

Road Safety Barrier Systems, End Treatments and other related Road Safety Devices

Assessed as accepted for use on state controlled roads in Queensland

May 2019

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Amendment Register

Issue/ Rev no.	Reference section	Description of revision	Authorised by	Date
1	Whole	<ul style="list-style-type: none"> First Release 	Noel Dwyer	27-Aug-13
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4.1.	Appendices A & B	<ul style="list-style-type: none"> Boylan and RMS supplier details removed. Highway Care contact details added/updated. 	-	13 Aug 2015 (V2)

Issue/ Rev no.	Reference section	Description of revision	Authorised by	Date
April 2016	Whole	<ul style="list-style-type: none"> Sections 1.6, 2.1, 3.1 and 3.3 modified. Minor modifications throughout. RAMSHIELD added Ingal MPR accepted on Ezy-Guard SMART. Deflection tables modified (PCB, JJ Hooks, T-Lok, Ironman, ArmorZone, Triton). End treatment options updated (JJ Hooks, T-Lok). 	Mike Whitehead	31-Mar-16
June 2016	Whole	<ul style="list-style-type: none"> Section 3.2 modified. Valmont supplier details added. ET2000-plus - MPS variant added. BG800 LDS - variant added. Minor amendments throughout. 	Mike Whitehead	24-Jun-16
November 2016	Whole	<ul style="list-style-type: none"> Ezy-Guard 4 added. Sentryline II terminal variant added. Minor amendments to Ezy-Guard SMART, X-Tension. W-beam design sheet updated. Limitations sections in various w-beam end terminal data sheets updated for consistency. 	Mike Whitehead	8-Nov-16
April 2017	Whole	<ul style="list-style-type: none"> Section 3 renumbered. Section 3.4 TL-0 removed. Sections 3.2 Deflection and 3.3 Footings added. Minor modifications to single-slope, thrie-beam, modified thrie-beam, w-beam. Ezy-Guard 4, Ezy-Guard SMART and Ramshield modified to "semi-flexible" sub-category. Ezy-Guard 4, Ezy-Guard SMART and Ramshield, Brifen, Flexfence and Sentryline-II design, limitations and references updated. DB80 and ArmorGuard Gate modified. Quadgard CZ added to Zoneguard. Minor other revisions throughout. 	Mike Whitehead	27-Apr-17

Issue/ Rev no.	Reference section	Description of revision	Authorised by	Date
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September 2017	Whole	<ul style="list-style-type: none"> Ezy-Guard High Containment (HC) added. 	Daniel Naish	7-Sep-17
January 2018	Whole	<ul style="list-style-type: none"> Sentry W-beam added. Shield I added Mobile Barriers MBT-1 added Section 2.3 amended Section 2.4 added Ezy-Guard 4 and Ezy-Guard Smart data sheets updated (Surface Mount variant accepted and TL-2 crash test information added) 	Daniel Naish	31-Jan-18
May 2018	Whole	<ul style="list-style-type: none"> Defender Barrier added. SMART Cushion – MASH TL-3 crash test information added. Minor amendments throughout. 	Daniel Naish	18-May-18
September 2018	Whole	<ul style="list-style-type: none"> Section 1 amended New Section 2.5 <i>Guidelines on specifying Barrier Systems in Contracts and Drawings</i> Section 5 added for listing of products assessed by ASBAP in accordance with AS/NZS 3845.2:2017 Appendix A updated (Laura Metaal and Innov8 contact details added) Defender Barrier added Sentry Median barrier information sheet updated (back-to-back variant added for median use) BarrierGuard 800 information sheet updated (Laura Metaal & Boylan group added as an owner and supplier respectively) 	Daniel Naish	05-Sep-18
September 2018 (Version 2)	Whole	<ul style="list-style-type: none"> JL-D-0850 Stuer-Egghe added J1-LED contact details added 	Daniel Naish	07-Sep-18

Issue/ Rev no.	Reference section	Description of revision	Authorised by	Date
February 2019	Whole	<ul style="list-style-type: none"> • MSKT added. • Biker-Shield added. • EzyGuard HC amended. • Defender 100 FS added • Flexfence amended • DB80 amended 	Santosh Tripathi	20-Feb-19
May 2019	Whole	<ul style="list-style-type: none"> • Barrierguard800 rename to BG800 • Armorzone MASH added • Ricochet added • Scorpion II added 	Santosh Tripathi	01-May-19

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1 Introduction

This is a controlled document which presents a listing of the road safety barrier systems and devices which:

1. The Department of Transport and Main Roads (the department) has assessed and considers acceptable (subject to appropriate design and installation) for use on the state-controlled road network. Refer to Section 4.
2. The Austroads Safety Barrier Assessment Panel (ASBAP) has assessed and considers acceptable in accordance with AS/NZS 3845.2:2017. Refer to Section 05, noting that systems and devices listed in Section 05 may require additional acceptance from the relevant authoritative sections elsewhere in the Department or in other external agencies prior to use.

Users of this document should note that road safety barrier selection and design for both temporary and permanent installations is a complex process frequently requiring risk assessment and the application of engineering judgement. In this regard, designers are directed towards *Road Planning and Design Manual* 2nd Edition Volume 3 Part 6.

The responsibility remains with the Designer/Principal to confirm the currency of this document.

1.1 Audience of the document

This is a public document.

1.2 Assessment process

The assessment of road safety barrier systems, end treatments and related road safety devices is undertaken by the Austroads Safety Barrier Assessment Panel (ASBAP).

Suppliers (or proponents) seeking acceptance for use on state controlled roads in Queensland of a road safety barrier system, product or device which is not included in this document are referred to the ASBAP secretariat¹ for an Assessment Submission Package.

Where an assessment by ASBAP results in a recommendation for acceptance, the recommendation together with any recommended conditions of acceptance is documented by Austroads. This department will be cognisant of the recommendations of the ASBAP process.

Suppliers (or proponents) seeking to use a road safety barrier system, product or device on state controlled roads in Queensland which is not included in this document but which has been assessed by ASBAP should submit an application to this department. It should be noted that whilst this department will be cognisant of the recommendations of the Austroads Panel, this department reserves the option to reject, restrict or condition the use of any road safety barrier system, product or device for use on state controlled roads in Queensland.

This department may rescind or modify at any time any product acceptance. This is particularly the case should the status of the acceptance be modified by the Austroads Safety Barrier Assessment Panel or should acceptance be modified in any way in other jurisdictions.

¹ For details, contact: Principal Engineer (Road Engineering Standards), Engineering & Technology Branch, Department of Transport and Main Roads, GPO Box 1412, Brisbane QLD 4001

1.3 Legacy products

This document was first released in 2005 as a way of communicating to suppliers, contractors, designers and other practitioners a listing of road safety barrier systems and devices that the department considers acceptable for use on the state controlled road network.

The acceptance of road safety barrier system, product or device for use on state controlled roads in Queensland predates the Austroads Safety Barrier Assessment Panel process. As such, this list may include road safety barrier systems, products or devices which have not yet been assessed by ASBAP.

It is the intention of this department that all road safety barrier systems, products or devices that are accepted for use on state-controlled roads in Queensland will eventually have been assessed by the ASBAP process.

It is the intention that for an undefined interim period, road safety barrier systems, products or devices that have not yet been assessed by ASBAP will be retained on this list. From time to time, suppliers of systems products or devices that have not been assessed by ASBAP will be invited to make a submission to ASBAP. The department will review the existing acceptance and determine whether to retain, rescind or otherwise modify the acceptance.

1.4 Expiry dates

The department does not currently specify expiry dates for acceptances.

However, the department may at any time review, rescind or otherwise modify the acceptance of a particular road safety barrier system, product or device.

1.5 Proprietary products

This listing nominates a "Registered Supplier" for each proprietary product. It is a requirement of this department that proprietary products installed on state controlled roads in Queensland are sourced from the nominated recognised supplier (or their agent).

1.6 Definitions

Refer to Australian/New Zealand AS/NZS 3845 and *Road Planning and Design Manual - 2nd Edition* Volume 3.

2 Standards

2.1 Governing manuals, specifications or guidelines

- Australian/New Zealand Standard AS/NZS 3845
- Manual of Uniform Traffic Control Devices (TMR)
- Road Planning and Design Manual - 2nd Edition Volume 3 (TMR)
- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2011
- Technical Specification MRTS14 (TMR)
- Technical Specification MRTS02 (TMR)
- National Cooperative Highway Research Program Report 350 (NCHRP350) (TRB, 1993)

- Manual for Assessing Safety Hardware (MASH) (AASHTO, 2016)
- European Standard EN1317 (various parts)

2.2 Other reference documents

- Roadside Design Guide 4th Edition (AASHTO 2011)
- Guide to Road Design Part 6: Roadside Design Safety and Barriers (Austroads 2009)
- Guidelines for Road Design on Brownfield Sites (TMR)

2.3 Testing and impact parameters

Generally, there are three main crash testing and impact parameter protocols that are adopted. These are (i) the *Manual for Assessing Safety Hardware* (MASH), and/or (ii) the *National Cooperative Highway Research Program Report 350* (NCHRP350), and/or (iii) the *European Normative EN1317* (EN1317).

This document identifies, where relevant, an Accepted Test Level for most products. Where a particular test protocol has been used to assess a product, the test protocol is noted with the Accepted Test Level. This department may rate a product and/or its variants an Accepted Test Level that is different to a product's crash test 'Test Level' rating or similar rating.

AS/NZS 3845.1:2015 and AS/NZS 3845.2:2017 both state that MASH is the current basis for crash testing protocol. Thus, with this consideration, it may be prudent to select systems in the following general preferential order that are suitable for both site and project specific circumstances:

1. Accepted systems that have undergone a full suite of MASH testing, then
2. Accepted systems that have not undergone a full suite of MASH testing.

