RamShield® Transition

Connecting to Rigid Barriers

SafeDirection
CRASH BARRIER SOLUTIONS

Table of Contents

Version	Date	Revisions
02	February 2026	Updated format, Inclusion of Blocking Pieces.

Leading Safety

Successfully crash tested to MASH Test Level 3

Complies with AS/NZS 3845.1:2015 Road safety barrier systems and devices

Safe vehicle containment and redirection

Simplified Installation

Just 5.9 m length, measured from the asymmetric transition

No nesting of the thrie-beam rail

No blocking pieces – just 235 mm system width

No requirement for cast-in ferrules when connecting to concrete

Standard 1860 mm RamShield® High Containment (HC) posts throughout the transition

1000 mm thrie-beam rail height

Compatibility

Suitable for attachment to the Austroads concrete anchor block design

Suitable for attachment to CrocGuard® bridge & culvert barrier

Same installation height as RamShield® High Containment (HC)

Can be connected directly to RamShield® W-Beam or MSKT Terminals

1.0 Introduction

Wherever it is necessary to change from one type of barrier to another, or to physically join them together (e.g. a bridge barrier to a road barrier), the interface must be designed to ensure that the overall system will perform safely when impacted by a design vehicle.

The RamShield® Transition provides a smooth, snag-free connection between steel guardrail barriers and rigid barriers, such as at bridge parapets. The RamShield® Transition gradually increases stiffness of the system reducing the potential for vehicle pocketing.

2.0 Specifications

Crash Test Compliance	MASH Test Level 3
MASH TL3 Dynamic Deflection	0.5 m
System Length	5.905 m
System Width	235 mm
System Height	1000 mm
System Finish	Hot dip galvanised in accordance with AS/NZS 4680

3.0 How the RamShield® Transition Works

The RamShield® Transition features 3.5 mm thick thrie-beam guardrail, eliminating the need for nesting rails. The posts are 1860 mm RamShield® High Containment (HC) posts, which are the same C-post profile as used in Australian public domain guardrail systems.

The RamShield® Transition achieves a controlled redirection of errant vehicles by releasing the thrie-beam guardrail from the post at an optimal load to retain rail height, limit dynamic deflection and to allow the post to collapse without tripping the vehicle.

The separation of the rail from the post is achieved by a release tab incorporated into the C-post. The tab controls the release of the rail within the impact zone providing stable vehicle containment and redirection with minimal vehicle roll.

The C-posts collapse upon impact yielding proximate to the ground surface. The sectional strength of the C-post limits barrier deflection, an important design consideration when reducing the potential for vehicle pocketing.

The 1000 mm thrie-beam rail height improves vehicle stability during containment and redirection.

4.0 Crash Test Performance

The RamShield® Transition has been fully crash tested and evaluated according to the specifications for Test Level 3 (TL3) of the AASHTO Manual for Assessing Safety Hardware (MASH). The MASH specification is an update to and supersedes NCHRP Report 350 for the purposes of evaluating new safety hardware devices.

MASH is also the basis of testing procedures for road safety systems as stated in *AS/NZS 3845.1: 2015 Road Safety Barrier System and Devices.*

The introduction of MASH follows changes to the vehicle fleet, researching of real-life impact conditions and updated criteria for evaluating barrier performance.

The RamShield® Transition is designed to connect longitudinal barriers of differing lateral stiffness. The MASH TL3 crash test matrix requires the following impacts:

- 2270 kg pick-up travelling at 100 km/h and 25 degrees (156.4 kJ).
- 1100 kg passenger car travelling at 100 km/h and 25 degrees (75.8 kJ).

Impacts performed with the pick-up truck (2270P) evaluates barrier strength and the potential for the vehicle to override the crash barrier system or rollover during redirection.

Impacts performed with the passenger car (1100C) investigates the potential for the vehicle to underride the crash barrier system and wheel snag. This impact also assesses occupant risk, including impact velocities and head-slap.

Figure 1: Crash Test Evaluation of the RamShield® Transition, Connection to a Concrete Parapet.

5.0 Material Traceability

Safe Direction operates a quality management system, independently certified to the requirements of ISO 9001:2015. A multi-stepped procedure is used by Safe Direction to verify the compliance of the material used in the production of the RamShield® Transition C-posts and thrie-beam guardrail to AS/NZS 1594.

Mill certificates and independent third-party laboratory test results are verified against Australian Standard guidelines recording the steel heat numbers, mechanical results and chemical composition. Safe Direction product is then stamped during manufacture with a 4-digit number providing industry-leading traceability to the steel heat number. The format for stamping thrie-beam guardrails is:

Example: SD 9419 350 27

Where: SD = product from Safe Direction
9419 = the last 4 digits of the heat no.
350 = steel grade (i.e. HA 350)
27 = base metal thickness (i.e 2.7 mm

TEST CERTIFICATE BLUESCOPE STEEL

CHEMICAL ANALYSIS

Percentage of element by mass (L=Cast, P=Product, -S=Soluble, -T=Total, CF=Chemical Formula, n=Min, x=Max)

Item No	Heat / Unit No	NATA Lab	L/P	C	P	Mn	Si	S	Ni	Cr	Mo	Cu	Al-T
0010	6709419	0632	L	.157	.019	.74	<.005	.015	.016	.035	.004	.042	.034

Item No	Heat / Unit No	NATA Lab	L/P	Ti	B-T	N	Nb	Sn	V	CF1	CF2	CF3
0010	6709419	0632	L	<.002	<.0003	.0045	.001	.002	<.003	.29	.10	.00

CF1=C+ (MN/6) + ((CR+MO+V)/5) + ((CU+NI)/15) CF2=NI + CR + CU + MO CF3=NB + TI + V

MECHANICAL TESTING

Tensile AS 1391

Item No	Heat No	Tested Unit	NATA Lab	Cat	Loc	THICK mm	ReH MPa	Rm MPa	Lo mm	ELONGN %
0010	6709419	1H1F9690	0631	B	LQF	2.70	420	520	80	25
0010	6709419	1H1F9845	0631	B	LQF	2.70	390	500	80	22

ITEMS COVERED BY THIS CERTIFICATE

Item No	Heat No	Ordered Dimensions (mm)	No of Units	Mass (Tonnes)	Unit Identities
0010	6709419	740.0X2.70XCOIL	6	24.030	1H1H9291AA 1H1H9291BA 1H1H9291CA 1H1H9291DA 1H1H9292AA 1H1H9292CA

6.0 Design Considerations

6.1 Offset from the Traffic Lane

Road safety barriers should be located (e.g. offset, lateral position) as far as possible from the edge of the traffic lane as site conditions permit but within the limits described below. This enables errant drivers to recover and regain control of the vehicle, minimising the frequency of barrier impacts. Wider offsets can reduce nuisance impacts on the barrier and enable disabled vehicles to be free of the traffic lanes on a high-speed road, therefore reducing the risk of secondary crashes.

Providing a consistent barrier offset is especially important for long lengths of continuous barrier. Consistent barrier design creates a uniform view, while frequent changes in barrier offset can mislead drivers and negatively impact decisions while driving, especially in adverse visibility conditions.

The offset is measured from the edge of the traffic lane to the face of the thrie-beam guardrail.

The offset needs to ensure that the available stopping sight distance and intersection sight distance are not impeded. Increased offsets allow vehicles to stand clear of the adjacent traffic lane after an impact if the vehicle is disabled and for maintenance activities. The practicality and costs of maintenance of a barrier and the areas on both sides of the barrier should be considered along with Occupational Health & Safety implications.

The recommended offsets to barriers are detailed in Table 1. It is recommended that barriers must not be closer than 0.5 m from traffic lanes on rural roads to minimise nuisance hits. Similarly, the minimum offset on urban roads is 0.3 m.

Table 1: Recommended Offset Distances. Source: Table 6.5 Austroads Guide to Road Design Part 6.

	Rural High Speed [1, 3]	Rural Low Speed	Urban Freeways [3]	Urban Roads [2]
Desirable	4.0 – 6.0 m	3.0 – 6.0 m	4.0 – 6.0 m	2.5 – 3.0 m
Minimum	3.0 m	2.5 m	3.0 m	1.0 m

Notes:

1. *Operating speed greater than or equal to 80 km/h.*
2. *The offset may be governed by the required offset to kerbs.*
3. *Adoption of widths less than 3 m shall include assessment of desired operating practices, including emergency response, maintenance and police enforcement.*

6.2 Flaring

Generally, there should be uniform clearance between traffic and roadside features, particularly in urban areas where there are many roadside features. Uniform alignment enhances road safety by providing the driver with a certain level of expectation, thus reducing driver concern for and reaction to the roadside features and barriers.

6.3 Advance Grading

It is recommended that the area in advance of the RamShield® Transition be limited to a grading of 10H:1V to ensure that the vehicle's suspension is neither extended nor compressed at the moment of impact with the barrier.

6.4 Placement in Rock or Asphaltic Concrete

The rail release mechanism and performance of the RamShield® Transition differs from traditional barrier designs. Traditional posts will absorb some crash energy through post rotation in the surrounding soil prior to fully yielding. Setting these posts in deep lift asphalt or rock may compromise the performance of the system.

The patented RamShield® tab regulates the forces required to release the w-beam rail during a vehicle collision. The RamShield® C-posts will typically yield by bending proximate to ground level.

Restraining the RamShield® C-posts below ground level does not adversely affect the rail release mechanism.

Therefore, acceptable foundation pavement conditions for the installation of the RamShield® C-posts includes the following:

- Narrow holes drilled into rock.
- Deep lift asphaltic concrete.
- Asphaltic concrete over granular pavement.
- Flush seal over granular pavement.
- Unsealed compacted formation.

Please consult with Safe Direction when rock is encountered, and full post embedment depth cannot be achieved.

6.5 The Asymmetric Transition

The use of an asymmetric transition is required to transition from thrie-beam to w-beam guardrail. The asymmetric transition panel is 1905 mm long (nett laying length) and is available as an approach or departure configuration (viewed from the road centreline).

The asymmetric transition lowers the height to top of the thrie-beam rail by 200 mm, making it compatible for use with RamShield® W-Beam guardrail and MASH compliant end terminals, which are installed with a rail height of 800 mm above ground level.

Note: The 1905 mm (6'3") nett laying length of the asymmetric transition differs from the standard 2 m post spacing of RamShield® guardrail variants.

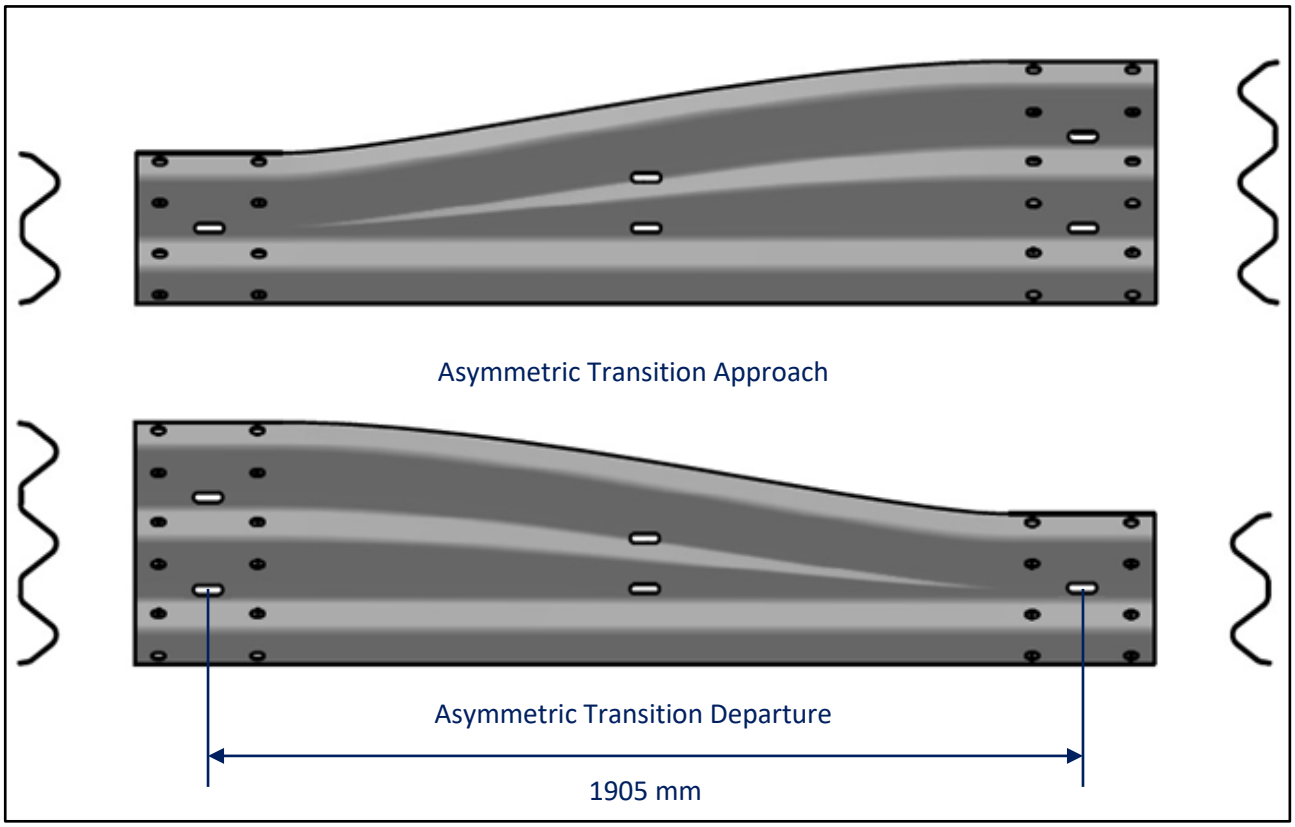


Figure 2: Asymmetric Transitions.

6.6 Connecting to Concrete

The RamShield® Transition may be connected directly to a rigid concrete barrier or abutment. If the concrete barrier or abutment is lower than the 1000 mm system height of the RamShield® Transition, a top mounting bracket is used to facilitate attachment of the thrie-beam terminal connector.

Crash testing of the RamShield® Transition when connected to a concrete parapet was performed with the terminal connector secured with M20 mechanical anchors eliminating the requirement for cast-in ferrules. The use of mechanical anchors simplifies installation and allows the installation contractor to position the terminal connector at the correct height.

6.7 Connecting to CrocGuard Bridge and Culvert Barrier

The RamShield® Transition may be connected directly to CrocGuard® bridge and culvert barrier. CrocGuard® features heavy duty abutment posts allowing the system to span up to 16 m. The 3.5 mm thick thrie-beam guardrail of the RamShield® Transition splices directly to the thrie-beam panel forming the CrocGuard® beam. The CrocGuard® beam is positioned 1000 mm above road level matching the installation height of the RamShield® Transition.

Figure 3: RamShield® Transition, Connection to Concrete.

Figure 4: RamShield® Transition, Connection to CrocGuard®.

6.8 Installation of Blocking Pieces

The standard configuration of the RamShield® Transition does not require blocking pieces providing a narrow width system. However, at constrained sites the use of 200 mm wide blocking pieces may be used. The installation of blocking pieces allows the face of the thrie-beam rail to be offset from the alignment of the C-posts. This can be an important design consideration when accommodating the alignment of drainage or other underground obstructions beneath the system.

The RamShield® Transition blocking piece is manufactured from 200 x 100 x 4 mm RHS. The face of the blocking piece features the RamShield® tab to facilitate attachment of the thrie-beam guardrail.

The RamShield® tab regulates the force to release the thrie-beam guardrail throughout the impact zone while the use of a closed section RHS for the manufacture of the blocking piece provides torsional strength reducing the potential for the block to deform during a vehicle impact.

Figure 5: RamShield® Transition, Installation of Blocking Pieces.

6.9 Minimum Installation Length

It is recommended, where space permits, to install continuous safety barrier rather than designing a barrier to shield a specific hazard. A continuous safety barrier aims to protect the entire roadside and prevent head-on collisions.

At sites where continuous barrier is not achievable, a shorter length barrier may be installed as shown in Table 2.

Table 2: RamShield® Transition, Minimum Installation Lengths.

Design Speed	Leading Guardrail End Terminal	RamShield® Transition Length	Minimum Installation Length
≤ 70 km/h	9.5 m TL2 MSKT	5.9 m	15.4 m
> 70 km/h	14.3m TL3 MSKT	5.9 m	20.2 m

6.10 Design Life

The durability of the finished hot dip galvanized coating is a function of the environment to which the article is exposed. According to industry standards, hot-dip galvanized coatings can last up to 50 years in rural environments and up to 25 years in more corrosive environments, such as coastal regions. These estimates are based on average environmental conditions, and the actual lifespan of a galvanized coating will depend on the specific conditions it is exposed to.

Example: The RamShield® C-Post has a thickness of 4.3 mm. Hot dip galvanising will provide a minimum average coating thickness of 70 µm. When installed in a C3 environment, the coating will provide approximately 33 years until first maintenance.

Table 3: Coating Thicknesses, AS/NZS 4680

Article Thickness, mm	Average Coating Thickness, µm	Average Coating Mass, g/m²
≤ 1.5	45	320
> 1.5 ≤ 3	55	390
> 3 ≤ 6	70	500
> 6	80	600

Table 4: Corrosivity Classifications, AS 4312

Corrosivity Category	
CX	Severe Surf Shoreline
C5	Surf Seashore
C4	Calm Seashore
C3	Coastal
C2	Arid/Urban Inland
C1	Dry Indoors

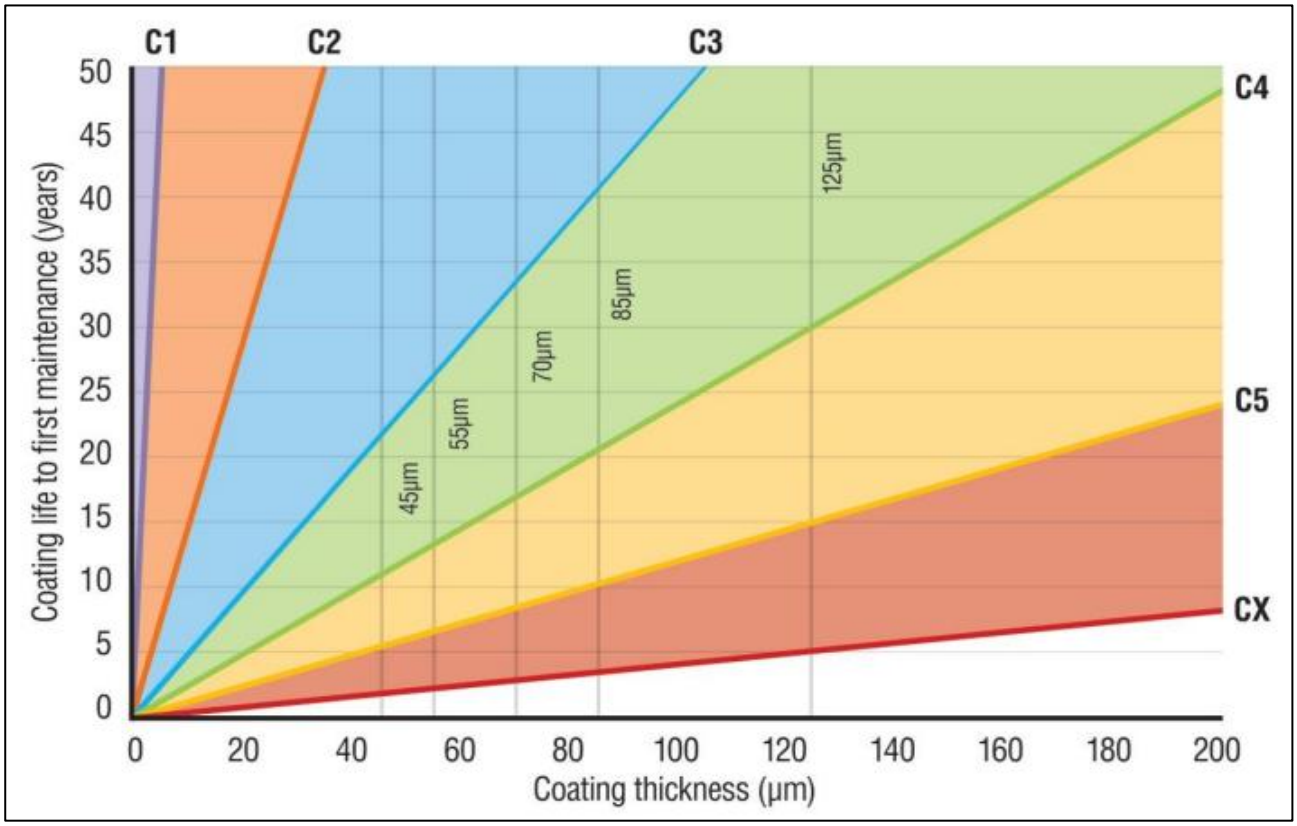


Figure 6: Calculated Corrosivity Rates for Hot Dip Galvanised Coatings, AS/NZS 2312.2.

7.0 Computer Simulation Analysis

Computer simulation analysis, also known as finite element analysis, has become an important tool in the development and assessment of crash barrier systems. Recent advances in computer hardware and finite element methodologies have given developers of crash barriers the ability to investigate complex dynamic problems involving vehicular impacts into safety barrier systems. Finite element analysis has been used extensively to evaluate both vehicle components and the crashworthiness of safety barriers and hardware.

Most computer simulation models use the LS-DYNA finite element code. LS-DYNA is a general-purpose, explicit finite element code and is widely used to solve nonlinear, dynamic response of three-dimensional problems and is capable of capturing complex interactions and dynamic load-time history responses that occur when a vehicle impacts a barrier system.

The full-scale crash test results of the RamShield® Transition have been numerically validated and verified in accordance with NCHRP Report 179 as required by the Austroads Safety Barrier Assessment Panel (ASBAP).

The RamShield® Transition simulation model has been used by Safe Direction to evaluate incremental improvements including:

- Varying installation height.
- The behaviour of the concrete beam when supporting posts with baseplates.
- Installation of blocking pieces.

Computer simulation analysis is not used to substitute compliance crash testing, however it has become a useful tool to assist designers and understand the impact performance of non-standard installation configurations.

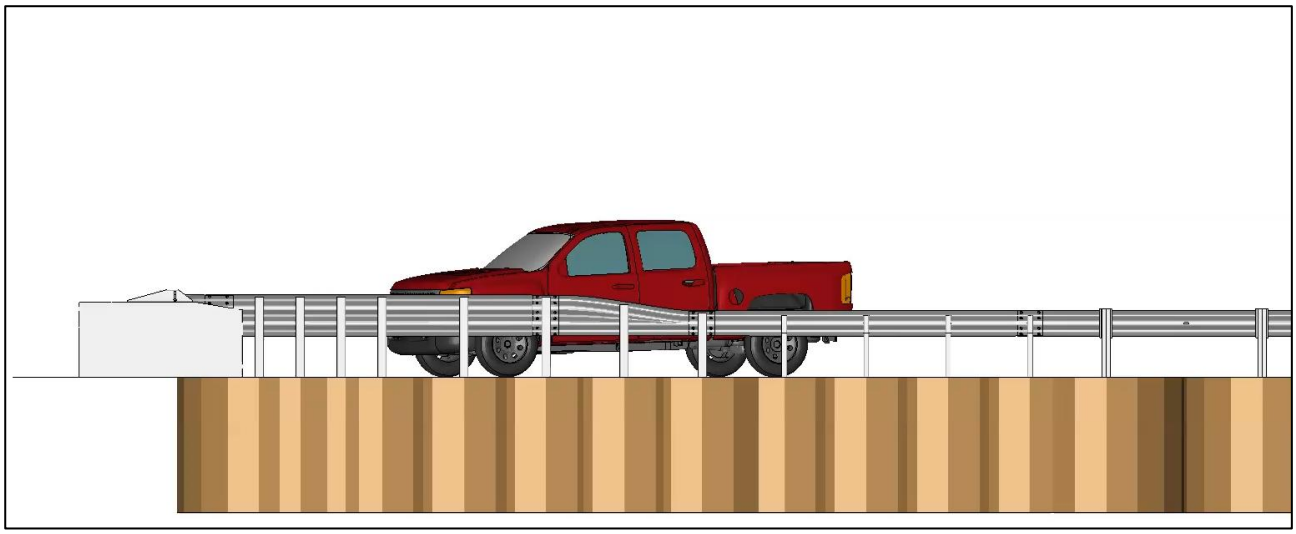


Figure 7: RamShield® Transition Simulation Analysis.

8.0 Connections & Attachments

8.1 Connection to RamShield® W-Beam

The use of an asymmetric transition is required to connect the RamShield® Transition to RamShield® w-beam variants. The asymmetric transition lowers the height to top of the rail by 200 mm, making it compatible for use with RamShield® W-Beam and RamShield® Low Deflection which adopt a w-beam rail height of 800 mm above ground level.

When connecting to RamShield® W-Beam, the 4 m w-beam section in advance of the asymmetric transition is installed with posts at 1 m centres as details in Figure 8. This arrangement gradually stiffens the RamShield® W-Beam system as it transitions to thrie-beam guardrail.

RamShield® Low Deflection features the same C-post profile as used within the RamShield® Transition. RamShield® Low Deflection also features w-beam splice mid-span between posts there the spacing of the posts in advance of the asymmetric transition is detailed in Figure 9.

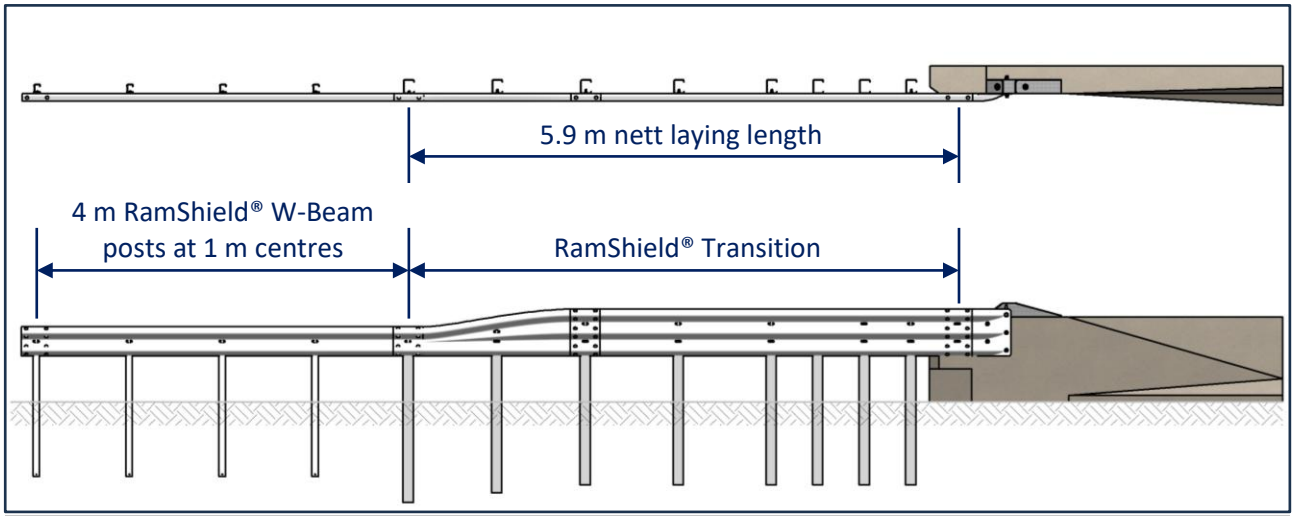


Figure 8: RamShield® Transition, Connection to RamShield® W-Beam.

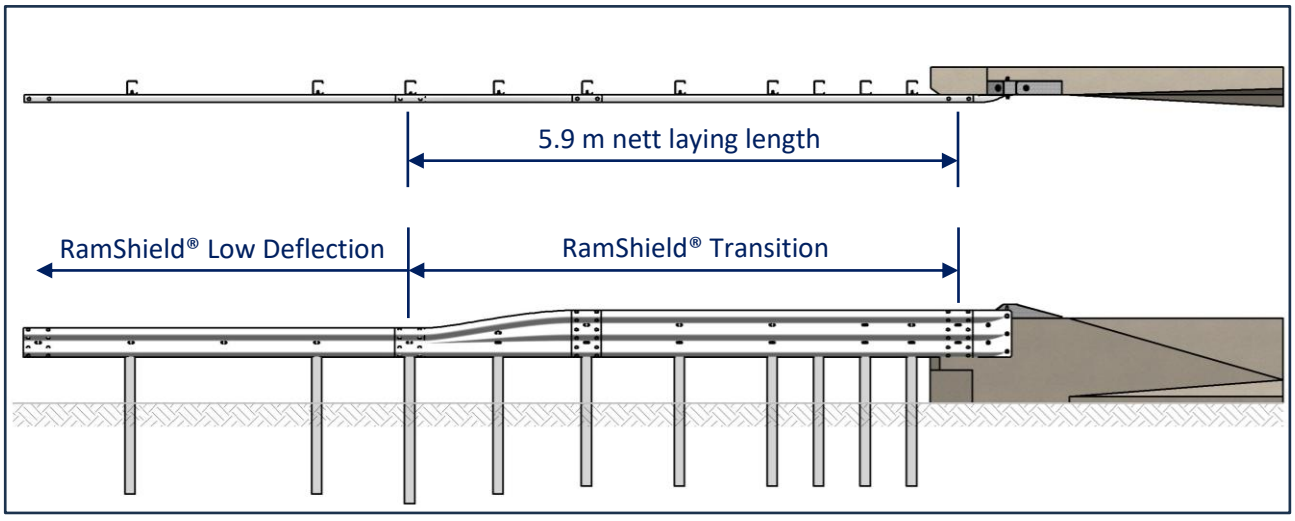


Figure 9: RamShield® Transition, Connection to RamShield® Low Deflection.

8.2 Connection to RamShield® High Containment

RamShield® High Containment (HC) features thrie-beam guardrail supported by C-posts. The C-posts used in the assembly of RamShield® HC are identical to the C-posts used within the RamShield® Transition. The thrie-beam mounting height of RamShield® HC is positioned 1000 mm above road level matching the installation height of the RamShield® Transition. Since an asymmetric transition is not required for connection to thrie-beam guardrail, the length of the RamShield® Transition is reduced to 4m as detailed in Figure 10.

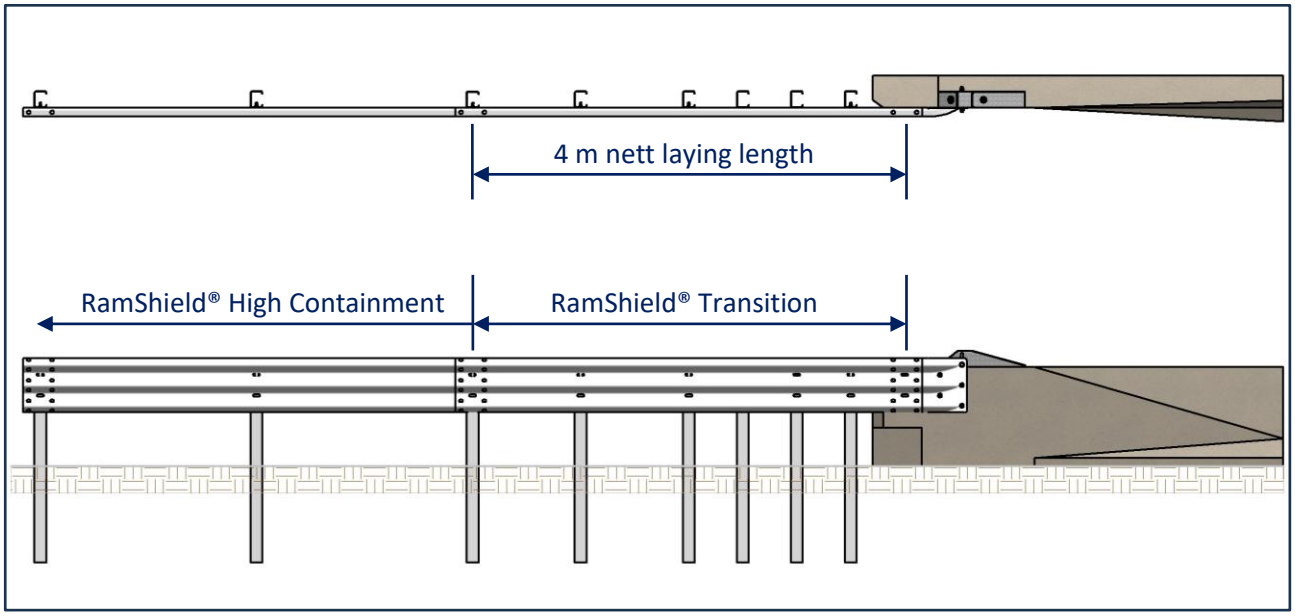


Figure 10: RamShield® Transition, Connection to RamShield High Containment.

8.3 Connection to Guardrail End Terminals

Guardrail end terminals are designed to anchor the safety barrier system and introduce the necessary tensile and flexural strength required for safe vehicle containment and re-direction throughout the length of-need section. They also provide the additional feature of reducing the severity of an impact near or at the end of the system.

Guardrail end terminals are installed using w-beam guardrail, therefore it is necessary to transition from thrie-beam using an asymmetric transition before commencing installation of the end terminal.

The Safe Direction MASH compliant MSKT and MAX-Tension guardrail end terminals may be connected directly to the asymmetric transition as detailed in Figure 11.

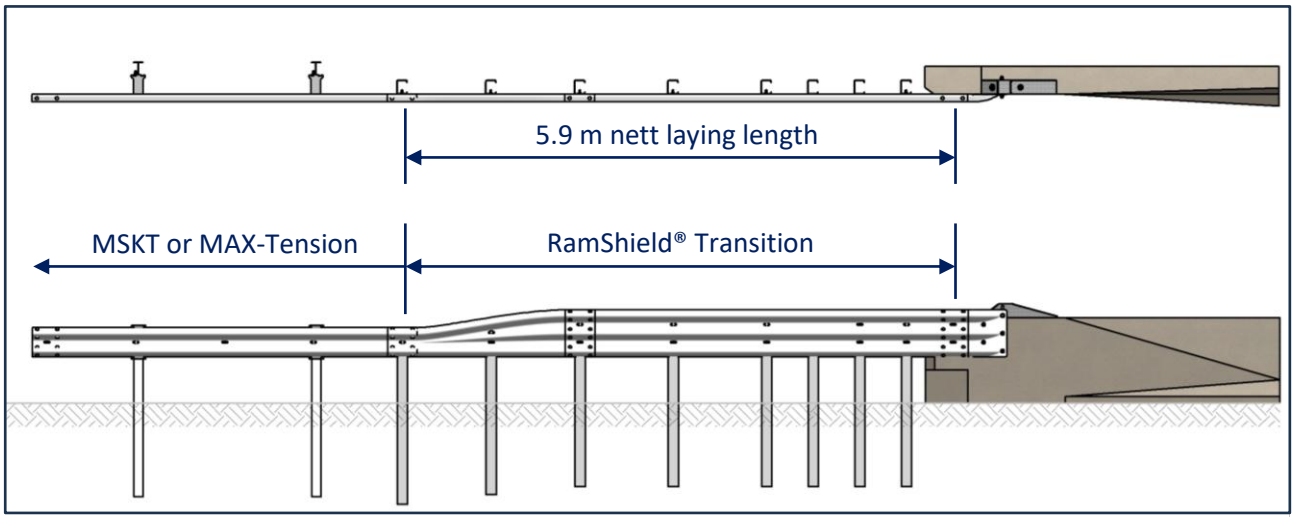
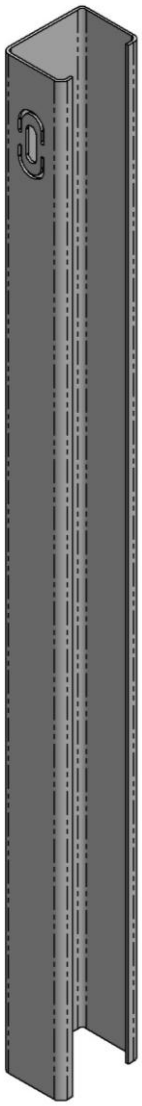
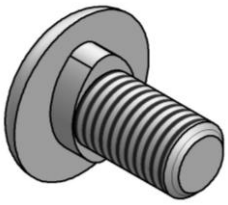


Figure 11: RamShield® Transition, Connection to Guardrail End Terminals.

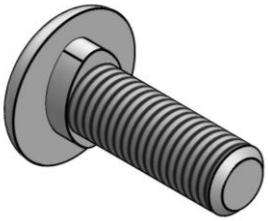
9.0 Component Identification (not to scale)



1860 mm
RamShield® C-Post
24 kg



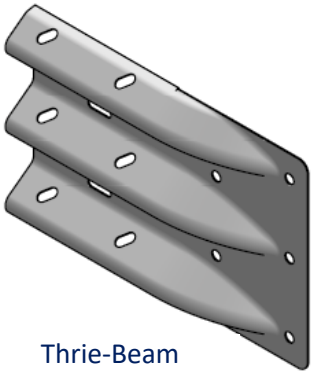
M16 x 32 mm
Mushroom Head Bolt



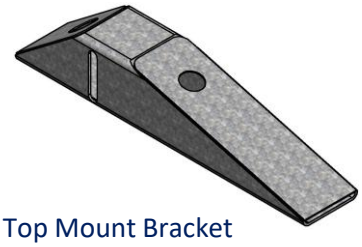
M16 x 50 mm
Mushroom Head Bolt

M16
Oversize Nut

M16
Standard Nut

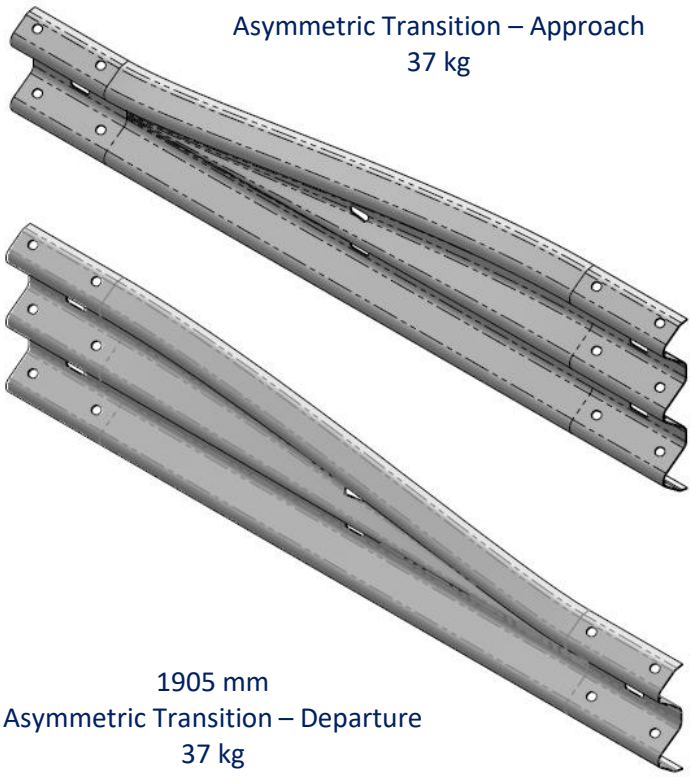


Thrie-Beam
Terminal Connector
11 kg



Top Mount Bracket
15 kg

1905 mm
Asymmetric Transition – Approach
37 kg



1905 mm
Asymmetric Transition – Departure
37 kg

4 m Thrie-Beam Guardrail, 3.5 mm
86 kg

10.0 Tools Required

Tools required for the installation of RamShield® Transition are the same as those used for the installation of all RamShield® variants. This includes:

- Post driving equipment or auger.
- Battery drill driver with 32 mm attachment.
- Hand socket with 24 mm attachment.
- Metal snips.
- String line.
- Tape measure.
- Hammer.
- 12 mm diameter pinch bar.
- Slings or chains.

10.1 Recommended PPE

It is recommended that the following personal protective equipment (PPE) be provided for the safe installation of the RamShield® Transition:

- Safety footwear.
- Gloves.
- Hearing protection.
- High visibility clothing.

- PPE as required for the use of post driving equipment or auger.

11.0 Site Establishment

11.1 Traffic Control

Prior to the commencement of any work, the site should be evaluated for risks to workers, pedestrians and other road users. The establishment of traffic control should provide safe travel for passing vehicles and/or pedestrians and appropriately protect workers near the roadside.

11.2 Underground Services

The installation of the RamShield® Transition requires the supporting C-posts to be embedded into the ground. Prior to the installation of posts an investigation for potential underground hazards is recommended.

11.3 Overhead Obstructions

The site should be evaluated for potential overhead instructions that may present a risk during the installation process. These obstructions typically include power lines, signage or trees.

11.4 Unloading Exclusion Zone

Only appropriate load-rated slings and chains should be used for the safe unloading of product. It is recommended that an exclusion zone be maintained around the unloading process. This provides distance between moving machinery and workers in the event that goods or the machinery move unexpectedly.

Unloading and the storing of the product on a level surface is recommended. Storing product adjacent to the installation area eliminates the requirement for workers to carry items over long distances.

12.0 Installation Sequence

The major steps in the installation of the RamShield® Transition are as follows:

- Set-out.
- Installing the C-posts.
- Attachment of the thrie-beam guardrail.
- Installing the asymmetric transition (when connecting to w-beam guardrail).
- Installing the thrie-beam terminal connector (when connecting to concrete barrier).

12.1 Set-Out

It is recommended that a string line be used to establish the alignment of the post locations. When establishing the post locations, take care to note the following:

- The standard configuration of the RamShield® Transition does not use offset blocks.
- The post spacing of the RamShield® Transition decreases throughout the system as it approaches connection to the rigid barrier.
- The nett laying length of the asymmetric transition is 1905 mm.

12.2 C-Post Installation

Potential Hazards: *Use of post driving equipment or auger, contact with underground hazards, excessive noise, hand injury from pinch points and injury from movements and posture.*

Recommended Control Measures: *Observe the safe work instructions as per machinery requirements, ensure the area has been inspected for underground hazards, wear appropriate hearing protection, wear gloves and observe correct techniques when lifting (bend at the knees).*

The C-posts may be installed by:

- Driving with an appropriate driving head to the required depth, or
- Auguring a minimum 200 mm diameter hole, placing the C-post in the hole and backfilling. The backfill material is to be placed in 150 mm lifts and compacted with tamping equipment.

C-posts supporting the 3.5 mm thrie-beam rail are embedded to a depth of 890 mm. C-posts supporting the asymmetric transition panel are embedded as shown in Figure 12.

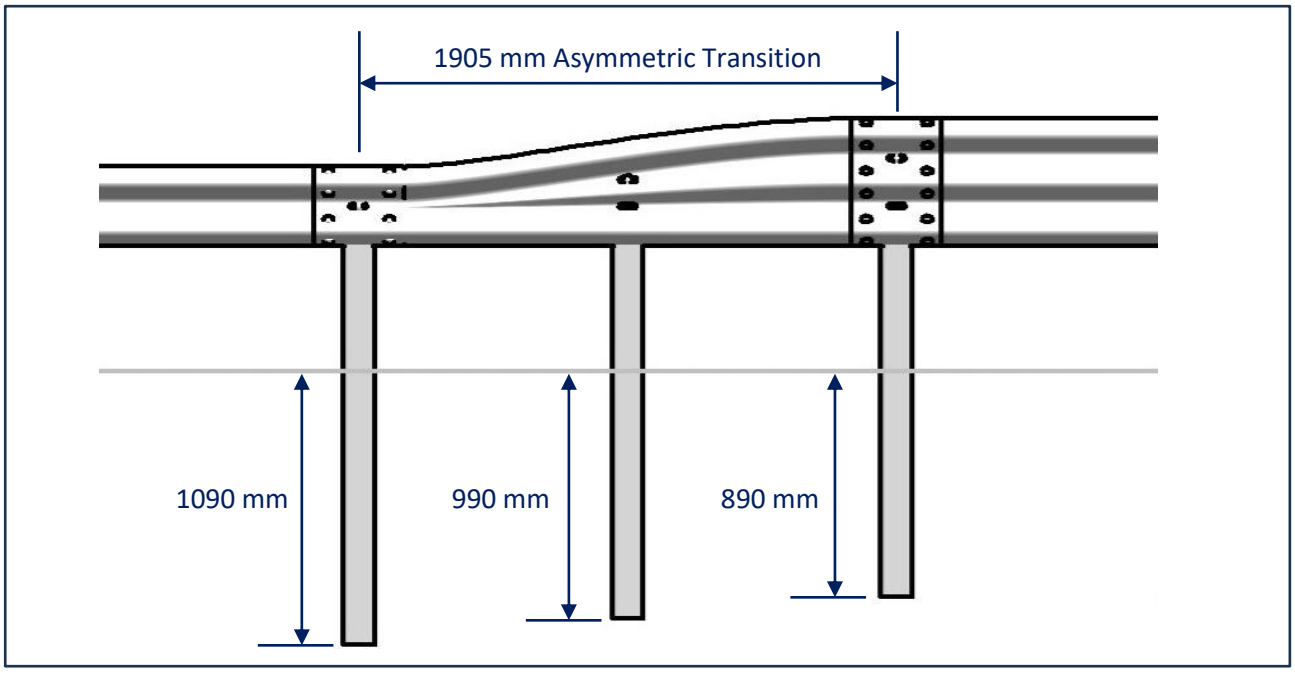


Figure 12: C-Post Installation, Asymmetric Transition.

12.3 Attaching the Thrie-Beam Guardrails

Potential Hazards: *Injury from movements and posture, hand injury from pinch points, strain to wrists from tightening bolts and excessive noise from use of impact driver.*

Recommended Control Measures: *Observe correct techniques when lifting rails (bend at the knees), wear gloves, use a pinch bar to align holes, use an impact drill to tighten bolts and wear appropriate hearing protection.*

A single 3.5 mm thick, 4 m thrie-beam guardrail is used within the RamShield® Transition system. The rail is secured to the C-posts using a M16 x 50 mm mushroom head bolt and oversize nut. The bolt passes through the upper slot in the thrie-beam rail. The oversize nut is tightened using a 32 mm attachment.

Note: *The thrie-beam rail is not bolted at C-post #2 and C-post #3.*

The thrie-beam lap is orientated so that the leading edge of the splice is shielded from the nearside approaching traffic. Thrie-beam rails are spliced together using twelve (12) standard M16 x 32 mm mushroom head bolts and oversize nuts. The nuts are tightened using a battery drill driver and 32 mm attachment.

The use of a pinch bar will assist in aligning the splice holes as the bolts are inserted. The use of a driving pin to elongate the splice holes is NOT permitted.

There is no torque requirement for the tightening of the post bolts or splice bolts. They should be tightened to a snug position.

Once secured to the C-posts, the finishing height of the thrie-beam will be 1000 mm above ground level, approximately 30 mm above the top of the C-posts.

Note: *A standard M16 nut may be used as an alternative to oversize nuts to secure the post bolts.*

12.3 Attaching the Asymmetric Transition

Potential Hazards: *Injury from movements and posture, hand injury from pinch points, strain to wrists from tightening bolts and excessive noise from use of impact driver.*

Recommended Control Measures: *Observe correct techniques when lifting rails (bend at the knees), wear gloves, use a pinch bar to align holes, use an impact drill to tighten bolts and wear appropriate hearing protection.*

An asymmetric transition is required when connecting to w-beam guardrail. The asymmetric transition panel is available as an approach or departure configuration as detailed in Figure 2. The asymmetric transition is secured to the C-posts using a M16 x 50 mm mushroom head bolt and oversize nut. The bolt passes through the upper slot in the asymmetric transition panel.

The thrie-beam end of the asymmetric transition is spliced to the 3.5 mm thrie-beam with twelve (12) standard M16 x 32 mm mushroom head bolts and oversize nuts. The oversize nuts are tightened using a battery drill driver and 32 mm attachment.

The w-beam end of the asymmetric transition is spliced to w-beam with eight (8) standard M16 x 32 mm mushroom head bolts and oversize nuts. The nuts are tightened using a battery drill driver and 32 mm attachment.

The use of a pinch bar will assist in aligning the splice holes as the bolts are inserted. The use of a driving pin to elongate the splice holes is NOT permitted.

There is no torque requirement for the tightening of the post bolts or splice bolts. They should be tightened to a snug position.

12.4 Installing the Thrie-Beam Terminal Connector

Potential Hazards: *Injury from movements and posture, hand injury from pinch points, strain to wrists from tightening bolts and excessive noise from use of impact driver.*

Recommended Control Measures: *Wear gloves, use an impact drill to tighten bolts and wear appropriate hearing protection.*

The thrie-beam terminal connector is used to secure the 3.5 mm thrie-beam rail to a concrete abutment or parapet. The terminal connector is spliced to the 3.5 mm thrie-beam with twelve (12) standard M16 x 32 mm mushroom head bolts and oversize nuts. The nuts are tightened using a battery drill driver and 32 mm attachment.

The terminal connector lap with the thrie-beam guardrail is orientated so that the leading edge of the splice is shielded from the nearside approaching traffic. The use of a pinch bar will assist in aligning the splice holes as the bolts are inserted. The use of a driving pin to elongate the splice holes is NOT permitted.

There is no torque requirement for the tightening of the post bolts or splice bolts. They should be tightened to a snug position.

The terminal connector is connected to the concrete abutment or parapet using M20 x 187 mm Fisher FBN II galvanised anchors. When applying torque to the anchors, the cone bolt is pulled into the expansion clip forcing is against the side walls of the drilled hole.

Using the terminal connector as a template, mark the anchor hole locations. The anchors are installed as follows:

1. Using a 20 mm masonry drill bit (same diameter as the Fischer FBN II galvanised anchor), drill each anchor hole to a depth of 140 mm.

2. Using compressed air or a pump, thoroughly clean the holes, removing all loose debris.

3. Align the terminal connector and position the nut and washer 3 mm below the top of the anchor and drive the anchor into the drilled hole to the full depth.

4. Torque each anchor to 200 Nm.

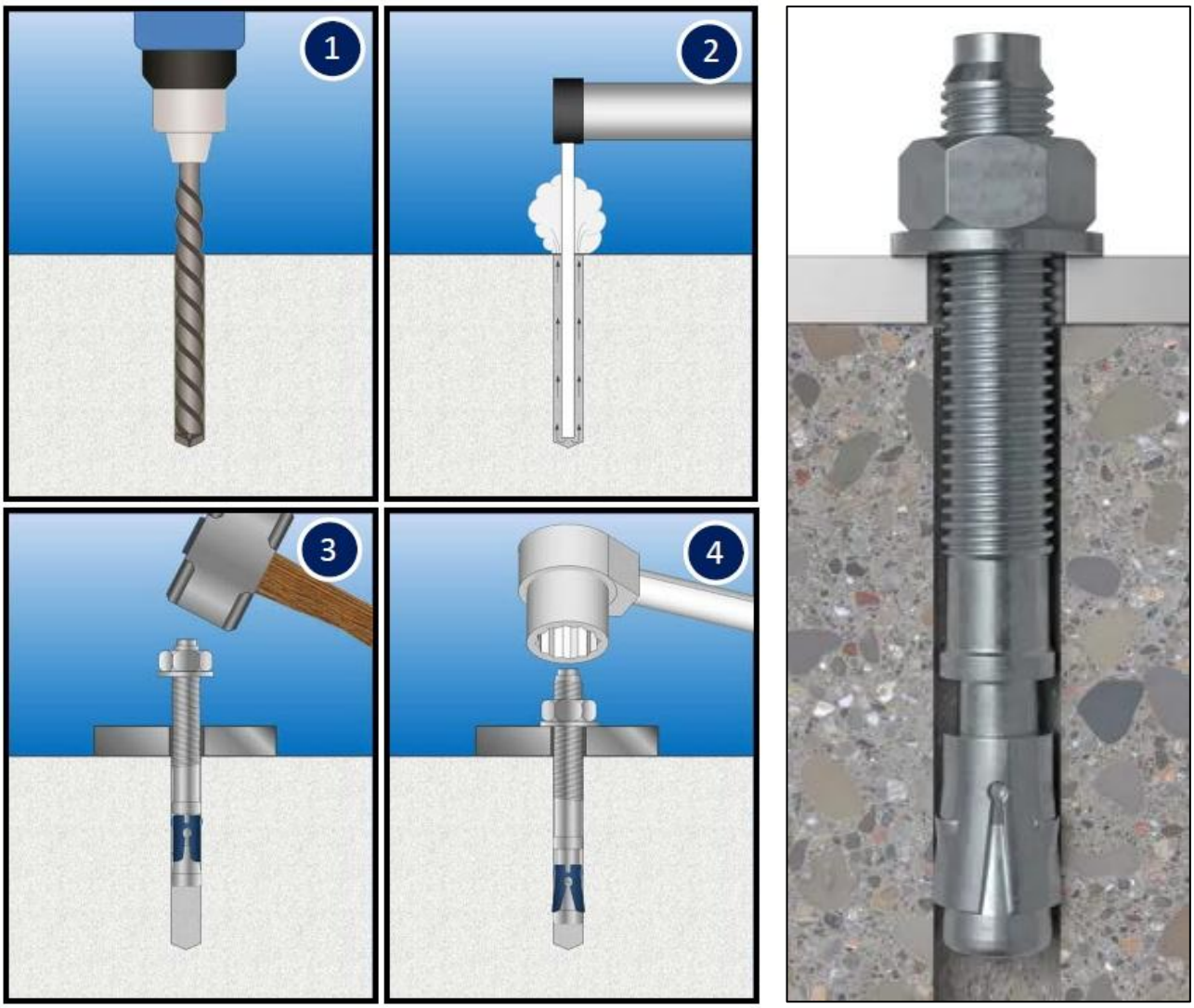


Figure 13: Fischer FBN II Anchor Installation.

12.5 Installing the Top Mount Bracket

Potential Hazards: *Injury from movements and posture, hand injury from pinch points, strain to wrists from tightening bolts and excessive noise from use of impact driver.*

Recommended Control Measures: *Wear gloves, use an impact drill to tighten bolts and wear appropriate hearing protection.*

If the concrete abutment or parapet is lower than the 1000 mm installation height of the RamShield® Transition, a top mount bracket is used to secure the upper portion of the terminal connector. The top mount bracket is secured to the top of the concrete parapet with two (2) M16 x 145 mm Fisher FBN II anchors.

1. Using a 16 mm masonry drill bit drill each anchor hole to a depth of 100 mm.

2. Using compressed air or a pump, thoroughly clean the hole, removing all loose debris.

3. Align the top mount bracket and position the nut and washer 3 mm below the top of the anchor and drive the anchor into the drilled hole to the full depth.

4. Torque each anchor to 100 Nm.

5. Secure the upper portion of the terminal connector to the top mount bracket with a M20 x 200 mm bolt/nut and two (2) washers.

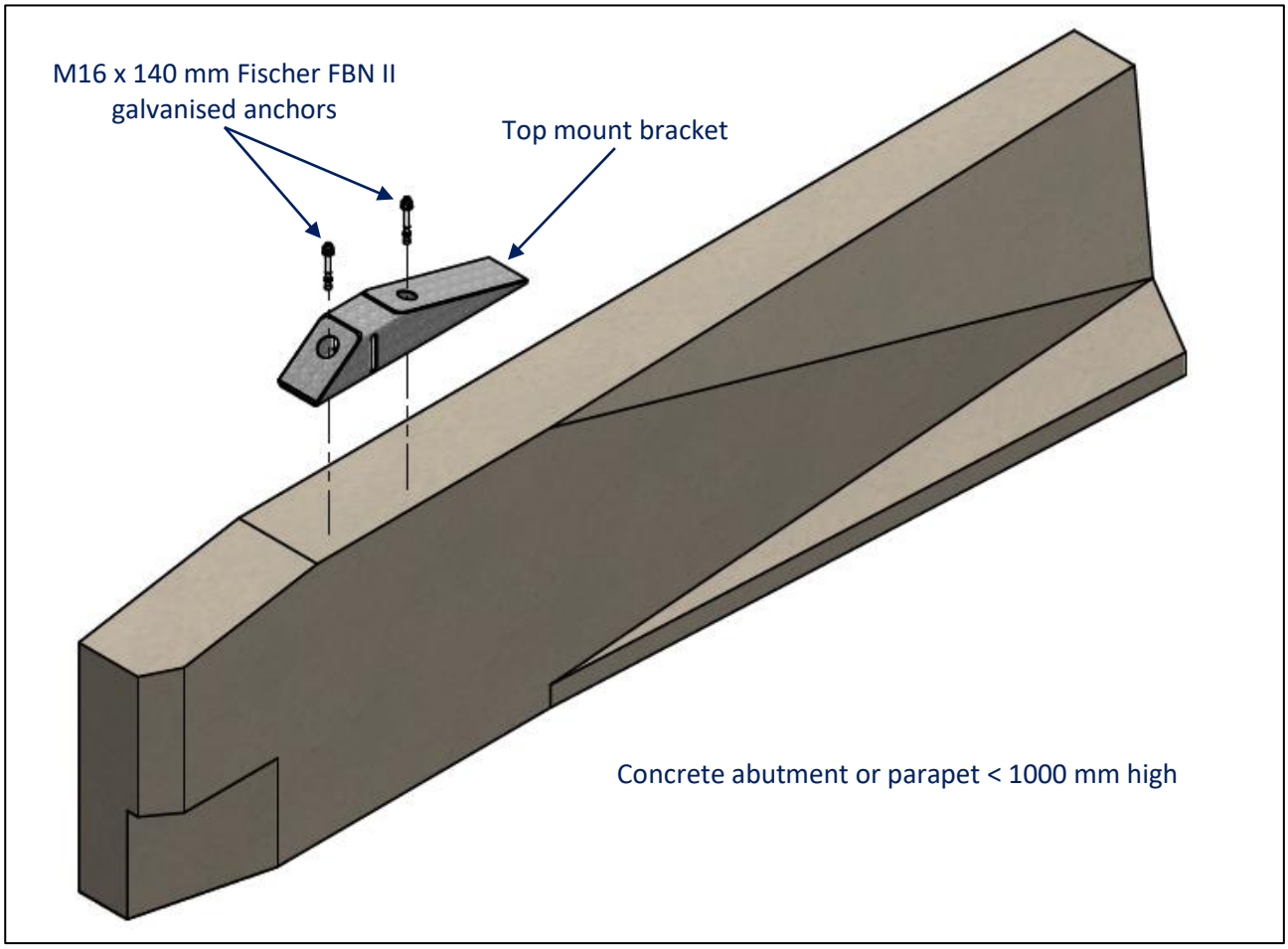


Figure 14: RamShield® Transition, Attachment of Top Mount Bracket.

13.0 Recommended Installation Tolerances

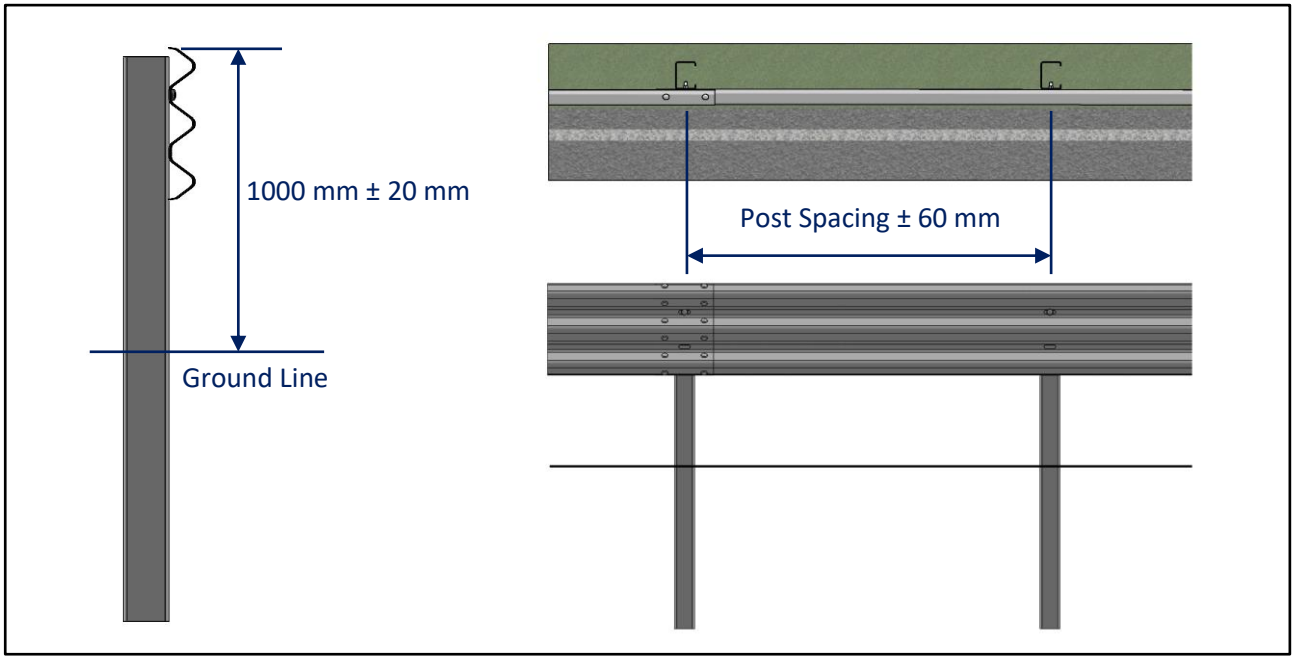


Figure 15: Recommended Installation Tolerances.

RamShield® Transition Inspection Form

Inspection Date	
Client	
Project Reference	
Name of Inspector	
Company	

❑ Yes ❑ No	The 4 m thrie-beam rail is 3.5 mm thick.
❑ Yes ❑ No	The spacing of posts complies with Safe Direction assembly drawings.
❑ Yes ❑ No	The thrie-beam rail is NOT bolted to Posts #2 & #3.
❑ Yes ❑ No	At all other C-post locations, thrie-beam rail is secured with one (1) M16 x 50 mm mushroom head bolt & nut.
❑ Yes ❑ No ❑ n/a	Asymmetric transitions are used when connecting to w-beam guardrail.
❑ Yes ❑ No ❑ n/a	When connecting to RamShield® W-Beam guardrail, the 4m in advance of the asymmetric transition has posts installed at 1 m centres.
❑ Yes ❑ No	The posts are correctly orientated with the release tab on the traffic side.
❑ Yes ❑ No	The height measured to the top of the thrie-beam rail is 1000 mm ± 20 mm.
❑ Yes ❑ No	The thrie-beam rail is spliced with twelve (12) M16 x 32 mm mushroom head bolt & oversized nuts.
❑ Yes ❑ No	The rail lap is orientated so that the leading edge of the splice is shielded from approaching traffic.
❑ Yes ❑ No	All post bolts and splice bolts are tightened.
❑ Yes ❑ No ❑ n/a	When connecting to a concrete parapet, the terminal connector is secured with M20 x 187 mm FBN II anchors (or alternative as approved by Safe Direction).
❑ Yes ❑ No ❑ n/a	If the concrete parapet is less than 1000 mm high, a top mount bracket is secured with two (2) M16 x 140 mm FBN II anchors to facilitate attachment of the terminal connector.
❑ Yes ❑ No ❑ n/a	The FBN II anchors are correctly torqued.
❑ Yes ❑ No	The fill material around the C-posts is suitably compacted.
❑ Yes ❑ No	Any minor damage to the galvanised finish is repaired using two coats of an organic zinc rich paint.
❑ Yes ❑ No	The area around the barrier is free of debris.
Comments/Notes	

14.0 Maintenance

The RamShield® Transition is a low maintenance barrier. Except for repairs due to impacts, it is recommended that an annual inspection be undertaken to assess the following:

- The barrier is appropriately delineated (if required).
- Debris has not accumulated around the barrier which may impede the function of the barrier.
- Vegetation around the barrier is appropriately maintained.
- Nuisance impacts have not gone undetected.
- The anchor assembly at the end terminals is taut and the bearing plate is correctly aligned.

14.1 Bushfire Damage

The RamShield® Transition is constructed from hot dip galvanised steel components. The performance of hot dip galvanised components when subjected to a fire depends upon numerous factors such as flame duration, flame intensity and the characteristics of the galvanised finish.

Bushfires can produce high temperatures, however exposure of roadside structures to maximum flame intensity is generally for a short duration as the fire front moves forward. The combination of the reflectivity of the galvanised surface and the heat sink provided by the mass of the steel to which the hot dip galvanising is applied has shown galvanised steel to provide excellent performance during bushfires.

If it is observed that a bushfire has caused damage to the galvanised coating it is recommended that these item(s) be replaced.

15.0 Repair

In the event of a vehicle impact, damage to the barrier is to be assessed in accordance with Table 6. Typically, impacts with the RamShield® Transition will require replacement of damaged sections of rails and C-posts. It is also recommended that new bolts be used where rails and C-posts have been replaced.

Additional tools required for repair include:

- Acetylene torch to cut away damaged rail.
- Heavy duty chain to remove damaged posts.
- Sledge hammer.
- Post extractor.

Similar to the installation sequence, it is recommended that the guidelines contained in Section 11.0 be observed in the establishment of traffic control and an unloading exclusion zone in addition to an investigation for underground services and overhead obstructions.

15.1 Removing the Thrie-Beam Rails

Potential Hazards: *Injury from movements and posture, hand injury from pinch points, strain to wrists from loosening bolts and excessive noise from use of impact driver.*

Recommended Control Measures: *Observe correct techniques when lifting rails (bend at the knees), wear gloves, use an impact drill to loosen bolts and wear appropriate hearing protection.*

Using a battery drill driver and 32 mm attachment, loosen the twelve (12) M16 oversize nuts and remove the M16 x 32 mm mushroom head splice bolts.

Remove the M16 x 50 mm mushroom head bolt and oversize nut securing the thrie-beam rail to the C-posts.

15.2 Removing the C-Posts

Potential Hazards: *Use of post extracting equipment or auger, contact with underground hazards, excessive noise, hand injury from pinch points and injury from movements and posture.*

Recommended Control Measures: *Observe the safe work instructions as per machinery requirements, ensure the area has been inspected for underground hazards, wear appropriate hearing protection, wear gloves and observe correct techniques when lifting (bend at the knees).*

Posts should be removed using an appropriate post extractor. Once the post is removed, the ground material should be suitably compacted.

15.3 Material Disposal

The RamShield® Transition features an all steel construction. Damaged items may be recycled.

16.0 Dismantling

Should the RamShield® Transition require dismantling, it is recommended that the guidelines contained in Section 12.0 be observed in the establishment of traffic control in addition to an investigation for underground services and overhead obstructions.

Table 5: Damage Assessment Guidelines.

Type of Damage	Description of the Damage	Remedial Action
Damage to the galvanised coating on the C-posts.	The sum total of the damaged area does not exceed 70 cm^2 (0.5% of the total surface area) and no individual damaged area exceeds 40 cm^2.	An organic zinc rich paint is to be applied to the repair area in two coats.
	The sum total of the damaged area exceeds 70 cm2 (0.5% of the total surface area) or an individual damaged area exceeds 40 cm^2.	The post is to be replaced.
Damage to the galvanised coating on the rails.	The sum total of the damaged area does not exceed 250 cm^2 (0.5% of the total surface area) and no individual damaged area exceeds 40 cm^2.	An organic zinc rich paint is to be applied to the repair area in two coats.
	The sum total of the damaged area exceeds 250 cm^2 (0.5% of the total surface area) or an individual damaged area exceeds 40 cm^2.	The rail is to be replaced.
Damage to the C-posts.	The C-post is bent.	The C-post is to be replaced.
Damage to the post tab.	The tab has distorted and released the post bolt.	The C-post is to be replaced.
Damage to the rails.	The rail is dented, twisted or flattened.	The rail is to be replaced.
	There are nicks in any part of the rail.	
	The slots in the rail are distorted.	
Damage to bolts.	The body of the bolt is distorted.	The bolt is to be replaced.
	The thread of the bolt is damaged.	
Disturbance of material around the posts.	The material around a post is loose.	The material is to be suitably compacted.

SafeDirection

CRASH BARRIER SOLUTIONS

RAMSHIELD TRANSITION

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