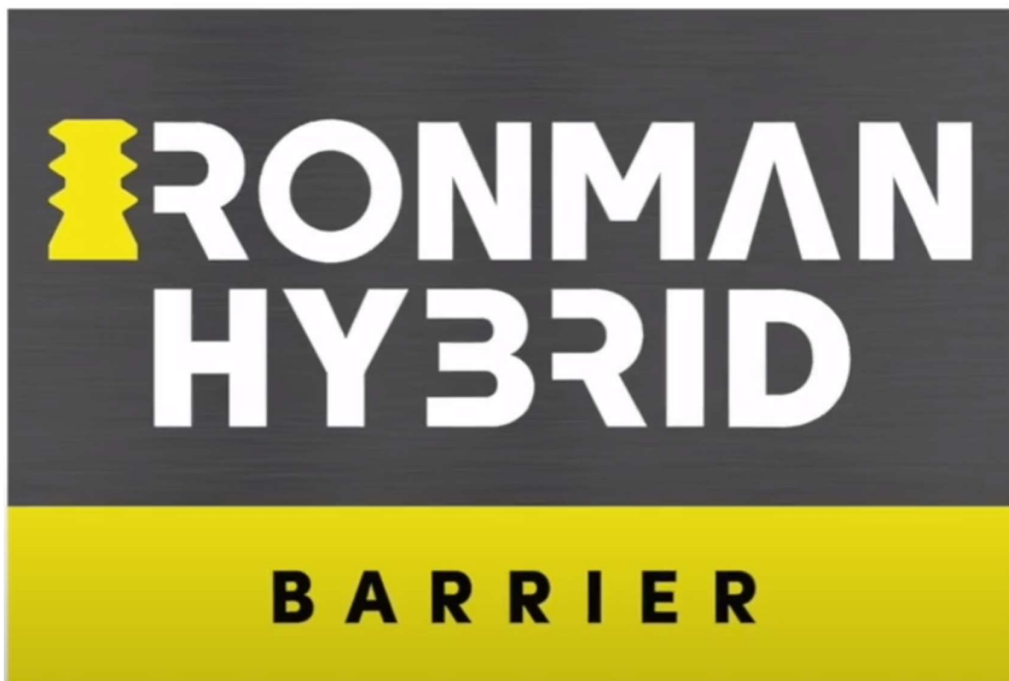


PRODUCT MANUAL



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Australian Version 3.1
September 2023

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Preface

For optimum performance, Saferoads Ironman Hybrid Barrier must be designed, installed and maintained as per this manual. Please thoroughly review and understand this manual before using the Ironman Hybrid Barrier.

Local requirements may also impose restrictions. Please refer to local governing body for further information.

If more information is required, please contact Saferoads:

Websites: www.saferoads.com.au

Australia: 1800 060 672

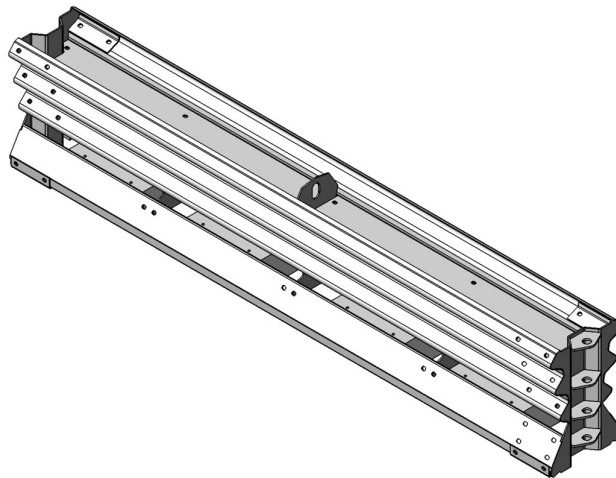
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Introduction

Saferoads Ironman Hybrid Barrier provides several unique advantages over traditional portable concrete barriers, Pinned Steel Barriers or other styles of portable safety barriers:

- Crash tested to –
 - MASH TL-2, 70km/h – 2,270kg Pickup @ 25 degrees
 - NCHRP 350 TL-3, 100km/h – 2,000kg Pickup @ 25 degrees
- Safe, consistent and reliable redirection
- Maintenance free
- Durable
- Energy-absorbing with low deflection.
- Quick and easy deployment and retrieval.
- No anchoring required along LON
- Economical to transport.
- Easily repaired after design impacts.
- May be re-used without repair after TL-2 70km/h or less impacts, pending inspection of impacted units.