Notes:

- i) An accepted product in this document, may or may not possess a full suite of MASH testing.
- ii) Designers are encouraged to contact system suppliers to determine if a crash test has been conducted for any specific situation.
- iii) For a system to claim to possess a full suite of MASH tests, a system may also require a full suite of MASH tests of the interfaces with other systems or with nominated end treatments.

This general preferential order of selection does not limit in anyway the ability to select a site and project specific system based on any other factors including economic, engineering and policy considerations.

2.4 Comparing Performance of Systems

Results obtained from crash tests (for example, deflection, working width) conducted under different testing protocols (for example, MASH, NCHRP350, EN1317) that help define the predicted performance of a system cannot be easily compared. Comparisons made on the basis of impact energy are possible, but such comparisons do not result in an equal level of predictable performance that crash tests provide. For example, for non-rigid systems, deflection for a TL-3 system tested to NCHRP350 is not expected to be the same as the deflection of the same TL-3 system tested to MASH because of the differences in impact energy. Additionally, for example, a TL-4 system tested to MASH may reportedly have higher deflection or working width than a TL-4 system tested to NCHRP350, but due to the difference in crash test energy, it is very difficult to make system performance comparisons.

The department advises that designs using a specific accepted system should, in general preferential order, be based on:

- Crash tested system performance data, then, if applicable or desired -
- Interpolations or extrapolations away from crash tested system performance data or conditions, which can be based upon any of the following:
 - a. in-service performance data, and/or
 - b. research and development testing, and/or
 - c. engineering simulation.

Any interpolations or extrapolations derived by the system owner are the responsibility of the system owner, and caution should be applied with any use.

2.5 Guidelines on specifying Barrier Systems in Contracts and Drawings

There are increasing difficulties in specifying barrier systems in design drawings and contracts because of the increasing number of proprietary systems (for example, numerous W-beam systems and terminals) and the wide range of current and superseded testing protocols (for example, MASH vs NCHRP350).

Specifications such as, “W-beam”, or “W-beam or equivalent”, or “TL-3 Barrier” do not promote clear design and contract management so these types of specifications should be avoided where possible.

During design, the variables of main interest are:

- Vehicle Mass (kg):- the mass of vehicle that is intended to be contained for example, 2270kg.
- Vehicle Impact angle (degrees):- the impact angle of an errant vehicle that is intended to be contained, for example, 25°.
- Vehicle Impact Speed (km/hr):- the vehicle speed of an errant vehicle that is intended to be contained, for example 100km/hr
- Working Width (metres):- the total distance that the designer is intending to be clear of hazards.

Thus, designers are encouraged to specify barrier systems as per the following or similar:

“Install a road safety barrier system that is redirective as per the location and extents on the design drawings for a vehicle mass of (M) kg, impact angle of (A) °, impact speed of (V) km/hr and achieves a working width of (W) m.

The system requires a compatible crashworthy end treatment at the locations specified (including any hazard free zones behind terminals) on the design drawings that is compatible with the selected longitudinal barrier. Compatibility between terminals and longitudinal barrier may need to be determined via agreement from multiple system suppliers.”

3 Other issues

3.1 Safety in Design considerations

The Work Health and Safety Act 2011 and Work Health and Safety Regulation (2011) impose requirements on certain duty holders. Road safety barrier hardware (permanent and temporary) present risks to the health or safety of persons who may be required to carry out any construction

work. Such risks may be particularly pertinent to temporary devices but may also apply to permanent devices. Such risks may include (but not necessarily be limited to):

- Fragments or debris expelled during impact.
- Excess deflection or failure of a system or device to adequately contain an impacting vehicle.
- Means of access over, through or around a system or device.
- Residual energy stored in devices (especially post-impact).

3.2 Deflection and working width

Deflection values reported in this document are typically those reported during crash testing performed under controlled conditions. Designers are encouraged to check with product owners that these values are correct before proceeding to select site-specific design deflections. Designers need to be cognisant that the crash test deflection value is a single data point, and that in-service performance may be expected to vary.

Working width is the distance behind the barrier that the vehicle and/ or barrier will intrude. Working width includes the parts of a vehicle that partially roll over the top of the system or intrude behind the barrier. Working width may be determined following a site specific risk assessment based upon type and speed of vehicles on the adjacent roadway, and knowledge of the performance characteristics of the barrier.

For further information, see RPDM 2nd Edition Volume 3 Part 6 (QTMR, 2014) section 6.3.15 to 6.3.17 and associated text in the Guide to Road Design Part 6 (Austroads, 2009). Further guidance is also provided in the Guidelines for Road Design on Brownfield Sites (TMR, 2013).

3.3 Footings and anchorages

The person (the designer) specifying any system relying on the resistance provided by the ground to function needs to be satisfied that the design is adequate to meet the intended level of performance for the site specific context and ground conditions. This may necessitate for example demonstration by calculation or otherwise that the proposed footing or anchorage is at least equivalent to that used during the compliance testing in order to adequately resist lateral or longitudinal displacement as well as rotation or pull-out.

3.4 Anti-gawk screens

The department does not maintain a list of accepted anti-gawk (or anti-debris) screens. Guidance pertaining to anti-gawk screens is provided in Section 3.16-1 of the supplement to Part 3 of the *Manual of Uniform Traffic Control Devices* (MUTCD).

The provisions for attachments to barriers is discussed in Australian/New Zealand Standard AS/NZS 3845.1:2015 cl.2.5.5, which states (among other things):

There shall be no attachment to a road safety barrier system unless it can be shown by crash testing or by assessment as a modification ... that it is suitable.

Anti-gawk screens are considered to be an attachment to a road safety barrier system and as such are subject to the above provisions of the Standard. Wherever full scale crash testing is not provided then assessment (as required by AS/NZS 3845.1:2015) is required. Such an assessment would need as a minimum to address among other things the provisions of AS/NZS 3845.1:2015 and MUTCD Part 3 Supplement s.3.16-1.

Thereafter, a second engineering assessment is required to determine whether any road safety barrier and associated anti-gawk screen is appropriate for use at a site-specific project location.

In any impact event, it is likely that some elements of the screen attachment will be displaced and will enter the workzone. Practitioners prescribing the use of anti-gawk screens should be cognisant of the consequent increase in risk to workers. Refer section 3.1.

3.5 Delineation

Nose delineation for road safety barrier terminals, including crash cushions should be provided in accordance with the *Manual of Uniform Traffic Control Devices*.


3.6 Standing Offer Arrangements







A Standing Offer Arrangement may exist for the supply to Transport and Main Roads projects of certain road safety barrier componentry and devices. Project Managers especially are advised to contact the department's Chief Procurement Office for further advice in this regard.

4 Accepted road safety barriers and devices

4.1 Permanent

4.1.1 Longitudinal barriers

<p><u>Single Slope Concrete Barrier</u> <u>Type:</u> Concrete (rigid) <u>Accepted Test Level:</u> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Public Domain <u>Notes:</u> Test Level subject to height and configuration. Refer to Departmental Standard Drawing 1468.</p>	
<p><u>THRIE beam</u> <u>Type:</u> Steel beam <u>Accepted Test Level:</u> MASH Not rated NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Public Domain <u>Notes:</u> Refer to various Departmental Standard Drawings. Used primarily in transitions.</p>	
<p><u>MODIFIED THRIE beam</u> <u>Type:</u> Steel beam <u>Accepted Test Level:</u> MASH Not rated NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Public Domain <u>Notes:</u> Refer to various Departmental Standard Drawings. Uses notched blockout.</p>	
<p><u>W-beam</u> <u>Type:</u> Steel beam <u>Accepted Test Level:</u> MASH Not rated NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Public Domain <u>Notes:</u> Refer to various Departmental Standard Drawings.</p>	
<p><u>Ezy-Guard 4</u> <u>Type:</u> Steel beam <u>Accepted Test Level:</u> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Ingal Civil Products</p>	
<p><u>Ezy-Guard SMART</u> <u>Type:</u> Steel beam <u>Accepted Test Level:</u> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 Not rated. <u>Registered Supplier:</u> Ingal Civil Products</p>	

<p><u>Ezy-Guard High Containment (HC)</u> <i>Type:</i> Steel beam <i>Accepted Test Level:</i> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 Not rated. <i>Registered Supplier:</i> Ingal Civil Products</p>	
<p><u>RAMSHIELD</u> <i>Type:</i> Steel beam <i>Accepted Test Level:</i> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 Not rated. <i>Registered Supplier:</i> Safe Direction</p>	
<p><u>Sentry W-beam</u> <i>Type:</i> Steel beam <i>Accepted Test Level:</i> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 Not rated. <i>Registered Supplier:</i> Australian Construction Products</p>	
<p><u>Brifen 4-rope</u> <i>Type:</i> Wire Rope <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Hill & Smith <i>Notes:</i> Brifen 4-rope requires Brifen End Anchor TL-3.</p>	
<p><u>Flexfence 4-rope</u> <i>Type:</i> Wire Rope <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Ingal Civil Products <i>Notes:</i> The TL-3 and TL-4 systems are different products. Flexfence 4-rope requires Flexfence End Anchor TL-3.</p>	
<p><u>Sentryline II 4-rope</u> <i>Type:</i> Wire Rope <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Australian Construction Products <i>Notes:</i> Sentryline II 4-rope requires Sentryline II End Anchor TL-3.</p>	

4.1.2 End treatments

<p><u>MELT</u> <i>Type:</i> Gating (Redirective from 3rd Post) <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Public Domain <i>Notes:</i> Refer to Departmental Standard Drawing 1474.</p>	
<p><u>Departure End Terminal (DET)</u> <i>Type:</i> Gating (Redirective to penultimate post) MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Public Domain <i>Notes:</i> Refer to Departmental Standard Drawing 1474.</p>	
<p><u>“ACP” MELT</u> <i>Type:</i> Gating (Redirective from 3rd Post) <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Australian Construction Products <i>Notes:</i> Flared, Parabolic; Non Energy Absorbing; X350 Post System and ACP plastic blackout.</p>	
<p><u>“INGAL” MELT</u> <i>Type:</i> Gating (Redirective from 3rd Post) <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Ingal Civil Products <i>Notes:</i> Flared, Parabolic; Non Energy Absorbing; Steel Yielding Terminal Post System and Ingal plastic blackout.</p>	
<p><u>ET2000 Plus</u> <i>Type:</i> Gating (Redirective from 3rd Post) <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <i>Registered Supplier:</i> Ingal Civil Products <i>Notes:</i> Tangential/Flared; Extruder Head; TL-2 (7.6m - shorter length), TL-3 (15.2m - longer length). <i>Accepted Variants:</i> ET2000 Plus Motorcyclist Protection Shield (see below) ET2000 Plus Head Cover (see below) <u>ET2000 Plus Motorcyclist Protection Shield</u> <i>Type:</i> Extruder Head Cover <i>Accepted Test Level:</i> MASH Not rated. NCHRP350 Not rated. <i>Registered Supplier:</i> Ingal Civil Products <i>Notes:</i> This component may be used where there is a relatively higher risk of motorcycle impact.</p>	 

ET2000 Plus Head Cover

Type: Extruder Head Cover

Accepted Test Level:

MASH Not rated.

NCHRP350 Not rated.

Registered Supplier: Ingal Civil Products

Notes: This component may be used where there is a relatively higher risk of motorcycle impact.

**FLEAT-SP**

Type: Gating (Redirective from 3rd Post)

Accepted Test Level:

MASH Not rated.

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

Registered Supplier: Safe Direction

Notes: Flared; Extruder Head. (FLEAT = FLared Energy Absorbing Terminal).

**MSKT**

Type: Gating (Redirective from 3rd Post)

Accepted Test Level:

MASH TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

NCHRP350 Not rated.

Registered Supplier: Safe Direction

Notes: Tangential/Flared; Extruder Head. (MSKT = Mash Sequential Kinking Terminal).

**SKT-SP**

Type: Gating (Redirective from 3rd Post)

Accepted Test Level:

MASH Not rated.

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

Registered Supplier: Safe Direction

Notes: Tangential/Flared; Extruder Head. (SKT = Sequential Kinking Terminal).

**TREND-350**

Type: Gating (Redirective from 3rd Post)

Accepted Test Level:

MASH Not rated.

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

Registered Supplier: Ingal Civil Products

Notes: Tangential; Extruder Head.

**X-Tension 350**

Type: Gating (Redirective 600 mm downstream from 1st Post)

Accepted Test Level:

MASH Not rated.

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6



Registered Supplier: Australian Construction Products

Notes: Tangential/Flared; Friction/Tension. Also identified as X350.

Accepted Variants:

Median (back to back) variant may be used.



<p><u>QUADGUARD</u> <u>Type:</u> Redirective Crash Cushion <u>Accepted Test Level:</u> MASH Not rated. NCHRP350 TL-1 <u>TL-2</u> <u>TL-3</u> TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Ingal Civil Products</p>	
<p><u>QUADGUARD High Speed</u> <u>Type:</u> Redirective Crash Cushion <u>Accepted Test Level:</u> MASH Not rated. NCHRP350 TL-1 TL-2 <u>TL-3+</u> TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Ingal Civil Products (<i>Note:</i> (+) Device has been subjected to suite of crash tests at nominal 112 km/h).</p>	
<p><u>QUADGUARD Elite</u> <u>Type:</u> Redirective Crash Cushion <u>Accepted Test Level:</u> MASH Not rated. NCHRP350 TL-1 <u>TL-2</u> <u>TL-3</u> TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Ingal Civil Products</p>	
<p><u>Smart Cushion</u> <u>Type:</u> Redirective Crash Cushion <u>Accepted Test Level:</u> MASH TL-1 TL-2 <u>TL-3</u> TL-4 TL-5 TL-6 NCHRP350 TL-1 <u>TL-2</u> <u>TL-3</u> TL-4 TL-5 TL-6 <u>Registered Supplier:</u> LB Australia <u>Accepted Variants:</u> SCI100GM (MASH TL-3, NCHRP350 TL-3) SCI70GM (NCHRP350 TL-2)</p>	
<p><u>TRACC</u> <u>Type:</u> Redirective Crash Cushion <u>Accepted Test Level:</u> MASH Not rated. NCHRP350 TL-1 <u>TL-2</u> <u>TL-3</u> TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Ingal Civil Products</p>	
<p><u>Universal TAU II</u> <u>Type:</u> Redirective Crash Cushion <u>Accepted Test Level:</u> MASH Not rated. NCHRP350 TL-1 <u>TL-2</u> <u>TL-3</u> TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Australian Construction Products</p>	
<p><u>Thrie-beam Bullnose</u> <u>Type:</u> Non-redirective system <u>Accepted Test Level:</u> MASH Not rated. NCHRP350 TL-1 TL-2 <u>TL-3</u> TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Public Domain <u>Notes:</u> Departmental Standard Drawing 1488. Hazard free zone required.</p>	

4.2 Temporary

4.2.1 Longitudinal barriers

Precast Concrete Barrier (PCB)

Type: Temporary Concrete Barrier – Single Slope

Accepted Test Level:

MASH Not rated.

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

Registered Supplier: Public Domain

Notes: Departmental Standard Drawings 1473 and 1458. Has a permanent configuration option, refer TMR SD1473. Photo shows example of anti-gawk screen attached.



DB80 Precast Concrete Barrier

Type: Temporary Concrete Barrier – F Shape

Accepted Test Level:

MASH TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

EN1317 N1 N2 **H1** H2 H3 H4a H4b

Registered Supplier: Orange Hire

Notes: This F shape temporary concrete barrier is only acceptable for use on roads with speed limits of 80 km/h or less.

Accepted Variants:

4m units are MASH TL-3

6m units are EN1317-2 H1



JJ-Hooks Precast Concrete Barrier

Type: Temporary Concrete Barrier – F Shape

Accepted Test Level:

MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

Registered Supplier: Australian Road Barriers

Notes: This F shape temporary concrete barrier is acceptable for use only on roads with speed limits of 80 km/h or less.



T-LOK Precast Concrete Barrier

Type: Temporary Concrete Barrier – F Shape

Accepted Test Level:

MASH TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

Registered Supplier: Saferoads

Notes: This F shape temporary concrete barrier is acceptable for use only on roads with speed limits of 80 km/h or less.

Accepted Variants:

T-Lok 350 (NCHRP350 TL-3)

T-Lok MASH (MASH TL-3)



BG800

Type: Temporary Steel Barrier

Accepted Test Level:

MASH TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6

NCHRP350 TL-1 **TL-2** **TL-3** **TL-4** TL-5 TL-6

Registered Supplier: Highway Care International

Notes: Suite of products include Standard, MDS (Minimum Deflection System), and LDS (Limited Deflection System).

Accepted Variants:

BG800 Standard (NCHRP350 TL-2, TL-3, TL-4; MASH TL-3)

BG800 MDS (NCHRP350 TL-3)

BG800 LDS (NCHRP350 TL-3)



Defender Barrier

Type: Temporary Steel Barrier

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	------	-------------	-------------	-------------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	------	------	------	------	------	------

Registered Supplier: Safe Barriers Pty. Ltd.

Notes: Suite of products include Defender Barrier 70, 100 LDS (Limited Deflection System), and 100 HC (High Containment).

Accepted Variants:

Defender Barrier 70

Defender Barrier 100 LDS

Defender Barrier 100 HC

Defender Barrier 100 FS

**IronMan**

Type: Temporary Steel Barrier

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	------	------	------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	------	-------------	-------------	------	------	------

Registered Supplier: Saferoads

Notes: There are a number of variants of Ironman. Refer to data sheet and consult supplier. Speed restrictions apply to some variants.

Accepted Variants:

IronMan Original

IronMan Heavy Duty

IronMan Hybrid

**Zoneguard**

Type: Temporary Steel Barrier

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	------	------	-------------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	------	------	-------------	-------------	------	------

Registered Supplier: Hill & Smith

Notes: Minimum Deflection System' available at TL-3.

Accepted Variants:

Zoneguard (NCHRP350 TL-4, MASH TL-3)

Zoneguard 'Minimum Deflection System' (MASH TL-3)

**ArmorZone MASH**

Type: Temporary Plastic Water Filled Device

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	------	-------------	------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	------	------	------	------	------	------

Registered Supplier: Australian Construction Products

Notes: ArmorZone MASH units must not be mixed with ArmorZone NCHRP350 units.



ArmorZone (NCHRP350)

Type: Temporary Plastic Water Filled Device

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	------	------	------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	-------------	------	------	------	------	------

Registered Supplier: Australian Construction Products

Notes: Water-filled temporary barrier for use in work zones where posted speed ≤ 50 km/h. May, **subject to detailed site-specific risk assessment**, be used to shield worksites where the posted speed does not exceed 70 km/h.

ArmorZone (NCHRP350) units must not be mixed with ArmorZone MASH units.

**Ricochet**

Type: Temporary Plastic Water Filled Device

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	-------------	------	------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	------	------	------	------	------	------

Registered Supplier: National Plastic Group

Notes: Water-filled temporary barrier for use in work zones where posted speed ≤ 50 km/h.

**Shield I**

Type: Temporary Plastic Water Filled Device

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	-------------	------	------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	------	------	------	------	------	------

Registered Supplier: National Plastic Group

Notes: Water-filled temporary barrier for use in work zones where posted speed ≤ 50 km/h.

**Triton (TL-1 variant)**

Type: Temporary Plastic Water Filled Device (with internal steel frame)

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	------	------	------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	-------------	------	------	------	------	------

Registered Supplier: Ingal Civil Products

Notes: Internal steel frame. Water-filled temporary barrier for use in work zones where posted speed ≤ 50 km/h. May, **subject to detailed site-specific risk assessment**, be used to shield worksites where the posted speed does not exceed 70 km/h.

**Mobile Barriers MBT-1**

Type: Temporary Workzone Protection Device

Accepted Test Level:

MASH	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
------	------	------	-------------	------	------	------

NCHRP350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
----------	------	------	------	------	------	------

Registered Supplier: Mobile Barriers

**4.2.2 End treatments**

Some permanent crash cushions as listed above may be suitable for connection to temporary barrier systems. Designer should consult system supplier to verify compatibility between systems.

Absorb 350Type: Non-Redirective, Gating Plastic Water Filled Crash CushionAccepted Test Level:

MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6

NCHRP350 TL-1 **TL-2** TL-3 TL-4 TL-5 TL-6Registered Supplier: Australian Construction Products

Notes: **Limited to ≤ 70 km/hr.** May be used in higher speed environments subject to site-specific risk assessment noting that product may only be used where high speed side impacts are unlikely, penetration behind the barrier is acceptable and use of a redirecting impact attenuator is not feasible for reasons other than cost or convenience. Note that configuration (length/no. of units) changes with impact speed rating.

**TRITON Concrete End Terminal (CET)**Type: Non-Redirective, Gating Plastic Water Filled Crash CushionAccepted Test Level:

MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6

NCHRP350 TL-1 **TL-2** TL-3 TL-4 TL-5 TL-6Registered Supplier: Ingal Civil Products

Notes: **Limited to ≤ 70 km/hr.** May be used in higher speed environments subject to site-specific risk assessment noting that product may only be used where high speed side impacts are unlikely, penetration behind the barrier is acceptable and use of a redirecting impact attenuator is not feasible for reasons other than cost or convenience. Note that configuration changes with impact speed rating, NSW, must be installed on pedestals where speed >70 km/h.




**4.3 Other road safety devices****4.3.1 Gates****ARMORGUARD Gate**Type: GateAccepted Test Level:

MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6Registered Supplier: Australian Construction Products**BARRIERGUARD 800 Steel Gate**Type: GateAccepted Test Level:

MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6

NCHRP350 TL-1 TL-2 **TL-3** TL-4 TL-5 TL-6Registered Supplier: A. Highway Care International, B. Boylan Group**4.3.2 Miscellaneous****Biker-Shield Motorcyclist Protection Device**Type: Motorcyclist RubrailAccepted Test Level:MASH **N/A**NCHRP350 **N/A**Registered Supplier: Safe Direction

<p><u>HIASA Rail Motorcyclist Protection Device</u> <u>Type:</u> Motorcyclist Rubrail <u>Accepted Test Level:</u> MASH N/A NCHRP350 N/A <u>Registered Supplier:</u> Australian Construction Products</p>	
<p><u>Ingal Motorcyclist Protection Rail</u> <u>Type:</u> Motorcyclist Rubrail <u>Accepted Test Level:</u> MASH N/A NCHRP350 N/A <u>Registered Supplier:</u> Ingal Civil Products</p>	
<p><u>RAPTOR</u> <u>Type:</u> Pole Cushion <u>Accepted Test Level:</u> MASH N/A NCHRP350 N/A <u>Registered Supplier:</u> Valmont Highway Distribution <u>Notes:</u> This is not a road safety barrier. It is a single point protector for use in lower speed environments.</p>	
<p><u>“ACP” Plastic Blockout</u> <u>Type:</u> Blockout <u>Accepted Test Level:</u> MASH N/A NCHRP350 N/A <u>Registered Supplier:</u> Australian Construction Products <u>Notes:</u> For use in selected terminals only. Approval for use of plastic blocks on W-beam guardrail strong posts was withdrawn in March 2008. Plastic blocks remain accepted for use in respective proprietary MELTs and when used with breakaway or weak posts. Where W-beam with plastic blocks is damaged the downstream blocks are to be removed and replaced with a compliant blockout.</p>	<p>No picture</p>
<p><u>“Ingal” Plastic Blockout</u> <u>Type:</u> Blockout <u>Accepted Test Level:</u> MASH N/A NCHRP350 N/A <u>Registered Supplier:</u> Ingal Civil Products <u>Notes:</u> For use in selected terminals only. Approval for use of plastic blocks on W-beam guardrail strong posts was withdrawn in March 2008. Plastic blocks remain accepted for use in respective proprietary MELTs and when used with breakaway or weak posts. Where W-beam with plastic blocks is damaged the downstream blocks are to be removed and replaced with a compliant blockout.</p>	<p>No picture</p>

5 Assessed by ASBAP in Accordance with AS/NZS 3845.2:2017

The products in this list have been assessed and accepted by ASBAP in accordance with AS/NZS 3845.2:2017. Products listed here have only been assessed in accordance with AS/NZS3845.2:2017, and there are other approvals that are required elsewhere in the Department or in other external agencies prior to use. In other words, a product listed here is not approved for use, but approved for its assessment in accordance with AS/NZS3845.2:2017 only.

In summary, among other things, AS/NZS3845.2:2017 primarily only assesses a products suitability from a crashworthiness perspective. Any other aspects of a product are not specifically reviewed by ASBAP.

Product Information Sheets (within the Appendix B) are not produced for these products.

Important Notes:

1. ASBAP have stated that after 31 December 2020, AS/NZS 3845.2:2017 type products should be assessed under MASH protocols.
2. Prior to 31 December 2020, crashworthiness may be demonstrated via crash testing to other protocols (for example, NCHRP350).
3. Operators are advised that over time, the list below will be populated as more products are submitted to ASBAP and assessed by ASBAP. Operators are recommended to be cognisant that the ASBAP assessment process may take considerable time, and they should continue with 'business as usual' arrangements.
4. Products not listed below may still be operationally acceptable to TMR under existing or future arrangements.
5. It is NOT the intention of the list below to imply that other products are not acceptable for use by TMR and cannot be used operationally by TMR.
6. Operators are recommended to select devices which are fit for purpose to their total requirements. Crashworthiness is just one aspect to consider.
7. Operators are recommended to select products that are suitable to their business needs. The evolving list below may be used as a guide in this regard.

5.1 Longitudinal Channelizing Devices

Nil

5.2 Truck and Trailer Mounted Attenuators

<u>BLADE</u> <u>Type:</u> Truck Mounted Attenuator <u>Accepted Test Level:</u> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> Innov8 Equipment Pty Ltd	
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<u>JL-D-0850 Stuer-Egghe “Julietta”</u> <u>Type:</u> Truck Mounted Attenuator <u>Accepted Test Level:</u> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> J1-LED	
<u>Scorpion II</u> <u>Type:</u> Truck Mounted Attenuator <u>Accepted Test Level:</u> MASH TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 NCHRP350 TL-1 TL-2 TL-3 TL-4 TL-5 TL-6 <u>Registered Supplier:</u> A1 Roadlines Pty Ltd	

5.3 Rear Underrun Protection Devices

Nil

5.4 Permanent Bollards

Nil

5.5 Sign Support Structures and Poles

Nil

Appendix A – Proprietors, suppliers and industry contacts**(Subject to change without notice)**

<u><i>A1 Roadlines Pty Ltd</i></u>	89 Rushdale Street, Knoxfield, VIC 3180 Ph: 03 9765 9400 Mob: 0407 555 101 www.a1roadlines.com.au Contact: Janine Bartholomew Email: janine@a1roadlines.com.au
<u><i>Advantage Plastics</i></u>	254 Easterbrook Road, RD1 Kaiapoi 7691, NZ Ph: 0800 668 534 Mob: 021 228 5284 www.advantageplastics.co.nz Contact: David Hickmott Email: david@adplasnz.com
<u><i>Australian Construction Products (ACP)</i></u>	Unit 3/55 Christensen Road, Stapylton, QLD 4207 Ph: 07 3442 6200 Mob: 0434 605 109 www.acprod.com.au Contact: Nicholas Hassan Email: Nicholas.Hassan@rocla.com.au
<u><i>Australian Road Barriers</i></u>	RMB H535, Old Creswick Rd, Ballarat, VIC 3352 Ph: 1800 003 826 Fax: (03) 5339 9273 www.roadbarriers.com.au Contact: Ben Sexton Email: ben@roadbarriers.com.au
<u><i>Highway Care International</i></u>	The Highlands, Detling, Maidstone, Kent, ME14 3HT, United Kingdom www.highwaycareint.com
<u><i>Hill & Smith</i></u>	1/242 New Cleveland Rd, Tingalpa, QLD 4173 Ph: 1300 277 683 www.hsroads.com.au Contact: Warwick Weeks Email: sales@hsroads.com.au
<u><i>Ingal Civil Products</i></u>	7 Nestor Drive, Meadowbrook, QLD 4131 Ph: 07 3489 9120 Fax: 07 3489 9130 www.ingalcivil.com.au Contact: Brett Wells Email: bwells@ingalcivil.com.au
<u><i>Innov8 Equipment Pty Ltd</i></u>	86 Mulgoa Road Penrith NSW 2750 Ph: 1300 071 007 www.innov8equipmwent.com.au Contact: Tim Eato Email: tim@innov8equipment.com.au
<u><i>J1-LED</i></u>	10 Production Street, Beenleigh QLD 4207 Ph: 0405693911 www.j1led.com Contact: Shane Kelly Email: ShaneK@j1led.com

<u>Laura Metaal Road Safety PTY Limited</u>	L11 1 Margaret street, Sydney, NSW 2000 Ph: 0426360675 www.laurametaal.com Contact: Onno van den Toorn Email: apac@laurametaal.nl
<u>LB Australia</u>	Unit 6/79, Mandoon Road, Girraween, NSW 2145 Ph: (02) 9631 8833 Fax: (02) 9688 4503 www.lbaustralia.com.au Contact: Paul Hansen Email: paul.hansen@lbaustralia.com.au
<u>Mobile Barriers</u>	24918 Genesee Trail Road, Golden, Colorado 80401, USA. Ph: 0432 931 981 http://int.mobilebarriers.com/ Contact: Ben Eizenberg Email: ben@mobilebarriers.com
<u>National Plastic Group</u>	22 Christensen Road, Staplyton QLD 4207 Ph: 07 3807 0055 Fax: 07 3807 2315 www.nationalplasticsgroup.com.au Contact: Nina Adcock Email nina@nationalplastics.com.au
<u>Orange Hire</u>	71 Lavarack Ave, Eagle Farm, QLD 4009 www.orangehire.com.au
<u>Saferoads</u>	22 Commercial Drive, Pakenham, VIC. 3810 Ph: 1800 060 072 Fax: 1800 060 673 www.saferoads.com.au Contact: Casey McMaster Email: casey.mcmaster@saferoads.com.au
<u>Safe Direction</u>	Unit 2, 5 Simpson Close, Smeaton Grange, NSW 2567 Ph: 1300 063 220 www.safedirection.com.au Contact: Terry Colquhoun Email: terryc@safedirection.com.au
<u>Safe Barriers</u>	PO Box 7178, Hemmant, QLD 4174 Ph: 1800 169 799 www.safebarriers.com Contact: David Moule Email: david.moule@safebarriers.com
<u>Valmont Highway Distribution</u>	57-65 Airds Road, Minto, NSW 2566 Ph: 02 9814 1711 www.valmonthighway.com Contact: Leigh Brown Email: lbrown@valmonthighway.com

Appendix B – Product information sheets

(Information Only)

- | | |
|--|---|
| 1. Single Slope Concrete Barrier | 27. TRACC |
| 2. Thrie beam | 28. Universal TAU II |
| 3. MODIFIED Thrie beam | 29. THRIE-beam Bullnose |
| 4. W-beam | 30. Precast Concrete Barrier (PCB) |
| 5. Ezy-Guard 4 | 31. DB80 Precast Concrete Barrier |
| 6. Ezy-Guard SMART | 32. J-J Hooks |
| 7. Ezy-Guard High Containment (HC) | 33. T-LOK |
| 8. RAMSHIELD | 34. BarrierGuard 800 |
| 9. Sentry W-beam | 35. Defender Barrier |
| 10. BRIFEN 4-rope TL-4 | 36. Ironman |
| 11. Flexfence 4-rope TL-4 (and TL-3 configuration) | 37. Zoneguard |
| 12. SENTRYLINE II 4-rope TL-4 | 38. ArmorZone MASH |
| 13. MELT | 39. Armorzone (NCHRP350) |
| 14. Departure End Terminal (DET) | 40. Ricochet |
| 15. "ACP" MELT | 41. Shield I |
| 16. "INGAL" MELT | 42. Triton |
| 17. ET2000-Plus | 43. Mobile Barriers MBT-1 |
| 18. FLEAT-SP | 44. Absorb 350 |
| 19. SKT-SP | 45. Triton Concrete End Terminal (CET) |
| 20. MSKT | 46. Armorguard Gate |
| 21. TREND-350 | 47. BarrierGuard 800 Steel Gate |
| 22. X-Tension 350 | 48. Biker-Shield Motorcyclist Protection Device |
| 23. QUADGUARD | 49. Hiasa Rail Motorcyclist Protection Device |
| 24. QUADGUARD High Speed | 50. Ingal MPR |
| 25. QUADGUARD ELITE | 51. Raptor |
| 26. SMART Cushion | |

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Single Slope Concrete Barrier

TMR Standard Drawing 1468

Created: Monday, 29 April 2019

12:59 PM

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Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Rigid

Main Material: Concrete

Ownership:

Public Domain

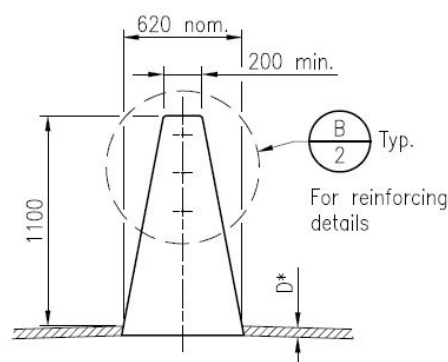
Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Supplier:

Public Domain



Introduction:

The single slope barrier is a rigid extruded reinforced concrete barrier with a 10.8° profile. Heights may vary.

AASHTO Roadside Design Guide (2011) (section 6.4.1.8) states "Concrete barrier shapes that meet the NCHRP Report 350 criteria are the New Jersey and F-shapes, the single-slope barrier (two variations in slope), and the vertical wall. These shapes, when adequately designed and reinforced may all be considered TL-4 designs at the standard height of 813mm and TL-5 designs at heights of 1067mm and higher".

An advantage of the single slope shape is that it can accommodate adjacent overlays without compromising the profile of the barrier. However, designers do need to be cognisant that overlays will reduce the effective height of the barrier and hence reduce its overall containment capacity.

Test Level:

Extruded Variant

Deemed to meet NCHRP 350 TL-5 (1100mm high, anchored) (based on AASHTO Roadside Design Guide (2011) and FHWA memorandum HMHS-B64 dt. 14-Feb-2000).

Refer to TMR Standard Drawing 1468 (rev. E) for further guidance on containment level.

PCB: Pre-cast variant

- Refer to Precast Concrete Barrier (PCB) data sheet
- Permanent configurations for PCB shown on TMR Standard Drawing 1473

Recommended End Treatments:

Any accepted permanent crash cushion (refer this document), with appropriate transition/connection. Alternatively, it is acceptable to transition to steel-beam barrier end terminal via transition (see TMR standard drawings).

Design:

Standard configurations of single slope extruded barrier are provided on TMR Standard Drawing 1468.

Whilst TMR Standard Drawing 1468 nominates the single slope barrier as a median barrier, it may be used at other locations. In order to maintain the specified containment capacity, adequate footing restraint must be provided to resist overturning and lateral deflection.

The minimum lengths of barrier nominated on TMR Standard Drawing 1468 apply to lengths between gaps provided for street lighting and/or expansion joints.

Where there is a risk that the end of a concrete barrier can be impacted, the end must be shielded by one of:

- (i) an accepted connection to another barrier system,
- (ii) a suitable method of overlap,
- (iii) an accepted crashworthy crash cushion.

Overlays (or lift or corrector) courses placed after initial construction of the barrier may reduce the relative/residual height of barriers and/or their profile. Designers should make provision for such future treatments when designing a barrier.

Deflection:

Whilst this barrier type is “rigid” and should exhibit zero deflection under impact, designers should be cognisant of the possibility of vehicle roll and working width when locating objects mounted on or situated behind the barrier.

Limitations:

Refer to TMR Standard Drawing 1468.

Designers and project managers should be cognisant that provision of lighting within barriers introduces some additional exposure to risk:

- (i) Street lighting poles are likely to exist within the working width envelope.
- (ii) Steel cover plates shown on standard Drawing 1469 are not expected to provide test level TL-5 containment capability.

Such design decisions should be documented in the design documentation.

References:

- AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Standard Drawing 1468 (rev. E)
- Roadside Design Guide (AASHTO, 2011)
- FHWA memorandum HMHS-B64 dt. 14-Feb-2000).

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Thrie beam

Various TMR Standard Drawings

Created: Monday, 29 April 2019

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Status*: Accepted

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

Category: Longitudinal

Gating/Non-Gating: Not Applicable

Sub Category: Semi-Rigid

Redirective/Non-Redirective: Redirective

Main Material: Steel

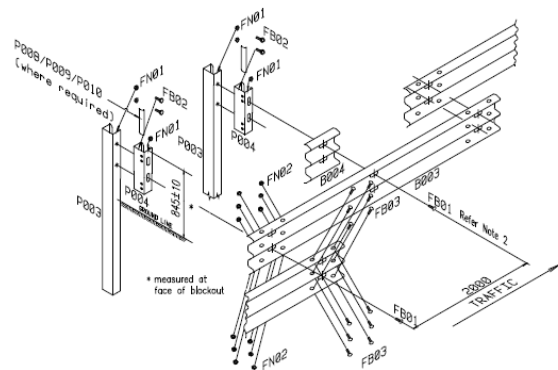
Permanent/Temporary: Permanent

Ownership:

Supplier:

Public Domain

Public Domain



Introduction:

Thrie beam is a longitudinal steel barrier comprising post and rail. The rail section is deeper than w-beam and comprises a triple-wave section (as opposed to the double-wave of w-beam).

The system is stiffer than w-beam and might be used where localised stiffening is required (for reduced deflection). Thrie beam is most commonly used in transitions between w-beam and concrete barrier.

NOTE that modified thrie-beam is a different system.

Test Level:

Based on Australian/New Zealand Standard AS/NZS 3845:1999 (superseded), the system is deemed to meet the requirements of NCHRP Report 350 test level TL-3.

Recommended End Treatments:

There is no end treatment specifically for Thrie-beam. Instead it is necessary to connect via transition (of appropriate length) to w-beam or concrete barrier, which must be terminated appropriately.

Design:

To reduce twisting of the rail, the rail to blockout bolts should alternate between the top and the bottom indentations.

Rail to blockout bolt washers should not be installed for this system, as they are not necessary for strength over the normal operating range of crashes. However, they will cause the rail to ride down during severe impact, leading to the possibility of vaulting by colliding vehicles. Omitting these washers keeps rail heights relatively constant during severe crashes, thus ensuring the system operates more effectively than if rail to blockout bolt washers were present.

When using semi-rigid barrier, designers must check barrier require sight distances to be checked for adequacy, especially sight distances around horizontal curves, at intersections and at accesses.

Transition pieces are available for connection to w-beam. AS 3845 and Main Roads Standard Drawings give details of such transitions.

The standard post spacing for thrie-beam blocked-out (strong post) should be at 2m as per AS3845.

Deflection:

AS/NZS 3845:1999 (now superseded) states 0.6 m (2000kg vehicle at 100km/h and 25 degrees), which are NCHRP Report 350 test level TL-3 conditions. This is not referenced, but is consistent in magnitude with deflections quoted in the AASHTO Roadside Design Guide for strong post timber blockout thrie-beam systems subjected to the same impact.

Limitations:

Information has not been entered.

References:

- AS/NZS 3845.1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- AASHTO Roadside Design Guide (4th Edition 2011)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

MODIFIED Thrie beam

Various TMR Standard Drawings

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

Category: Longitudinal

Gating/Non-Gating: Not Applicable

Sub Category: Semi-Rigid

Redirective/Non-Redirective: Redirective

Main Material: Steel

Permanent/Temporary: Permanent

Ownership:

Supplier:

Public Domain

Public Domain



Introduction:

Modified Thrie-Beam is a steel rail barrier system with a triple wave profile.

The "modification" refers to the blockout, which is wider than a conventional blockout and includes a triangular notch in the web behind the front flange. This notch allows the lower portion of the thrie-beam and the flange of the spacer block to bend such that upon impact, the rail remains nearly vertical in the collision area and the posts are pushed backwards.



Test Level:

Based on Australian/New Zealand Standard AS/NZS 3845:1999 (superseded), the system is deemed to meet the requirements of NCHRP Report 350 test level TL-4.

Recommended End Treatments:

There is no suitable end treatment for Thrie-beam. An acceptable transition (including length) to w-beam or concrete barrier must be provided together with an approved end treatment for either of those systems.

Design:

The modified thrie-beam is an improved version of the thrie-beam guardrail, with capacity to contain larger vehicles than both thrie-beam and W-beam guardrail.

A spacer block, with a triangular notch cut from its web, allows the lower portion of the thrie-beam and the flange of the spacer block to bend when hit and results in small vehicles being redirected less severely in collisions. This characteristic is suited for guardrail situations on high volume roads carrying a mix of heavy vehicle through traffic and local passenger vehicle traffic (e.g., highways approaching regional centres).

Upon impact, the rail remains nearly vertical in the collision area and the posts are pushed backwards.

The triangular notch cut from the web of the blockout allows the lower portion of the thrie beam to and the flange of the steel blockout to bend inward during a crash, keeping the rail face nearly vertical in the impact zone as the posts are pushed backwards. This raises the height of the rail and further minimizes the likelihood of a vehicle rolling over the barrier.

- AASHTO RDG, 2011

Rail to blockout bolt washers should not be used.

Refer to RPDM and TMR Standard Drawings including but not limited to SD1475, SD1477, SD1481, SD1482, SD1483, SD1484, SD1486.

Deflection:

Measured (crash test) deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)
2,000	25	100	0.60
8,000	15	80	0.90

(source: Roadside Design Guide, AASHTO 4th Ed, 2011)

It is noted that these tests were conducted on a US configuration of modified thrie-beam.

Practitioners may note that Australian Standard AS/NZS 3845:1999 (superseded) nominated a dynamic deflection of 1.0m under the following test conditions: 8,000kg vehicle at 100km/h and 25° impact (with posts spaced at 2m intervals). It is noted that the test configuration described in the Standard is not a regular test level configuration: this may be an error in the Standard.

Limitations:

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Roadside Design Guide (AASHTO, 2011)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

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W-beam

Various TMR Standard Drawings

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

Category: Longitudinal

Gating/Non-Gating: Not Applicable

Sub Category: Semi-Rigid

Redirective/Non-Redirective: Redirective

Main Material: Steel

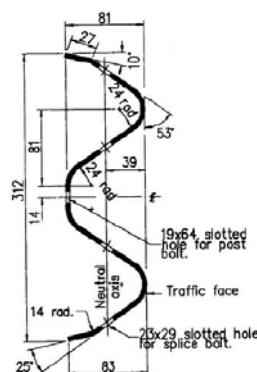
Permanent/Temporary: Permanent

Ownership:

Supplier:

Public Domain

Public Domain



Introduction:

W-Beam is a steel rail barrier system with a double wave profile. The w-beam rail is supported by a blockout attached to steel posts. When impacted, the blockout assists to keep the point of impact outside the plane of the posts, thereby reducing the risk of vehicle snagging. The likelihood of vehicle vaulting over the barrier is also reduced because of the rail height being maintained during the initial stages of post deflection during impact.

The W-Beam system used by Transport and Main Roads (TMR) is based on the "G4" design in Australian Standard AS3845:1999 Road Safety Barrier systems. This is based on the AASHTO "G4" system used in the United States: however, the Australian design uses a C-Section as the post and the blockout.

Test Level:

Based on Australian/New Zealand Standard AS/NZS 3845:1999 (superseded), the system is deemed to meet the requirements of NCHRP 350 test level TL-3.

Recommended End Treatments:

There are a number of recommended end treatments (listed in this document) that can be used to terminate w-beam. W-beam may also be transitioned to and connected to other systems.

Design:Normal design domain:

When installed correctly, the centreline of the rail will be at a height of 570 mm with the top of rail at 726 mm (subject to tolerances in and measured in accordance with technical specification MRTS 14).

When shielding an embankment, a minimum distance of 1000 mm should be provided between the face of the rail and the hinge point (consistent with std. dwg. 1474).

The area between the traffic lane and the barrier system should have a cross-fall no greater than 10H:1V. Barrier should not be installed behind kerbs and drains.

Extended design domain (scenarios requiring specific design documentation):

Adjacent pavement overlays may result in reduction in effective height. Overlays compromising effective barrier height must not result in a height to the top of the rail of less than 710 mm (~27% as recommended by FHWA). Where height is compromised, Abraham blockouts (std. dwg. 1478) may be used to lift the rail.

Placement of rail face closer to the hinge-point than 1000 mm is discussed in the Guidelines for Road Design on Brownfield Sites (section 5.1.13.1). See also RPDM 2nd Ed Vol 3 Pt 6 App. H.3.1. Designers should note that installation of non-standard length posts may require an enhanced asset inventory for purposes of maintenance/replacement.

Where posts cannot be installed due to existence of underground features (e.g., drainage, PUP) the following treatments should be considered (in order of preference):

- (i) Relocate the constraining feature and install the rail correctly.
- (ii) Modify post spacing locally (possibly requiring fabrication of bespoke lengths of rail).
- (iii) Multiple posts may be replaced by one of the footing options on std dwg 1490.
- (iv) Single posts only may be replaced by base plate option (std dwg 1478).
- (v) If a single post MUST be omitted, it is possible to delete a single post and to install a nested double rail (i.e. two w-beam rails).

Specialist advice should be sought for any direct connections or interactions with other structures.

For installations in proximity to kerbs, refer RPDM 2nd Ed Vol 3 Pt 6 6.3.5.

Deflection:Normal design domain:

Australian/New Zealand Standard AS/NZS 3845:1999 (superseded) nominates a dynamic deflection of 1.0 m under NCHRP Report 350 Test 3-11 test conditions (i.e., 2,000 kg vehicle at 100 km/h and 25 degree impact) for a system with posts spaced at 2 metre intervals. While no source for this information is known, it is similar in magnitude to equivalent testing of other semi-rigid barrier systems with similar post spacings (refer Roadside Design Guide, 4th Ed, AASHTO, 2011).

Extended design domain (scenarios requiring specific design documentation):

The standard w-beam post spacing is 2 m. Where excessive deflection would be undesirable, the distances between posts may be decreased or three-beam may be used instead. TMR gives no definitive quantitative guidance on the use of decreased post spacing in order to limit deflection. Designers should however note that decreasing post spacing is likely to increase system stiffness.

Limitations:

The use of multiple blockouts is not appropriate.

Posts should not be driven through any bound pavement layer. Refer to technical specification MRTS14.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- Road Planning and Design Manual (2nd Ed, Vol 3, Pt 6)
- Guidelines for road design on brownfield sites (2013)
- Technical Specification MRTS14
- FHWA W-Beam Guardrail Factsheet (Sep 2010)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Ezy-Guard 4

Created: Monday, 29 April 2019

12:59 PM

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Status*: Accepted

Status Commencement Date: 19-Oct-2016

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-flexible

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Ingal Civil Products
57-65 Airs Road, Minto, NSW 2566
Ph: 02 9827 3333
Fax: 02 9827 3300
www.ingalcivil.com.au

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

Ezy-Guard 4 is a proprietary W-Beam steel rail barrier system utilizing 50 x 90 x 1650 Z-section posts driven into the ground to a depth of 873mm. A slider eliminates the need for blocking pieces and stiffener backing plates.

When installed, the height to the top of the rail is nominally 787 mm.

Test Level:

Ezy-Guard 4 has been tested to:
MASH test level TL-3, and
NCHRP Report 350 test level TL-4

Recommended End Treatments:

ET 2000 Plus, Trend 350, public domain terminals. Designer to consult supplier for details of transitions to these terminals.

Design:

Product limitations, tolerances for installation, material specifications, etc. need to be furnished by the supplier.

A back-to-back variant is accepted for median use. Designer should consult supplier on how to manage connections to terminals.

Where posts cannot be installed to the required in-ground depth due to existence of underground features (e.g. drainage, PUP), posts may be replaced by base plate option. Refer to systems product manual for installation details.

Extended Design Domain:

In instances where the road surface has been overlaid or resurfaced and the rail height is no longer within tolerances, a retrofittable carriage (called Ezy-Lift) with provision for height adjustment is accepted for use. Refer to systems product manual for installation details. Ezy-Lift is not accepted on the back-to-back variant of Ezy-Guard 4. Practitioners need to ensure that the lifted configuration is such that the top of rail remains higher than the top of the Ezy-Lift carriage.

Designers to consult supplier for minimum length of barrier.

Deflection:

Measured (Crash Test) Deflections and Working Widths:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Working Width (m)
2,000 ¹	25	70	0.89	Obtain from supplier
2,270 ²	25	100	1.65	1.65
8,000 ³	15	80	1.53	Obtain from supplier

Notes:

1. NCHRP Report 350 TL-2 compliance testing on Ezy-Guard SMART system.
2. MASH TL-3 compliance testing on Ezy-Guard SMART system
3. NCHRP Report 350 TL-4 compliance testing on Ezy-Guard 4 system.

Limitations:

The preference is that the distance to the hinge point is sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document. Consult with supplier when other conditions are encountered.

References:

- NCHRP Report 350
- Manual for Assessing Safety Hardware (MASH)
- Austroads Conditions document (05 Sep 2017)
- Ingal Product Manual 08/17
- Holmes Report 102350.97-5-3A (Mar 2011)
- Holmes Report 113003.00 (Dec 2014)
- Holmes test no. 113004-310-1WB (4-Dec-2014)
- Ingal Civil Products Drawing No. EZY-SM-102

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Ezy-Guard SMART

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-flexible

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Ingal Civil Products
57-65 Airds Road, Minto, NSW 2566
Ph: 02 9827 3333
Fax: 02 9827 3300
www.ingalcivil.com.au

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

Ezy-Guard SMART is a proprietary W-Beam steel rail barrier system utilizing 50 x 90 x 1600 Z-section posts driven into the ground to a depth of 880 mm. A slider eliminates the need for blocking pieces and stiffener backing plates.

When installed, the height to the top of the rail is nominally 730 mm and the top of the post is nominally 720 mm.



Test Level:

Ezy-Guard SMART has been tested to MASH test level TL-3.

Recommended End Treatments:

MELT; DET (note limitations); ET2000 Plus. Designer to consult supplier for details of transitions to these terminals.

Design:

Product limitations, tolerances for installation, material specifications, etc. need to be furnished by the supplier.

A back-to-back variant is accepted for median use. Designer should consult supplier on how to manage connections to terminals.

Where posts cannot be installed to the required in-ground depth due to existence of underground features (e.g. drainage, PUP), posts may be replaced by base plate option. Refer to systems product manual for installation details.

Extended Design Domain:

In instances where the road surface has been overlaid or resurfaced and the rail height is no longer within tolerances, a retrofittable carriage (called Ezy-Lift) with provision for height adjustment is accepted for use. Refer to systems product manual for installation details. Ezy-Lift is not accepted on the back-to-back variant of Ezy-Guard SMART. Practitioners need to ensure that the lifted configuration is such that the top of rail remains higher than the top of the Ezy-Lift carriage.

Designers to consult supplier for minimum length of barrier.

Deflection:

Measured (Crash Test) Deflections and Working Widths:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Working Width (m)
1,100 ¹	25	100	0.99	0.99
2,000 ²	25	70	0.89	Obtain from Supplier
2,270 ¹	25	100	1.65	1.65

Notes:

1. MASH TL-3 compliance test.
2. NCHRP Report 350 TL-2 compliance test.

Limitations:

The preference is that the distance to the hinge point is sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings. MASH TL-3 capacity testing of the EzyGuard system close to the hinge point has been undertaken. Consult supplier for details.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document. Consult with supplier when other conditions are encountered.

References:

- NCHRP Report 350
- Austroads Conditions document (7-Feb-2017)
- Holmes Report 102350.97-5-3A (05 Sep 2017)
- Holmes test no. 113004-310-1WB (4-Dec-2014)(back to back)
- Ezy-Guard SMART Product Manual (Ingal, ver. 08/17)
- Ingal Civil Products Drawing no. EZY-SM-102

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Ezy-Guard High Containment

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Status*: Accepted

Status Commencement Date: NOT SET

Status Expiry Date*: NOT SET

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-flexible

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Ingal Civil Products
57-65 Airds Road, Minto, NSW 2566
Ph: 02 9827 3333
Fax: 02 9827 3300
www.ingalcivil.com.au

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

Ezy-Guard HC is a proprietary Thrie-Beam steel rail barrier system utilizing 60 x 140 x 2000 Z-section posts driven into the ground to a depth of 1020 mm. There is no blockout or stiffener plates. A slider connects the rail to the post. The slider fits down over the flanges of the line posts and is seated on the stopper plate.

When installed, the height to the top of the rail is nominally 980 mm. Posts are spaced at 2 metre centres.

The Thrie-beam rails are connected with lap joints at 4m centres, at the post location. The lap joints are oriented so as to reduce snagging in the direction of flow.

Variants Accepted:

- Back-to-back (see Design notes)
- Base plate
- Single post omission (no more than 1 in 16 posts)

Test Level:

Ezy-Guard HC has been tested to MASH test level TL-4.

Recommended End Treatments:

ET 2000 Plus, Trend 350, MELT, DET (note limitations).
Designer should consult supplier for details of transitions to these terminals.

Design:

Product limitations, tolerances for installation, material specifications, etc. need to be furnished by the supplier.

Ezy-Guard HC is not a replacement for another products, but a new product. Designers need to be satisfied that the product meets the site specific design requirements.

A back-to-back variant is accepted for median use. Designer should consult supplier on how to manage connections to terminals.

Minimum Length of Barrier:

MASH Test Level	Minimum Length (m)	Note
TL -3	44	1
TL-4	82	1

Notes:

1. Not including transitions or terminals

Deflection:

Measured (Crash Test) Deflections and Working Widths:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Working Width (m)
1,100 ¹	25	100	0.88	1.02
2,270 ¹	25	100	1.16	1.16
10,000 ¹	15	90	1.77	2.46

Notes:

1. MASH TL-4 compliance test.

Limitations:

The preference is that the distance to the hinge point is sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document. Consult with supplier when other conditions are encountered.

References:

- MASH (AASHTO, 2009)
- HSNZ Report 131395 (Oct 2016)
- Austroads conditions document (30 May 2017)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

RAMSHIELD W-Beam Guardrail Barrier

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date:

Status Expiry Date*:

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Steel

Gating/Non-Gating:

Not Applicable

Redirective/Non-Redirective:

Redirective

Permanent/Temporary:

Permanent

Ownership:

Safe Direction
Unit 2
5 Simpson Close
Smeaton Grange NSW 2567
Ph. 1300 063 220

Supplier:

Safe Direction
Unit 2, 5 Simpson Close
Smeaton Grange NSW 2567
Ph. 1300 063 220
www.safedirection.com.au



Introduction:

RAMSHIELD is a proprietary W-Beam steel rail barrier system utilising 70 x 100 x 1560mm C-posts driven into the ground to a depth of 880mm. Height to top of the W-Beam rail is 730mm. A release tab incorporated into the post is designed to pull forward and release the rail during impact providing vehicle containment and redirection. The system does not require blocking pieces or stiffener backing plates. RAMSHIELD has been evaluated for bi-directional impacts.

RAMSHIELD uses standard W-Beam steel rail elements and standard fasteners. Posts are spaced at 2 metre centres.



Test Level:

RAMSHIELD has been tested to MASH Test Level 3.

Recommended End Treatments:

SKT-SP, FLEAT-SP, Public domain terminals (MELT / DET).
Designer to consult supplier for details of transitions to these terminals.

Design:

Product limitations, tolerances for installation, material specifications, etc. need to be furnished by the supplier.

RAMSHIELD is not a replacement for other products, but a new product. Designers need to be satisfied that the product meets the site specific design requirements.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Notes
2,270	25	100	1.57	1
1,100	25	100	0.78	1
1,700	25	110	1.50	2
1,100	25	100	0.88	3

Notes

1. Holmes Report 113005.00.WB dt. 9-Mar-2015
2. Holmes Report 113187.00WBVD0.1 dt. Apr 2015. It is noted that this test was conducted near to a 2:1 V-ditch (200mm to back of post).
3. Holmes Report 114268.00 dt. Oct 2015. It is noted that this is a reverse direction impact.

Limitations:

The preference is that the distance to the hinge point is sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings. Some testing of the Ramshield system installed close to the hinge point has been undertaken. Consult supplier for details.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document.

References:

- AS/NZS 3845
- MASH (AASHTO, 2009).
- TMR Road Planning and Design Manual.
- Austroads recommended acceptance conditions document dt. 10-Dec-2015.
- Safe Direction Product Manual ref. PM 003/02.
- Safe Direction Installation and Maintenance Manual ref. IM 003/02.
- Holmes Report 113005.00.WB dt. 9-Mar-2015.
- Holmes Report 113187.00WBVD0.1 dt. Apr 2015.
- Holmes Report 114268.00 dt. Oct 2015.

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Sentry W Beam

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: NOT SET

Status Expiry Date*: NOT SET

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-flexible

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au

Supplier:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au



Introduction:

Sentry W Beam is a proprietary w-beam steel rail barrier system utilizing 72 x 115 x 1640 mm C-posts driven into the ground to a depth of 850mm.

The post has a rectangular slot to allow the nut and washer connected to the rail to slide vertically during impact. The collapsing washer release mechanism assists in releasing of rails from the post when impacted.

When installed, the height to the top of the w-beam rail is nominally 800 mm. Posts are spaced at 2 metre centres.



Test Level:

Sentry W beam has been tested to MASH test level TL-3.

Recommended End Treatments:

X-350, MELT, DET (note limitations).

Design:

Product limitations, tolerances for installation, material specifications, etc. need to be furnished by the supplier.

A back-to-back variant is accepted for median use. Designer should consult supplier on how to manage connections to terminals.

Designers to consult supplier for minimum length of barrier.

Deflection:

Measured (Crash Test) Deflections and Working Widths:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Working Width (m)
1,100 ¹	25	100	1.02	1.02
2,270 ¹	25	100	1.59	1.59

Notes:

1. MASH TL-3 compliance test on Sentry W Beam System.

Limitations:

Placement of the system on ground with slope steeper than 10H: 1V is undesirable and would be regarded as a departure from the Normal Design Domain.

The distance to the hinge point is preferred to be sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document. Consult with supplier when other conditions are encountered.

References:

- MASH (AASHTO, 2009)
- Holmes Solutions Report 113770 v1.3 (Sep 2016)
- Austroads conditions document (30 May 2017)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

BRIFEN 4-rope TL-4

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Flexible

Main Material: Wire Rope

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

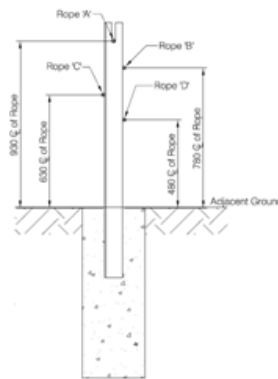
Permanent/Temporary: Permanent

Ownership:

Hill and Smith Pty Ltd
1/242 New Cleveland Rd Tingalpa. Q 4173
PO Box 9406 Wynnum Plaza, Wynnum West. Q 4178
Phone 1300 277 683
www.hillandsmith.com.au

Supplier:

Hill and Smith Pty Ltd
1/242 New Cleveland Rd Tingalpa. Q 4173
PO Box 9406 Wynnum Plaza, Wynnum West. Q 4178
Phone 1300 277 683
www.hillandsmith.com.au



Introduction:

Brifen wire rope (4-wire TL-4) is a proprietary flexible barrier system comprising four 19mm wire rope cables supported on a post. Wire rope cable heights are 480mm, 630mm, 780mm and 930mm, the lowest three of which are woven from side to side around alternate posts. Posts are 1430mm long and are supported in a concrete footing, and are "Z" or "S" shaped to suit the direction of traffic. Traffic should pass to the right side of a "Z" post and to the left side of an "S" post. Nominal post spacing is 3.2m.

Test Level:

NCHRP350 TL4

Recommended End Treatments:

BRIFEN End Anchor TL-3

Design:

Designers should consult with the supplier, particularly for configurations other than tested, to determine/verify the:

1. system length and post spacing and their effect on system deflection (and risk of vehicular penetration), and
2. minimum allowable length
3. maximum allowable length between end or intermediate anchors (as wire rope safety barriers may lose capability after an impact, it is recommended that the length of wire rope barrier installations do not exceed 1000m between end or intermediate anchors), and
4. product limitations, tolerances for installation, material specifications, etc.

Designers may consider the effect of site specific temperature fluctuation on wire rope tension (and hence deflection). Note that the system nominal tension is 22.25kN while the tested TL-4 rope tension was 28kN. Note also that the reported TL-3 deflection was on a 60 m test article.

Note that the supplier may provide deflection information to support wider post spacing. Designers are urged to give consideration to the likely change in deflection when considering post spacing that differs from the nominal post spacing.

Terminal:

The TL-3 terminal configuration is accepted by TMR. The TL-4 terminal configuration has not been assessed by TMR.

Practitioners should be aware of the correct configuration of the end terminal which comprises among other things, an anchor block, an angled post (post 1) and a finger plate. Upon a reverse impact, the cables are designed to uncouple. A "safety check" rope connected to the anchor is intended to restrain the movement of the released rope if impacted.

Anchors shall be designed to suit site specific conditions. Refer section 3.3 of this document.

The system is deemed to be redirective 9.6m from the anchor point.

Deflection:

Measured (crash test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
820	20	100	1.35	1
2,000	25	100	2.5	2
8,000	15	80	2.21	3

Notes (refer table below for test configuration):

Note	Test Length (m)	Post Spacing (m)	Test Tension (kN)
NCHRP350 4-10 MIRA-04-1008159	275	3.2	28
NCHRP350 4-11 SWRI 18.15611.01.100.FR1	60	6.4	-
NCHRP350 4-12 MIRA-04-1007578	275	3.2	28

Limitations:

The preference is that the distance to the hinge point is sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings. The supplier has made representations that the Brifen TL-4 system has been tested for hinge point applications both near and far side of a 'V' median installation. Consult supplier for details.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document.

The system is tested with posts installed in galvanised steel post sockets in concrete footings. Driven posts are not accepted.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- MIRA test report ref. MIRA-04-1008159 (Feb 2005)
- SWRI test report ref. 18.15611.01.100.FR1 (May 2010)
- MIRA test report ref. MIRA-04-1007578 (Feb 2005)
- MIRA test report ref. MIRA-05-1009967 (Aug 2005)
- MIRA test report ref. MIRA-05-1009968 (Aug 2005)
- Guidelines for Road Design on Brownfield Sites (TMR, Jul 2013)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Flexfence 4-rope

TL-4 (& TL-3) variants

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Apr 2014

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Flexible

Main Material: Wire Rope

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

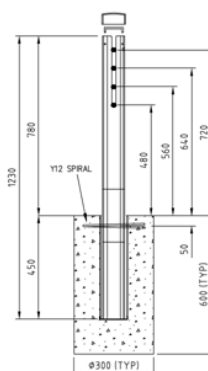
Permanent/Temporary: Permanent

Ownership:

Ingal Civil Products
57-65 Airds Road, Minto, NSW 2566
Ph: 02 9827 3333
Fax: 02 9827 3300
www.ingalcivil.com.au

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

Flexfence is a proprietary flexible barrier system comprising four 19 mm wire rope cables supported on a slotted post. Wire rope cable heights are 480 mm, 560 mm, 640 mm and 720 mm. Posts are 1230 mm long sigma-shaped (Σ) posts and are set into 600 mm deep x 300 mm diameter concrete footings. Each post also comprises a stiffening plate at ground level, and a rope hook.

Nominal post spacing is 2.5 m.

Nominal rope tension is 25 kN.

Note that a TL-3 configuration also exists, which differs from the TL-4 system by omission of the ground level stiffening plate and rope hook. The TL-3 system is nominally tensioned to 15 kN.

Variants Accepted:

- Flexfence Driven Sleeve

Test Level:

NCHRP350 TL-4

Designers should note that a TL-3 variant does exist and may be specified for use on state-controlled roads. The data provided in this design sheet pertains to the TL-4 tested system.

Recommended End Treatments:

Flexfence End Anchor TL-3

Design:

Designers should consult with the supplier, particularly for configurations other than tested, to determine/verify the:

1. system length and post spacing and their effect on system deflection (and risk of vehicular penetration), and
2. minimum allowable length, and
3. maximum allowable length between end or intermediate anchors (as wire rope safety barriers may lose capability after an impact, it is recommended that the length of wire rope barrier installations do not exceed 1000m between end or intermediate anchors), and
4. product limitations, tolerances for installation, material specifications, etc.

Designers may consider the effect of site specific temperature fluctuation on wire rope tension (and hence deflection). Note that the system nominal tension is 25 kN. The TL-3 deflection was recorded on a 121 m long test article.

Note that the supplier *may* provide deflection information to support wider post spacing. Designers are urged to give consideration to the likely change in deflection when considering post spacing that differs from the nominal post spacing.

Terminal:

Designers should be aware that more than one end treatment configuration exists. The accepted (NCHRP350 tested) end treatment configuration comprises a tapering height from ground level to full height over 11 posts. This terminal shall be used on State Controlled Roads in Queensland.

The terminal is sometimes described as a non-release terminal. A “safety check” rope connected to the anchor to restrain the movement of the released rope if impacted is not mandated for this system, but may be supplied if specified.

Anchors shall be designed to suit site specific conditions. Refer section 3.3 of this document.

The system is deemed to be redirective 12.6m from the anchor point.

Deflection:

Measured (Crash Test) Deflections:

TL-4 configuration

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Notes
820	20	100	1.28	1
2,000	25	100	1.41	2,4
8,000	15	80	1.21	3

Notes	Test Length (m)	Post Spacing (m)	Test Tension (kN)
1 = NCHRP 350 4-10	121	2.5	25
2 = NCHRP 350 4-11	121	2.5	25
3 = NCHRP 350 4-12	85	2.5	25
4	Test deflection is recorded as 1.41m. However 1.90m should be adopted to allow for working width/vehicle overhang.		

TL-3 configuration

Contact supplier for test deflections derived from crash testing of test level TL-3 configuration. Refer to the following:

- Flexfence Product Manual Release 004
- VTI Test Report ref. 56379
- VTI Test Report ref. 56419
- VTI Test Report ref. 56592

Limitations:

The preference is that the distance to the hinge point is sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings. To the knowledge of this department, there has not been any testing of the Flexfence systems when installed on or in close proximity to the hinge point.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document.

The system is tested with posts installed in post sockets in concrete footings. Driven posts are not accepted.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Flexfence Product Manual Release 02/14
- Holmes Test Report 102350.12-1-2 (Nov 2010)
- Holmes Test Report 102350.12-1-1 (Nov 2010)
- