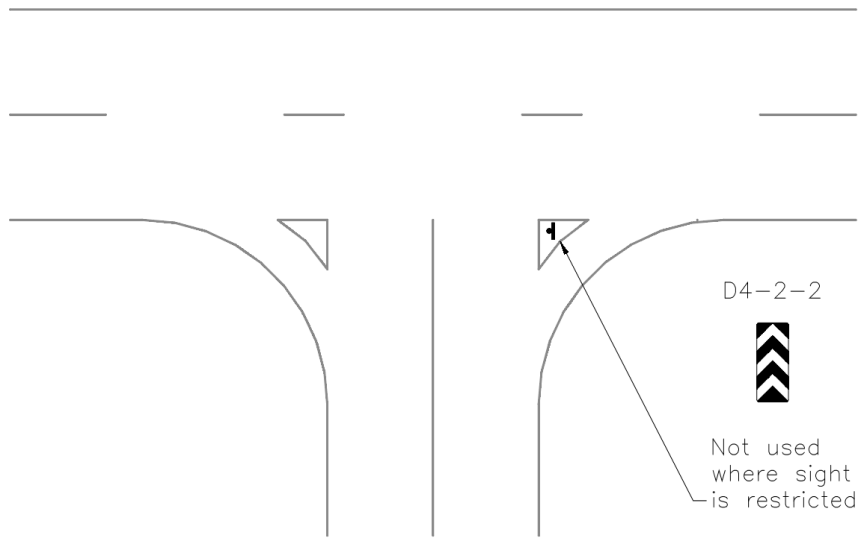


Figure 5.9: Use of bi-directional hazard markers

5.7 Guide Posts at Intersections

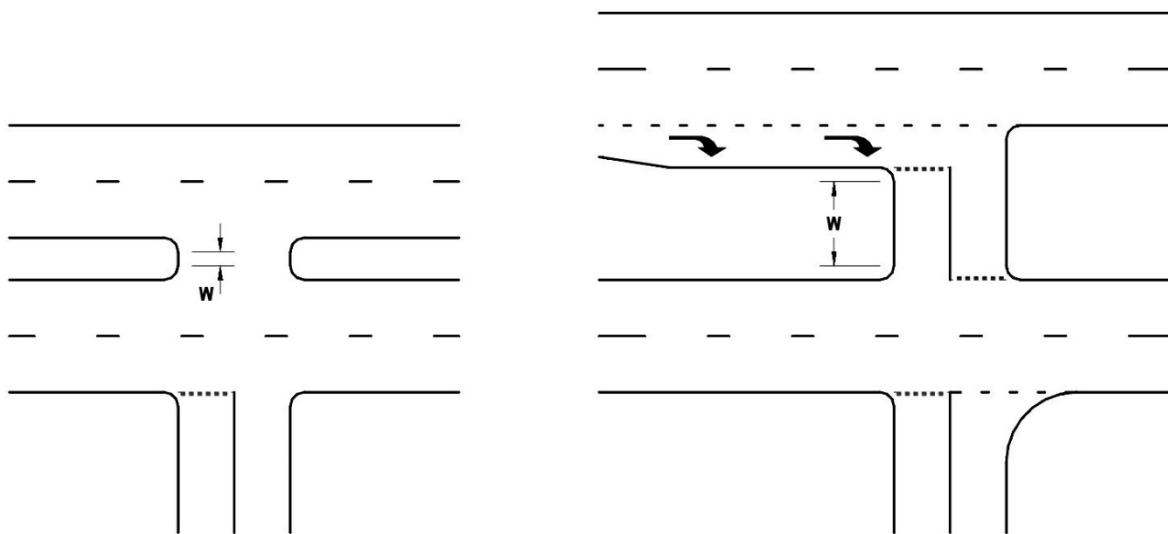
Guide posts used for delineation at intersections should be installed as shown in Appendix A.

6 Divided Roads

Situations have occurred where drivers from side roads have attempted to turn right onto or cross a divided carriageway without recognising the existence of the second carriageway. Drivers have been known to turn right into the left carriageway against oncoming traffic as well as mistakenly continuing across the second carriageway without caution after having safely crossed the first. It is thought that these incidents occur because the second carriageway is not visible to the driver approaching from the side road.

For a median to be considered wide it should be able to accommodate the largest legal vehicle that is likely to be using the side road as well as catering for two-way traffic through the median opening. In general, a wide median should have a section of straight roadway of at least 20 m in length marked for two-way traffic. This should be measured from the tangent points of the straight section of the median opening and the curved taper of the opening, taking into account any exclusive turn lanes, as shown in Figure 6.1.

The definition of a wide median should not be rigidly applied as the manner with how road users use the median opening should be the governing factor - even though this is controlled to some degree by the treatment in place.



(a) Typical arrangement for a “narrow median” w less than 20m

(b) Typical arrangement for a “wide median” w of 20m or greater

Figure 6.1: Narrow and Wide Median Definition

Taking care to ensure that directional signs at the T-intersection or intersection, along with the regulatory signs recommended in this Instruction, are correctly positioned, should provide sufficient information to drivers about the divided nature of the main road. Although advance warning signs could be used to advise of the divided nature of the main road, signs at the T-intersection and intersection are considered to be more important as it is here where drivers from a side road are most likely to make the decision of which path to take when entering or crossing the main road. Therefore, this Instruction places a stronger emphasis on the cues to drivers provided by the signs at the T-intersection or intersection rather than the advance warning signs. The recommendations for the use of warning signs in this Instruction are consistent with the use of warning signs as per AS 1742.2 – 2022.

Sections 7 and 8 set out recommended sign layouts for intersections and T-intersections, categorised as having either a narrow or wide median.

6.1 Intersection Direction Signs (TES Signs)

Direction signs placed at intersections and T-intersections shall be positioned to provide drivers guidance in turning into the correct carriageway as well as towards their destination. Signs should be positioned so that the driver's attention is not directed towards the median opening (other than checking for traffic) unless they need to cross or turn right onto the divided road. Desirable distances for directional signs can be determined from in Table 4.1 or alternatively Figure 7.2, depending on the actual layout of the intersection or T-intersection.

The placement of directional signs must not adversely affect the sight distance at the intersection or T-intersection.

7 Divided Roads with Narrow Medians

Drivers are likely to commence their turn or decide to cross the second carriageway prior to reaching the median. Therefore, drivers should be able to position their vehicle in a manner which they feel comfortable and safe in order to complete their manoeuvre. In this case, marking a separation line or other form of guidance in the median opening would generally be inappropriate.

7.1 T-Intersections

Regulatory controls on the side road are not needed, unless there is difficulty in achieving the required sight distance, as drivers approaching a road from a terminating road are required by law to give way. Advance warning of the T-intersection may be provided using a W2-SA57 installed at distance A, as defined in Table 7.1, in advance of the T-intersection. In this instance the W2-SA57 is used as a replacement for the standard W2-3 T-intersection warning sign and shall be used in the same manner (refer to AS 1742.2 - 2022 clause 2.9.4).

85 th percentile speed (km/h)	Distance A (m)
<75	80 – 120
75 – 90	120 – 180
>90	180 - 250

Table 7.1: Location of Warning Signs

Where advance direction signs and intersection direction signs (TES signs) are provided in the manner discussed in Section 6.1, the W2-SA57 sign shall not be used.

If provided, the size of the warning sign shall be:

- W2-SA57B for a side road 85th percentile speed less than 90 km/h.
- W2-SA57C for a side road 85th percentile speed of 90 km/h or greater.

A R2-3B “keep left” sign shall be placed in the centre median, arranged to be visible to side road traffic (refer to AS 1742.2 - 2022 clause 2.8.2(b)).

Where the second carriageway or the nose of the median cannot readily be seen by drivers from the side road, due to a crest or difference in carriageway levels, then a turn line may be marked on the pavement to give additional guidance to turning drivers.

A hazard board D4-SA1-1(R) shall be installed facing the side road, placed at a sufficient height to enable it to be visible from the side road. Intersection direction signs may be erected with the hazard board (refer to AS 1742.2 - 2022 clause 2.12.2).

The general layout of signs for a T-intersection with a narrow median is shown in Figure 7.1.

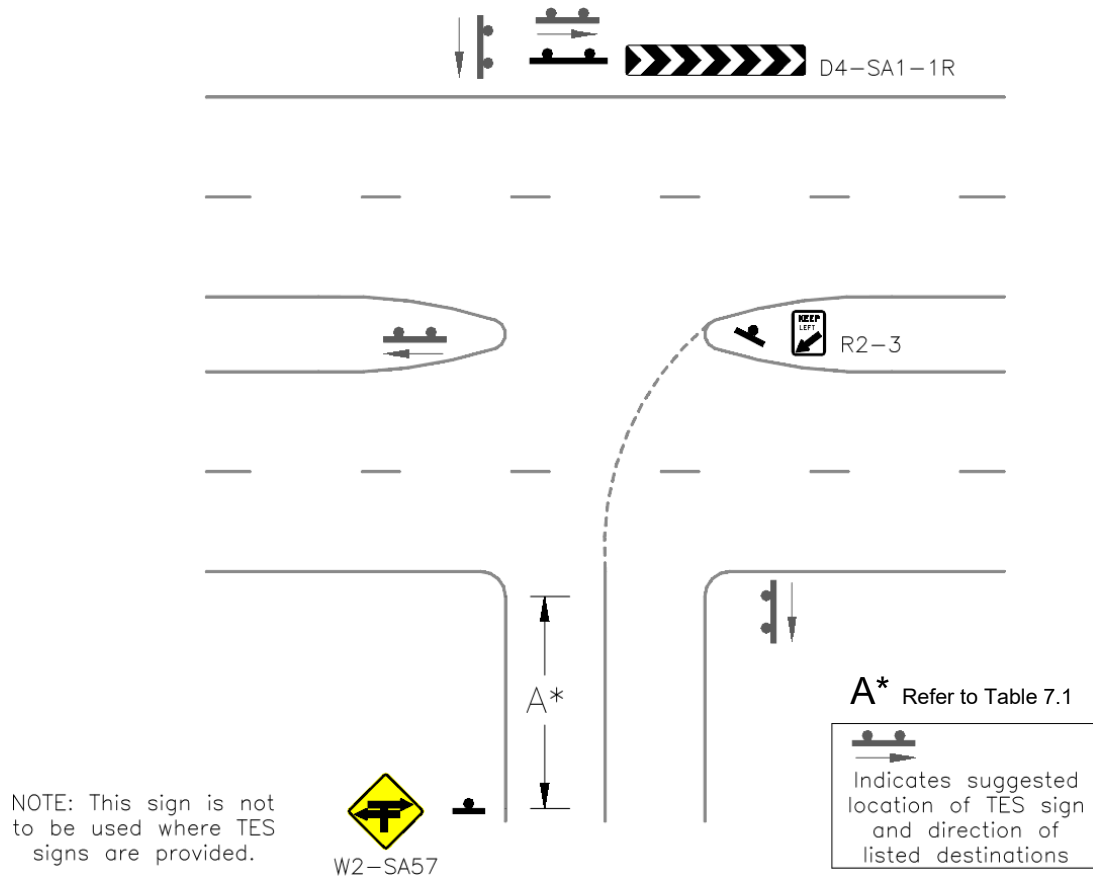


Figure 7.1: General Sign Arrangement for Narrow Median T-intersections

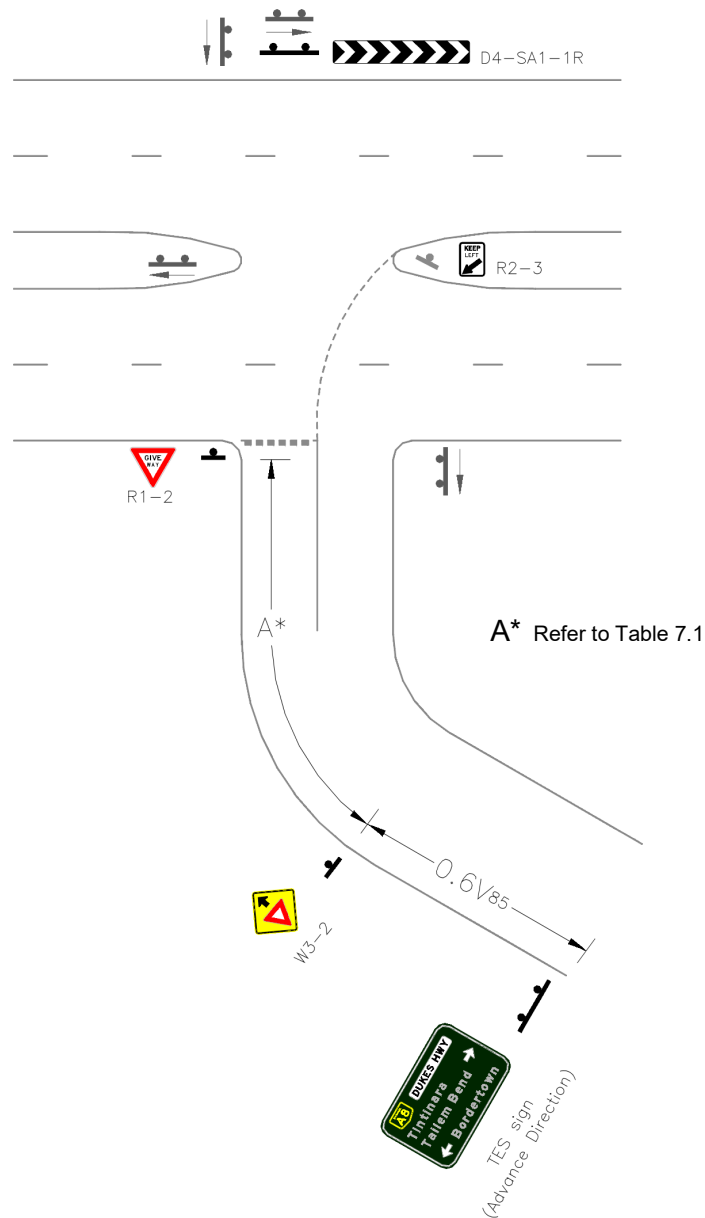


Figure 7.2: Combining Advance Direction and Warning of Traffic Control Signs

Where advance directions signs (G1 series – TES signs) are provided on the side road and a W3-2 sign is required due to insufficient sight distance, then the advance direction sign shall be at least $0.6V_{85}$ metres prior to the W3-2, (where V_{85} is the 85th percentile speed) as shown above.

Where there have been multiple documented reports of vehicles turning into on-coming traffic on the first carriageway, and all other measures are in place, duplicated R2-4B, NO ENTRY signs, complemented with a GE9-15A, WRONG WAY plate may be placed on the first carriageway. These shall be placed approximately 15 - 20 m to the right of the T-intersection and arranged to face side road traffic. The signs shall be located so as not to affect sight distance at the T-intersection. Refer to Figure 8.1 for guidance.

7.2 Intersections

At intersections regulatory controls are required on the side roads. In most cases this will be a R1-2B, Give Way sign, as shown in Figure 7.3. A W3-2 Give Way Ahead warning sign shall only be used when the sight distance to the give way sign is less than the stopping sight distance for approaching vehicles (refer to AS 1742.2 - 2022 clause 2.10.3(a)). The size of the warning sign shall be:

- W3-2B for a side road 85th percentile speed less than 90 km/h.
- W3-2C for a side road 85th percentile speed of 90 km/h or greater.

A R1-1, Stop sign shall only be considered where the requirements for the installation of stop signs contained in Section 3.2 and AS 1742.2 – 2022 clause 2.5.4 are met. Where a Stop sign is used, a W3-1, Stop Sign Ahead warning sign may be used in the same manner as a Give Way Ahead warning sign (refer to Section 4 and AS 1742.2 - 2022 clause 2.10.3(b)).

R2-3B KEEP LEFT signs shall be placed in the centre median, arranged to be visible to side road traffic (refer to AS 1742.2 - 2022 clause 2.8.2(b)).

Where the second carriageway or the nose of the median cannot readily be seen by drivers from the side road, due to a crest or difference in carriageway levels, then a turn line may be provided to give additional guidance.

Where there have been multiple documented reports of vehicles turning into on-coming traffic on the first carriageway, and all other measures stated above are in place, duplicated R2-4B, NO ENTRY signs, complemented with a GE9-15A, WRONG WAY plate, may be placed on the first carriageway. These shall be placed approximately 15 - 20 m to the right of the intersection and arranged to face side road traffic. The signs shall be located so as not to affect sight distance at the intersection. Refer to Figure 8.2 for guidance.

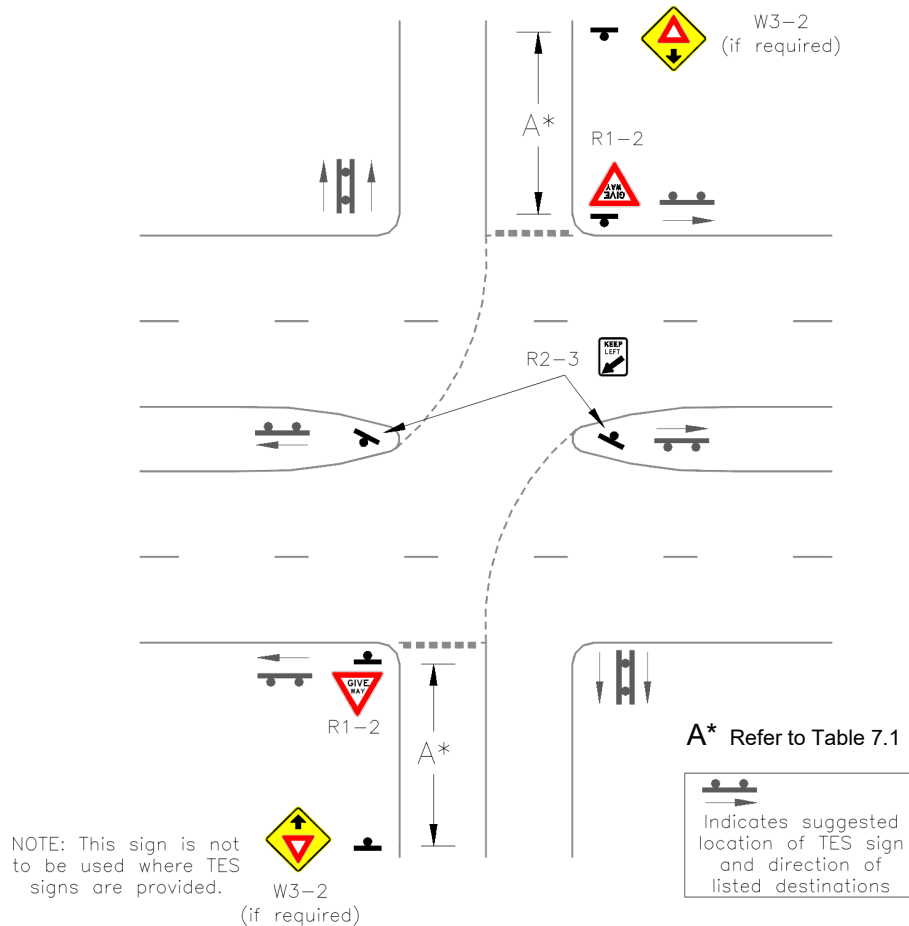


Figure 7.3: Sign Arrangement for Narrow Median Intersections

7.3 Auxiliary Lanes at Seagull Intersections

While guidance on the treatment at the end of a left lane acceleration lanes is provided in *AS 1742.2-2022* clause 4.6.2(b) and figure 4.13, it does not provide guidance for the treatment of a lane reduction from the right. A merge requiring a lane change from the right typically occurs at the end of an acceleration from a seagull treatment.



Where the length of the acceleration lane is 200 m or greater, the merge shall be treated as shown in Figure 7.4.

A W4-SA101 Right Lane Ends sign with a W8-SA101 Merge Left sign supplementary sign is located a distance A from the merge taper. This is supported with a G9-SA101 Merge Left sign at the merge taper.

For dimension A see Table D1 of *AS 1742.2 – 2022*.

Locations where the acceleration lane length is less than the minimum 200m should be treated as per Figure 7.5, with only the G9-SA101 Merge Left sign at the merge taper, and one or two painted arrows. Refer to DIT *Pavement Marking Manual* Section 2.1.7.3 for lane change arrow dimensions.

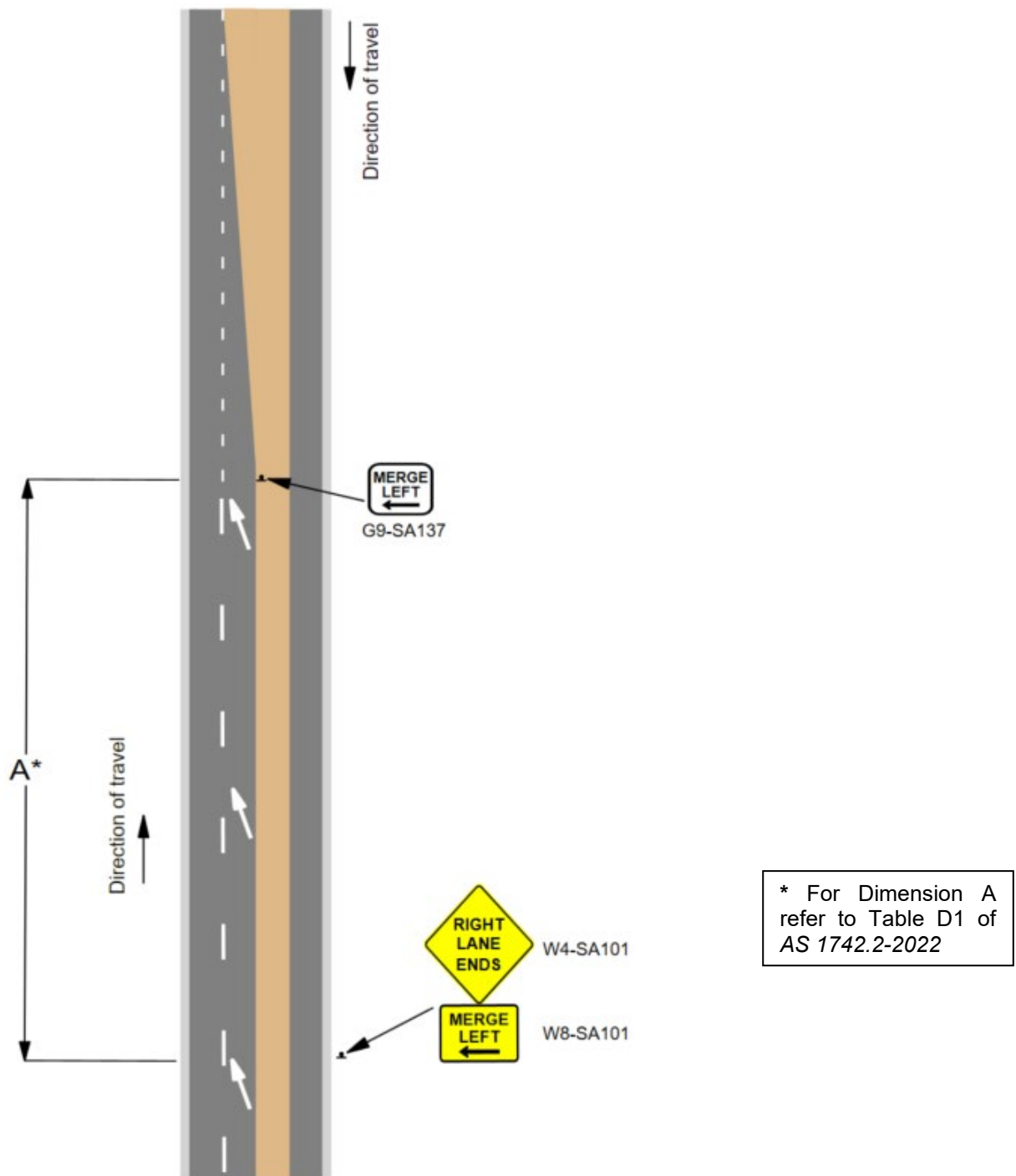


Figure 7.4: Lane Reduction from Right ($\geq 200\text{m}$ in length)

Example: [Port Wakefield Road/Carslake Road](#)

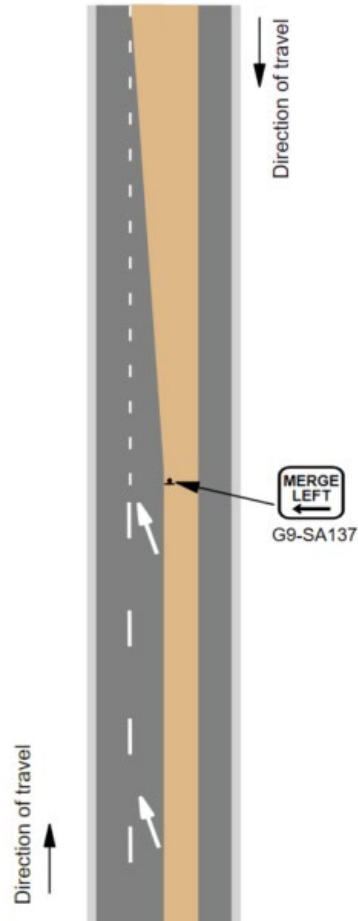


Figure 7.5: Lane Reduction from Right (<200m in length)

8 Divided Roads with Wide Medians

Wide medians provide drivers the opportunity to perform right turn or cross movements from the side road in two stages. As this type of manoeuvre is considered safer than trying to complete the turn or cross as a single manoeuvre, traffic controls should be installed to encourage this movement. With the additional space available in the median opening, providing clear delineation through the median opening area will also minimise the potential for vehicle conflict in this area.

8.1 T-Intersections

Regulatory controls on the side road are not typically required at T-intersections. However, as the first carriageway effectively operates as a “crossroad” for drivers approaching from the side road and median opening, Give-Way signs may be installed for the first carriageway only. A Stop sign shall only be used if the requirements of AS 1742.2 are met (refer to AS 1742.2 - 2022 clause 2.5.3 figure 2.1).

A W3-2, Give Way Ahead warning sign shall only be used when the sight distance to the Give Way sign is less than the stopping sight distance for approaching vehicles (refer to AS 1742.2 - 2022 clause 2.10.3(a)). The size of the warning sign shall be as shown in Section 7.2. Where a Stop sign is used, a W3-1, Stop Sign Ahead warning sign may be used in the same manner as the Give Way Ahead warning sign (refer to AS 1742.2 - 2022 clause 2.10.3(b)). Where a W3-2 is required in conjunction with an advance direction sign, the signs shall be arranged as shown in Figure 7.2.

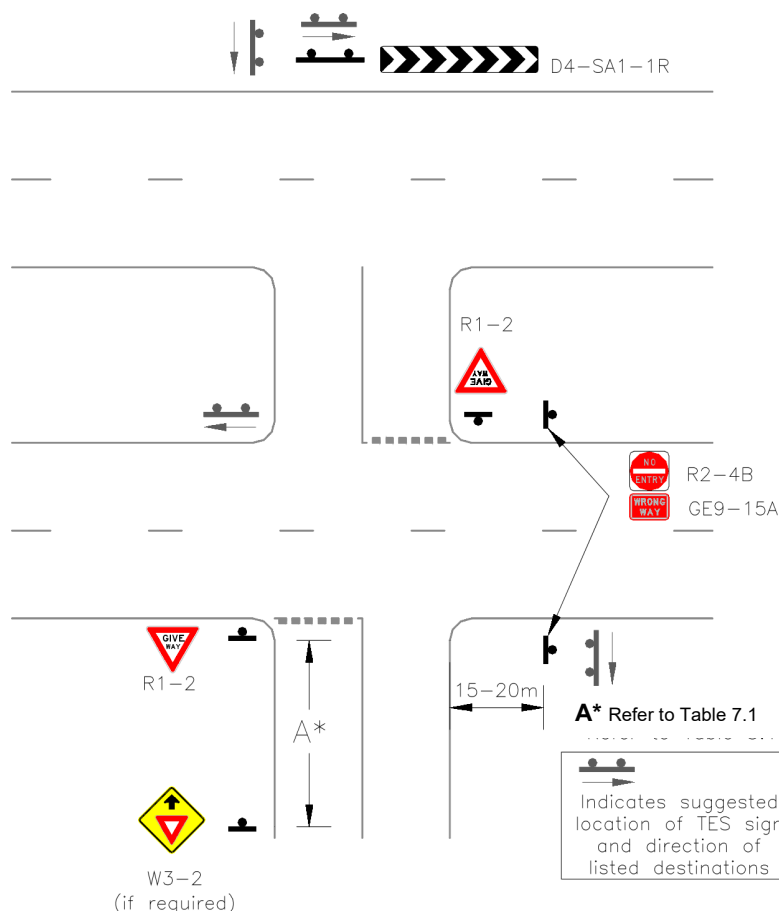


Figure 8.1: Sign Arrangement for Wide Median T-intersection

Duplicated R2-4B, NO ENTRY signs, complimented with a GE9 15A, WRONG WAY plate shall be placed on the first carriageway, approximately 15 - 20 m to the right of the T-intersection and arranged to face side road traffic as shown in Figure 8.1. The signs shall be located so as not to affect sight distance at the T-intersection.

A sight board D4-SA1-1(R) shall be installed facing the side road, placed at a sufficient height to enable it to be visible from the side road. Intersection direction signs may be erected with the sight board). A turn line may be provided where the second carriageway or the nose of the median cannot be readily seen by drivers on the side road. The general layout of signs for a T-intersection with a wide median is shown in Figure 8.1.

8.2 Intersections

At intersections regulatory controls are required on the side roads. In most cases this will be a R1-2, Give Way sign. A W3-2, Give Way Ahead warning sign shall only be used when the sight distance to the Give Way sign is less than the stopping sight distance for approaching traffic (refer to AS 1742.2 - 2022 clause 2.10.3(a)). Size of the warning signs shall be as shown in Section 7.2. Where a W3-2 sign is required in conjunction with an advance direction sign, the signs shall be arranged as shown in Figure 7.2.

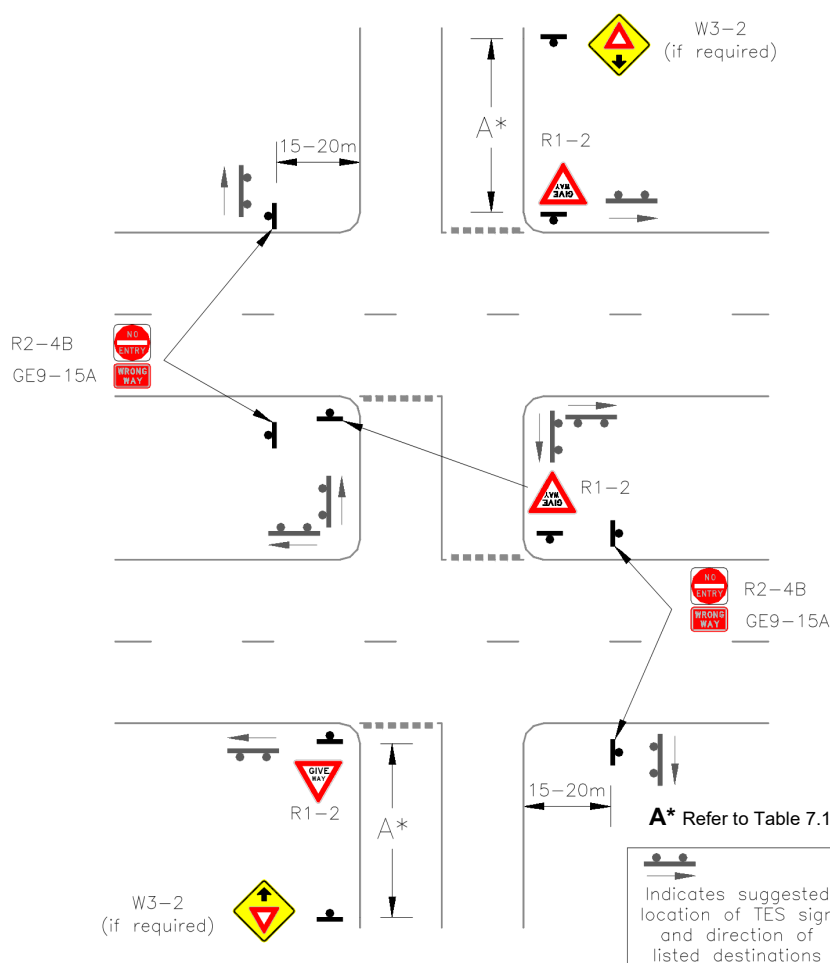


Figure 8.2: Sign Arrangement for Wide Median Intersections

The use of a R1-1, Stop signs shall only be considered where the requirements for the installation of stop signs contained in AS 1742.2 are met (refer to AS 1742.2 - 2022 clause 2.5.3). Where a Stop sign is used, the W3-1, Stop Sign Ahead warning sign may be used in the same manner as a Give Way Ahead warning sign (refer to AS 1742.2 - 2022 clause 2.10.3(b)).

Duplicated R2-4B, No Entry signs, complimented with a GE9-15A, WRONG WAY plate shall be placed on both carriageways, approximately 15 - 20 m to the right of each side road approach and arranged to face drivers entering from the side road. The signs shall be located so as not to affect sight distance at the intersection.

The general sign arrangement for an intersection with a wide median is shown in Figure 8.2. A turn line may be provided where the second carriageway or the nose of the median cannot be readily seen by drivers on the side road.

9 Wide Median Treatment

The main emphasis of this Operational Instruction is addressing operational difficulties drivers are experiencing with the layouts of Intersections and T-intersections with divided roads. For any new works or major upgrade/improvement work, it is important that the driver error problems occurring at the existing side road treatments is addressed.

Where a side road joins a divided road at a point where the median is wide (not less than 20 m) consideration should be given to the wide median treatment shown in Figure 7.5 of the Austroads 2021 Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections.

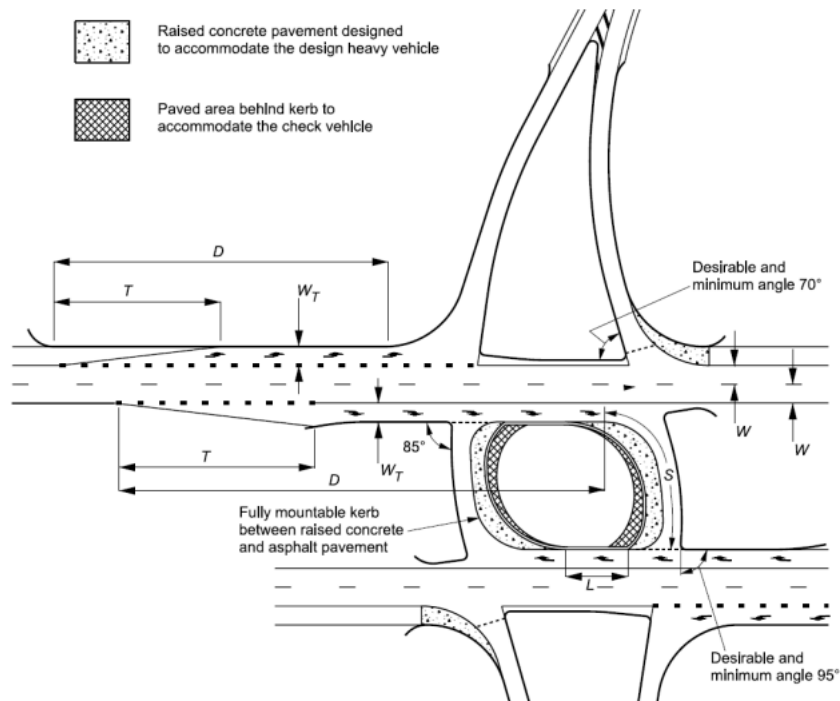


Figure 9.1: Wide Median Treatment

(Source: Austroads 2017, *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*)

10 Rumble Strips

Rumble strips on the pavement surface are intended to alert drivers to an approaching change in conditions and draw their attention to the associated warning signs. Specific signing is a key component of the rumble strip treatment.

10.1 Installation Criteria

Rumble strips shall only be used on approaches to rural intersections on the secondary road. Information on the use of rumble strips on the approaches to other hazards should be discussed with the Manager, Traffic Services.

In looking at an intersection of a primary rural arterial road with a secondary rural road, rumble strips should only be used where many of the following conditions are present:

- Excessive speeds or inattention are diagnosed as the apparent error in crashes.
- Fatigue may be an issue due to long travel distance and excessive distances between services (townships).
- There may be misleading cues leading up to the intersection, leading drivers to be confused about the priority and location of the intersection.
- The location should have a consistent history of crashes or have a serious concern raised by Road Safety Auditors related to the above factors.
- Drivers on the approach have experienced a long distance of high speed, relatively straight road on which they have had priority at intersections.
- Sight distance to the intersection for the approaching driver may be restricted on the approach.
- The site is unlikely to attract funding for a permanent solution (e.g. changes to geometric layout) in the foreseeable future.

NOTE: Every effort must be made to install standard signs and devices in accordance with the previous sections in this document before installing rumble strips.

Rumble strips should not be installed on substandard curves requiring an advisory speed, particularly in consideration of the possible effects on the control of motorcycles. The slight bumps and different surface textures, particularly with a wet surface, may cause vehicles, especially motorcycles, to lose traction.

The use of rumble strips at a limited number of targeted locations will ensure the effectiveness across the road network.

Rumble strips should only be installed where the speed limit is 100 km/h or greater.



Figure 10.1: Example of Intersection Rumble Strip

10.2 Operating Characteristics

Rumble strips should be 14-18mm above the normal road level to effectively alert drivers. When the physical properties of the strips are optimal, the noise, vibration, and 'bumpy' ride associated with high speed is difficult to ignore, encouraging drivers to slow down in order to reduce the stimulation.

Their appearance would therefore arouse the expectation of vibration and, concurrently, induce a planned deceleration response. A contrast in shade or colour may be considered for visual effect (but not painted) although it is not a mandatory requirement.

Audio tactile and visual pulses are commonly used in traffic engineering. A pulse every second is generated by the rumble strips to alert the driver, and these are started a distance from the point of concern where it would require a heavy vehicle driver to begin to react and slow to a stop if necessary.

The treatment distance should be based upon the 85th percentile speed observed before the treatment, taken at a good vantage point somewhere between 400 m and 500 m from the point of potential conflict.

The last 160 m – 200 m preceding the intersection should be left clear for smooth braking. Coupled with signing, road users should now be well aware of the approaching intersection.

If the rumble strips are placed closer to the intersection, vehicles tend to bounce, particularly if the rumble strips are at a reduced spacing. This causes overloading on the pavement which in turn could fail prematurely.

10.3 Surface Texture and Seal Treatment

The surface of the rumble strips should be of a rougher texture to give an audible warning to drivers as well as the tactile warning given by the rising of the rumble strip. This can be achieved by using a larger aggregate in the rumble strip.

Materials used shall conform to the DIT Master Specification.

For the installation of rumble strips there are two seal treatments proposed depending on the texture of the existing seal:






- Where the existing seal is a 5 mm or 7 mm seal, then 16 mm rumble strips shall be installed as per guidelines.
- Where the existing seal is a 10 mm or a 14 mm seal, then a 5 mm or 7 mm seal shall be applied for approximately 210 m (20 m before the first rumble strip and 20 m after the last rumble strip). The 16 mm rumble strips shall then be installed on top of the first seal coat as per guidelines.

10.4 Signs and Installation Criteria

The action required to safely negotiate the hazards is given in accompanying traffic signs. Rumble strips in themselves do not convey much information, and the road user will be actively scanning for more useful information. Confusion must not be created. Their installation must be clearly related to nearby signs, i.e. advance warning signs, supplementary approach signs (if necessary), delineation devices, regulatory signs and other warning signs.

A Stop sign shall only be used where road users are required to come to a complete stop provided that the requirements which are set out in Section 3.2 and AS 1742.2 – 2022 clause 2.5.3 are met.

Table 10.1 shows the signs to be used at rural intersections as components of the rumble strip treatment.

		 R1-2B	 R1-1B	 W3-2C		 W3-1C		 W2-3C	
				200m	400m	200m	400m	200m	400m
T-Intersection	Standard							✓	✓
	GIVE WAY Controlled ¹	✓		✓	✓				
	STOP Controlled		✓			✓			✓
Cross Roads	Standard	✓		✓	✓				
	STOP Controlled		✓			✓	✓		

Notes:

1. A Distance (W8-5) supplementary plate shall accompany all signs at 200m and 400m from the conflict point.
2. The Crossroads (W2-1) sign shall NOT be used on any approach controlled by Stop or Give Way signs (AS1742.2-2022 Clause 2.9.3)

Table 10.1: Signing on Rural Intersection with the Rumble Strip Treatment

Many intersections may already have existing Advance Direction (AD) signs installed which may be located where T-intersection warning signs are to be located. In this case, the AD sign should be re-located

to 500 m from the intersection. Service and tourist signs located prior to the intersection should be removed and made into a supplementary plate and mounted below the AD sign.

10.5 Delineation

Guideposts should be installed in the 150 m preceding the intersection at 15 m spacing, to create a high speed perception effect and hence a sense of urgency for the road user to slow down. The guideposts should be installed on both sides of the road and meet DIT specifications.

Each site should have edge lines marked and it is preferable there be a 1.2 m wide sealed shoulder for 400 m on approach to the intersection. Retro-reflective pavement markers (RRPMs) shall be used on the approach treated with the rumble strips. All RRPMs and pavement marking shall be installed in accordance with standard practice shown in the DIT Pavement Marking Manual.

10.6 Drainage

Rumble strips may disrupt drainage patterns across the pavement and sealed shoulder to some extent, and although this is not expected to be significant in typical rural two-lane applications, it may need to be considered in some circumstances.

10.7 Maintenance

Rumble strips should be maintained to a level that the audible and tactile effect of the strips is still present and capable of alerting a fatigued or inattentive road user to the presence of the approaching intersection.

10.8 Adverse Effects

Rumble strips may not be desirable at locations near residences due to a possible increase in outside noise created by the vehicles passing over the rumble strips. If residents are nearby to a location being considered (within 150 m), consultation should take place explaining the safety benefits anticipated.

Some road users may cross into an opposing lane while no traffic is coming the other way or onto a sealed shoulder to avoid the rumble strips. It is considered that this type of act would be deliberate but rare and usually occur with almost no traffic about.

10.9 Rumble Strip Design and Dimensions

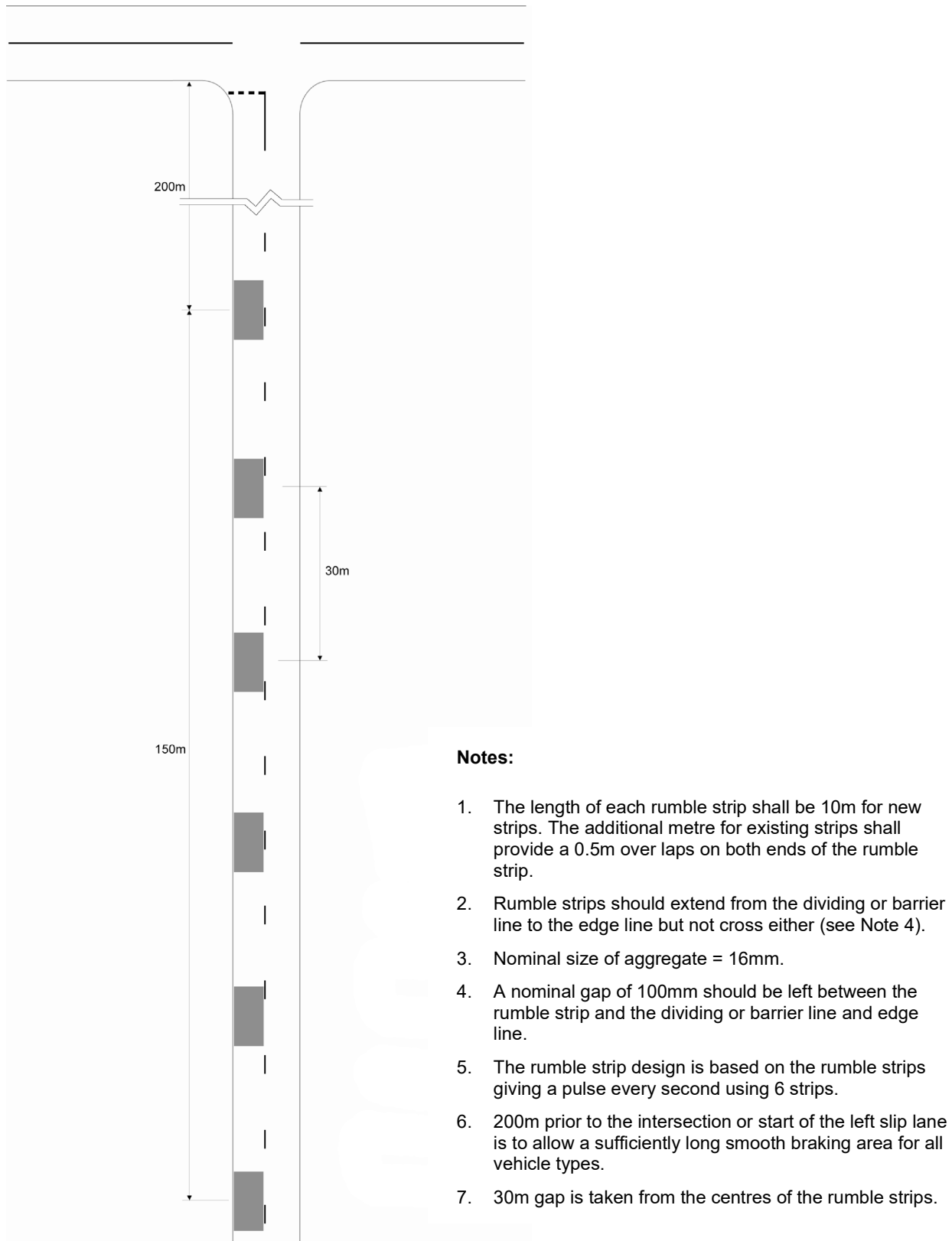


Figure 10.1: Layout of Rumble Strips on a T-Intersection

Specific Road Signs - Specifications, South Australia

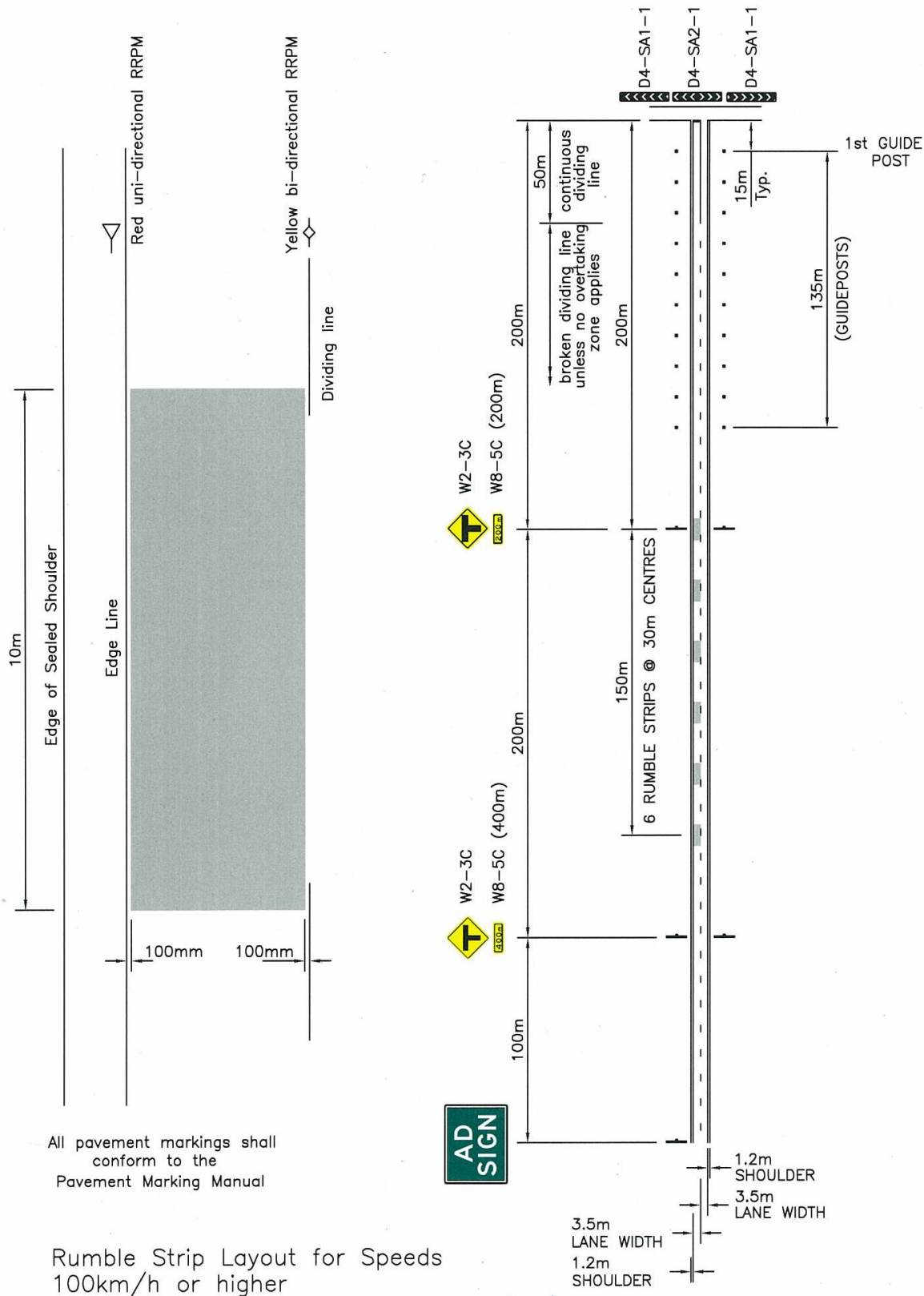


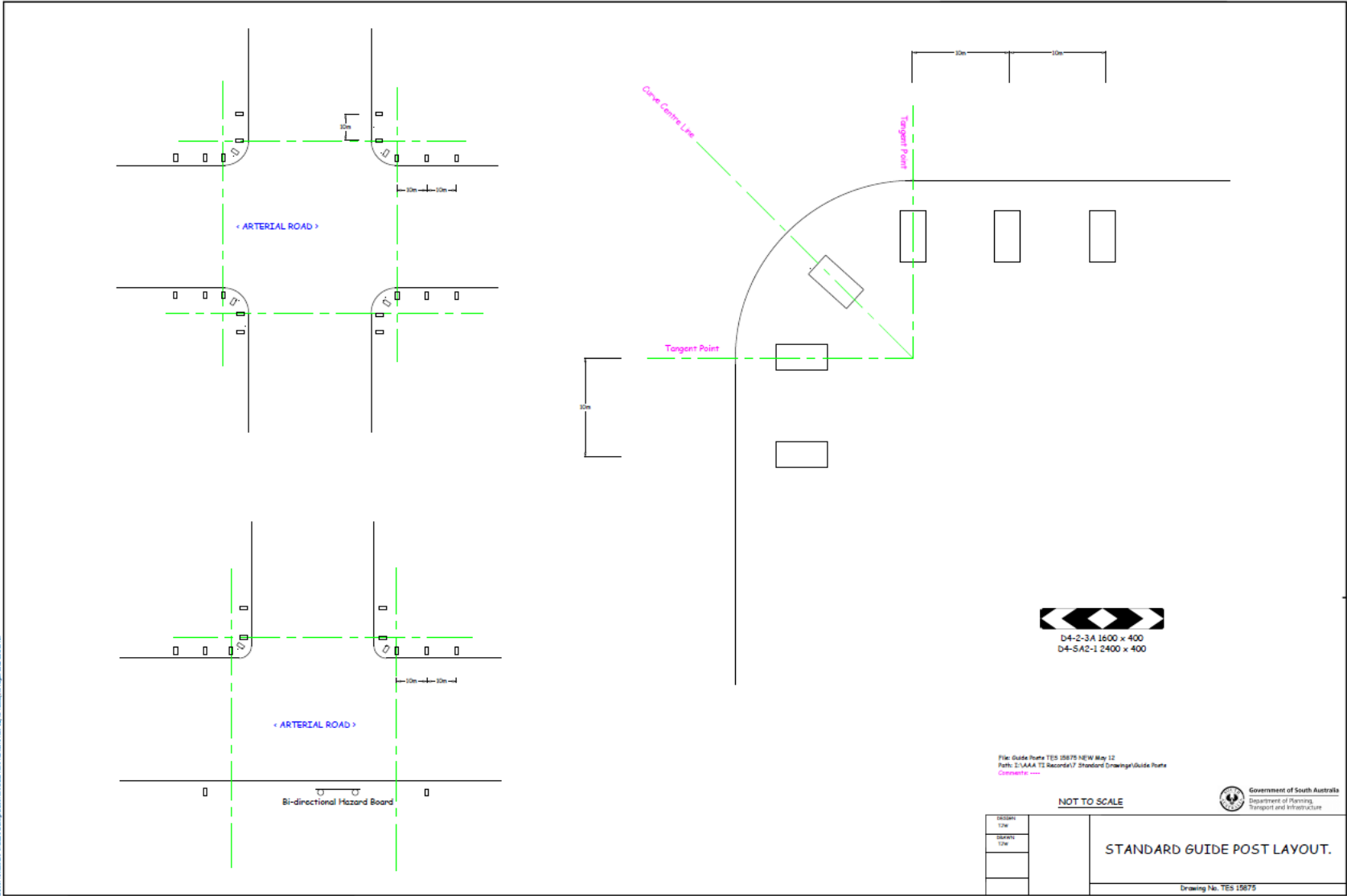
Figure 10.2 - Rumble Strip Standard Drawing

11 References

- AS 1742.1 (2021) Manual of Uniform Traffic Control Devices Part 1: General introduction and index of signs
- AS 1742.2 (2022) Manual of Uniform Traffic Control Devices Part 2: Traffic Control Devices for General Use.
- Austroads (2021) Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections
- Austroads (2020) Guide to Traffic Management Part 10: Transport Control – Types of Devices
- Dravitzki, VK et al (1998). Use of Rumble Strips as Warning Devices on New Zealand Roads (Research Report No. 103). Transfund New Zealand: Wellington.
- Road Traffic (Vehicle Standards) Rules 1999

Appendices

Appendix A Guide Posts at Intersections



Appendix B RJAWs Lite – L_{min} Calculation

L_{min}

$$L_{min} = \frac{V_1^2 - V_2^2}{254(d + 0.01a)}$$

a = longitudinal grade

d = coefficient of deceleration (refer Table 5.3 Austroads GRD Part 3)

d = 0.2																	
a = 0 %			1 %			2 %			3 %			4 %			5 %		
V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}
km/h	km/h	m	km/h	km/h	m	km/h	km/h	m	km/h	km/h	m	km/h	km/h	m	km/h	km/h	m
110	80	112	110	80	107	110	80	102	110	80	98	110	80	94	110	80	90
100	70	100	100	70	96	100	70	91	100	70	87	100	70	84	100	70	80
90	60	89	90	60	84	90	60	81	90	60	77	90	60	74	90	60	71
80	50	77	80	50	73	80	50	70	80	50	67	80	50	64	80	50	61

d = 0.26																	
a = 0 %			1 %			2 %			3 %			4 %			5 %		
V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}	V ₁	V ₂	L _{min}
km/h	km/h	m	km/h	km/h	m	km/h	km/h	m	km/h	km/h	m	km/h	km/h	m	km/h	km/h	m
110	80	86	110	80	83	110	80	80	110	80	77	110	80	75	110	80	72
100	70	77	100	70	74	100	70	72	100	70	69	100	70	67	100	70	65
90	60	68	90	60	66	90	60	63	90	60	61	90	60	59	90	60	57
80	50	59	80	50	57	80	50	55	80	50	53	80	50	51	80	50	50

Refer to Section 4.4 - Rural Junction Active Warning System (RJAWs) Lite