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Applications

Saferoads Ironman Hybrid Barrier functions as an unanchored longitudinal barrier to prevent errant vehicles from penetrating, vaulting, or under-riding. Traffic is kept from entering the work area or from hitting exposed objects or excavations. The Ironman Hybrid Barrier provides positive protection for roadside workers.

Impacting vehicles are redirected at a shallow angle in the vicinity of the impact area, thereby reducing the potential for dangerous secondary impacts. The Ironman Hybrid Barrier absorbs impact energy and cushions vehicular impacts while significantly reducing the risk to occupants of the impacting vehicle.

The Ironman Hybrid Barrier can be used in many applications. Some examples are:

- General road maintenance performed by road authorities, contractors, local municipalities etc.
- Road construction
- Lane closures
- Toll plazas
- Road resurfacing
- Excavation or culvert protection
- Detours
- Bridge repairs
- Median or roadside installations

The Ironman Hybrid Barrier can be used on concrete, asphalt and spray sealed surfaces.

Limitations

The Ironman Hybrid Barrier has been fully tested and evaluated as per the recommendations of the Manual for Assessing Safety Hardware (MASH 2016).

The Ironman Hybrid Barrier is capable of decelerating and redirecting an errant vehicle up to 2,270 kg at speeds up to 70 km/h and angles of 25 degrees (MASH Test Level 2).

To ensure adequate performance in the event of an impact, the Ironman Hybrid Barrier must be deployed and maintained in accordance with the manufacturer's instructions and local authority guidelines.

Impacts that exceed the design capabilities described in this manual (vehicle weight, speed and impact angle) may not result in acceptable crash performance as described in MASH relative to structural adequacy, occupant risk and vehicle trajectory factors.

Higher than reported deflections can be expected outside the Length of Need (LON) section.



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Testing

The Ironman Hybrid Barrier has been successfully crash tested to MASH 2016 Test Level 2 (TL-2) as a redirecting longitudinal safety barrier for vehicle weight up to 2,270kg at speeds up to 70 km/h.

Whilst no longer approved at 100km/h, the Ironman Hybrid Barrier has been crash tested to the superseded Standard NCHRP 350, TL-3 - 2,000kg vehicle, 100km/h at 25 degrees. This test shows the extra capacity of the system, this impact has 80% more energy than the MASH TL-2 test and the deflection was 1.9m, only 28% more than the MASH TL-2 Deflection.

Barrier Segments

An Ironman Hybrid Barrier installation is constructed from a series of individual barrier segments. Each segment is constructed from steel with four concrete inserts attached to the underside of the barrier. The dimensions of each segment are:

Installed length	4.15m
Segment Width	546mm
Segment Height	813mm
Weight	925kg

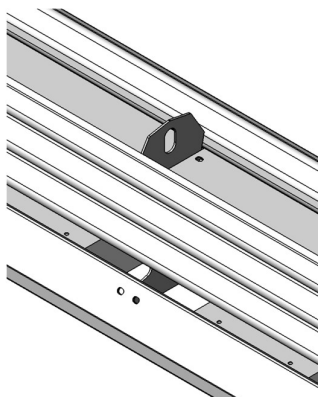
The ends of each section are constructed with knuckles that interlock with those of other segments. The end knuckles are vertically aligned to accept a steel connecting pin. The pin securely joins the sections for maximum impact performance. The sections can swivel at the pin for easy positioning around work areas.

Limiting deflection spacers are to be installed to reduce the deflection and movement in the joints, they may only be omitted where a tighter radius deployment is required.

The Ironman Hybrid Barrier is constructed in a unique shape. The sloping ribbed side walls interact with an impacting vehicle in a way that resists penetration, vaulting, and under-riding. Each section contains four concrete ballast blocks that are contained between the bottom rub rails providing weight and stability to reduce the deflection of the freestanding Barrier.

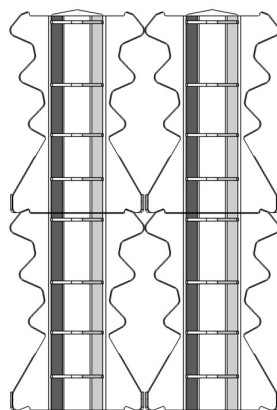


Barrier segments feature a central integrated lifting point. Barriers can be safely lifted from the centre lifting point.



The Ironman Hybrid Barrier is designed to accept a barrier stacked on top for storage and freighting purposes. The segments interlock, so timber bearers between the barriers are not required. Saferoads recommends stacking the Ironman Hybrid Barriers no more than two high.

Caution should be used when freighting so that the lower level is strapped down and secured before loading the second level.



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Minimum Deployment

Ironman Hybrid Safety Barrier installations require a minimum deployment length of 57.5m, 11no. Hybrid Barriers plus 2 TL-2 SLED end treatments, to safely contain and redirect at MASH TL-2.

Length of Need

Saferoads Ironman Hybrid Barrier installations utilise SLED TL-2 end treatments to ensure occupant safety in the event of an impact to the end of a barrier installation.

The Length of Need begins at the joint between the 4th and 5th Hybrid Barrier, 22.5m downstream from the nose of the SLED. The End Length of Need is 22.5m Upstream from the downstream end of the System.

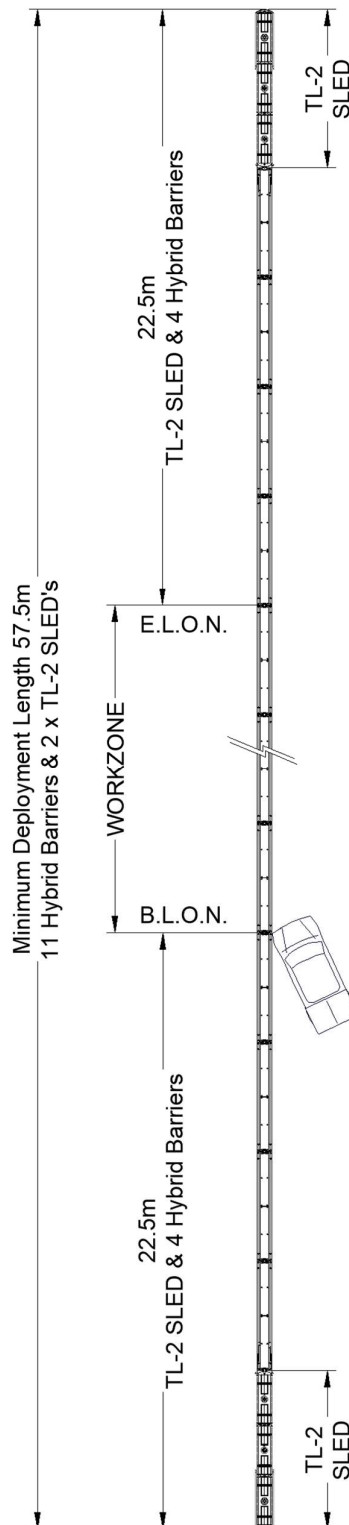
Crash testing revealed that a 2,270kg Dodge Ram was successfully redirected when impacting the plastic modules of the Upstream SLED at 70km/h on a 20° angle. The deflection of the system was 3.5m, whilst the system will redirect vehicles from the first steel barrier, to rely on the 1.49m deflection the BLON starts at the end of the 4th Barrier.



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Deployment Diagram



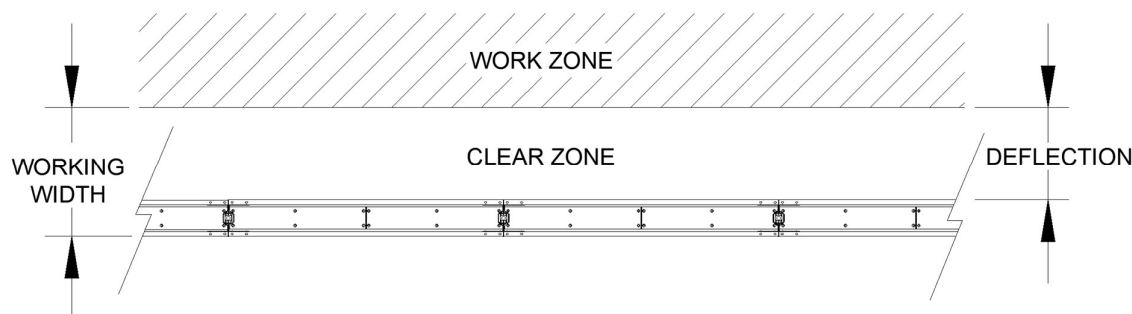
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System Deflection & Working Width

A sufficient clear zone must be allocated between the Ironman Hybrid Safety Barrier and the work zone to allow for deflection of the barrier during an impact. The Crash tested deflection for a TL-2 impact, 2,270kg Pickup at 70km/h at 25 degrees is 1.49m.

The Working width, which includes the Barrier width plus the Deflection is 2.04m



The table below shows the deflection and working width for impacts along the Length of Need (BLON). These results are taken from MASH TL-2 compliant impacts using a 2270kg Dodge Ram pickup. Please note that actual deflections, and therefore working widths, may vary from expected results due to site conditions.

	LON
Speed	70km/h
Angle of Impact	25°
Deflection	1.49m
Working Width	2.04m

Site Considerations

While Saferoads Ironman Hybrid Barrier can be installed on most worksites, some obstacles must be avoided. Ironman Hybrid Barriers should not be installed if there is:

- Curvature tighter than 78m radius
- For 60km/h or less, a Radius as tight as 10m can be achieved using the Ironman Hybrid Wedge. See page 11
- Cross slope steeper than 5%
- Longitudinal slope steeper than 5%
- Crest sharper than 5%
- Ditch sharper than 5%
- Kerbs or similar obstacles restricting the deflection

For more information, please contact Saferoads or the relevant road authority.



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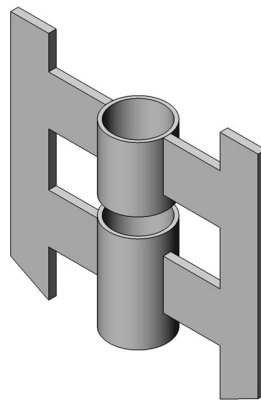
Barrier Deployment

Before beginning deployment, ensure there is adequate traffic management, and whenever possible personnel should remain on the non-traffic side of the installation. Also ensure appropriate lifting equipment is used and operated by competent personnel.

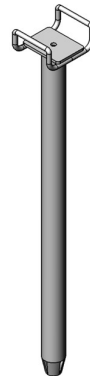
1. Beginning at the upstream end of the installation, unload the first barrier segment and place in the correct position.

The Ironman Hybrid Barrier Deflection Limiting Spacer is designed to minimise the risk of hand injuries during deployment. The following procedure is designed to prevent possible injury.

2. Working downstream of the first barrier segment, unload the second barrier segment, place the spacer on the 1st Barrier, it will sit on the Knuckles of the bulkhead.

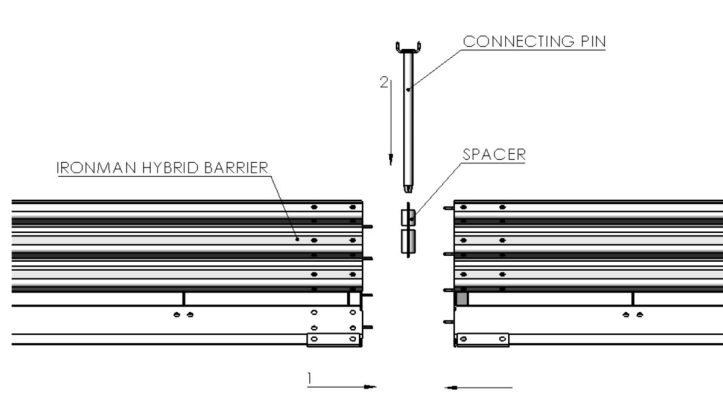


SPACER



PIN

3. Manoeuvring the next Barrier into position. Remain cautious of potential pinch and crush points when lowering and connecting barriers.
4. Bring barrier segments together with care.
5. Insert the Connecting Pin
6. Repeat until all barrier segments are placed into the correct position and joined to adjacent barrier segments.



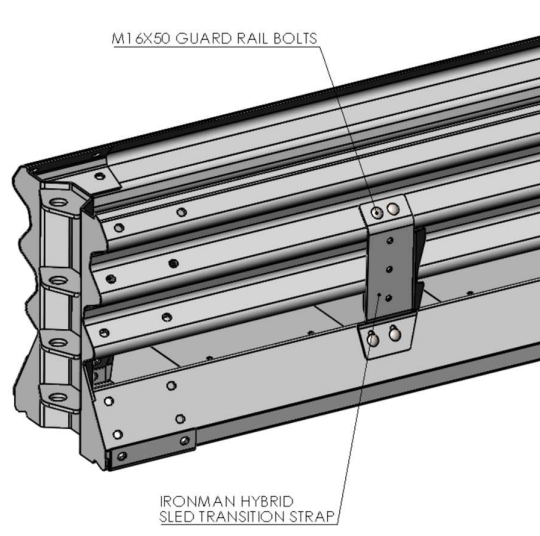
7. For installing the SLED end terminal refer to the SLED Manual



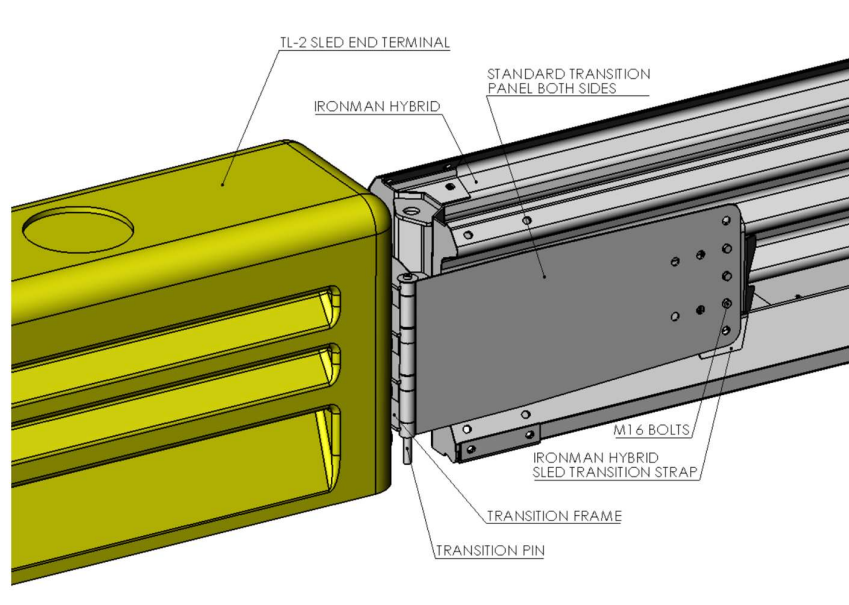
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8. A SLED Transition Strap is required to attach a Standard SLED Transition Panel to the Ironman Hybrid Barrier. See below, 3 bolts are to be removed at the quarter Bulkhead, use the Strap to mark and then drill the forth hole (18mm dia.)



9. Attach the Strap with M16 x 50 Mushroom head Gal bolts
10. See below standard SLED Transition attachment to the Hybrid Barrier, 3 x M16 x 30 Hex Bolts attach the SLED Trans Panel to the Hybrid Transition Strap.



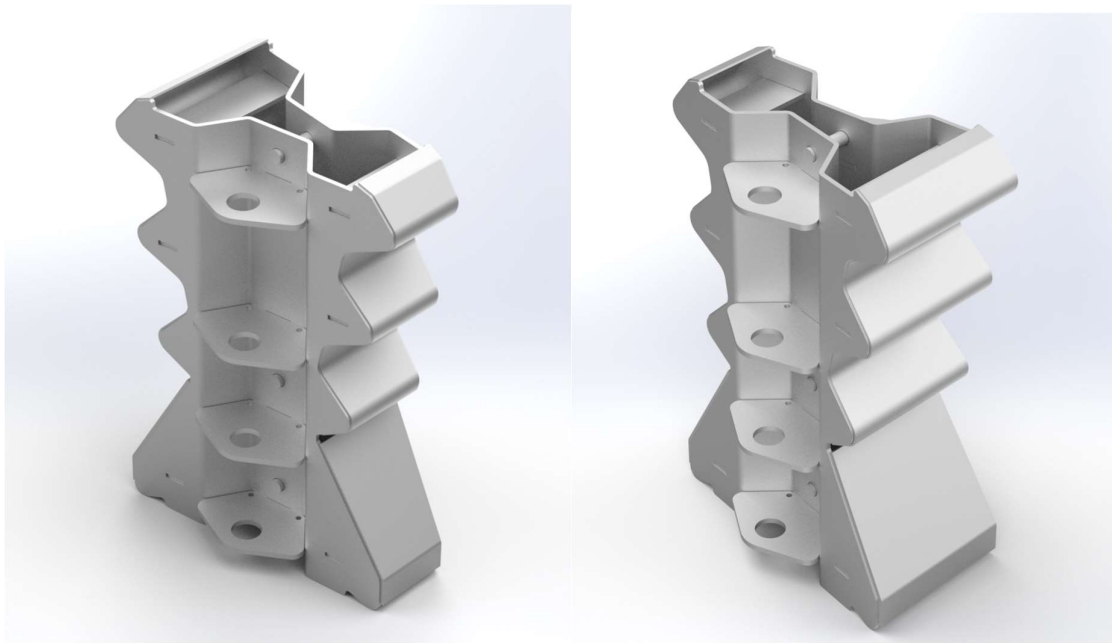
To ensure compliance of the Ironman Hybrid Barrier, attachments such as anti-gawk screens, signs, flashing lamps etc. must not be fitted to the barrier without written permission from Saferoads. Any unauthorized attachments could affect impact performance.



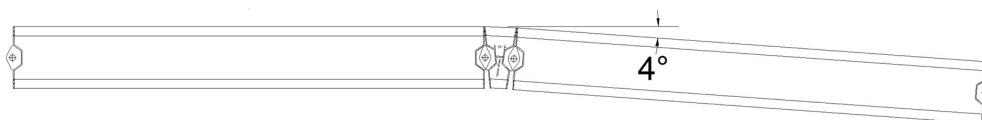
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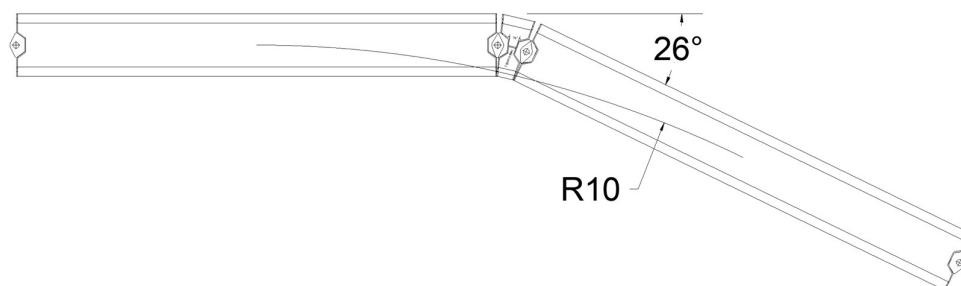
Ironman Hybrid Steel Wedge



Saferoads have developed a bespoke custom Steel Wedge that enables the Ironman Hybrid Barriers to be deployed at a tighter radius. The Ironman Hybrid Barriers can achieve a 78m Radius, with a standard maximum 3 degrees angle at each joint. The Steel Wedge allows each joint to be deployed at an angle from 4 degrees, up to 26 degrees, enabling a deployment radius as tight as 10m when Steel Wedges are used in-between each Ironman Hybrid barrier.



Plan view of 2 Barriers laid out with the Wedge at 4 degrees



Plan view of 2 Barriers laid out with the Wedge at 26 degrees



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All angles in between 4 and 26 degrees are achievable. The Wedge can be used in the left or right orientation to enable the barriers to curve left or right.

The Wedges have a single lifting points and weigh 80kg each.

The Wedges should only be used where Traffic Speeds are restricted to 60km/h or below.

Deflection limiting spacers are not required at joints where the Wedge is installed.

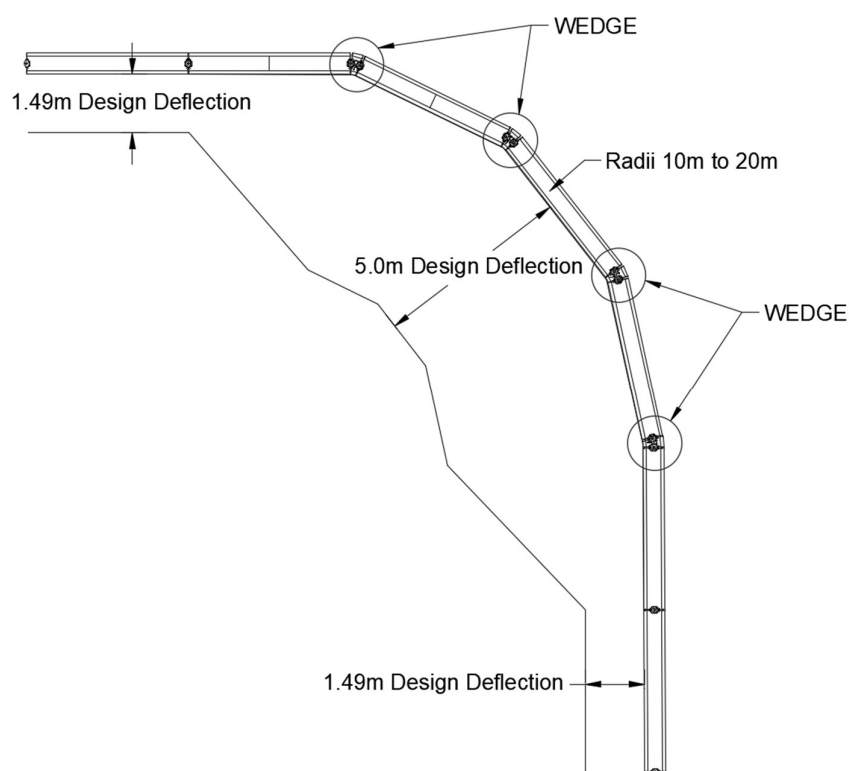
Deflection Guidance when using Wedges -

The design deflection behind Ironman Hybrid Barriers where wedges are used should be conservatively set to 5m. This is based on test data where the alignment of the barriers follows a 10m radius and turn a 90-degree bend, for example at a T-Intersection. This is the worst-case scenario deflection where vehicles were able to impact the barrier at a 90-degree angle.

Where the Wedges are used to follow an alignment of between a 78m to 20m radius and the likely impact angle is 45 degrees or less, a design deflection of 3.5m can be adopted.

Please refer to Saferoads for further Guidance for the advantages and proper use of the Ironman Hybrid Wedges.

See example below for a 10m to 20m radius deployment –



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Maintenance and Repair

Each Ironman Hybrid Barrier segment is made up of twelve main components, all of which are fully replaceable as designed to ensure a long service life.

The Ironman Hybrid Barrier is bolted together using standard guardrail bolts so any individual component can be easily removed and replaced.

Barriers which show evidence of impact will require close inspection of concrete ballast blocks, all struts, braces and supports showing particular attention to weld point integrity.

It is not recommended to self-repair any components as this could compromise the integrity of the barrier in regard to its original design specification. Any damaged sections must be replaced with original modular sections supplied by the manufacturer. Failure to do so will negate the manufacturer's guarantees in regard to the tested performance of the Ironman Hybrid Barrier.



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Safe Work Method Statement

Activity	Hazard Identified	Controls Required	Risk Before Controls	Person Responsible	Residual Risk	Sign Off
Lifting Ironman Segments	Lifting equipment failure	Ensure machinery and operators are appropriately certified. Ensure all equipment is in good, working and tagged condition.	M		L	
	Contact with overhead services	Ensure there are no hazards above the area. If unsure arrange a spotter.	H		L	
	Contact with people or property	Ensure hazards are cleared from area, and do not use lifting equipment in adverse weather.	M		L	
Placing Ironman Segments	Crushing under or between segments	Where possible personnel should be away from area. If personnel are required body parts should be clear when lowering and joining barrier segments. Appropriate PPE should also be worn.	M		L	
Arriving or departing worksite	Collision with people or property	Abide by worksite speed limits and transport routes. Ensure nearby personnel are wearing high-vis clothing.	L		L	
Attending worksite	Environmental hazards	Personnel should wear appropriate clothing and foot wear for environmental conditions.	L		L	
	Excess noise	Where required personnel should wear appropriate hearing protection.	M		L	
	Falling items or debris	Where required personnel should wear appropriate protective gear such as helmets, boots and eye protection.	M		L	



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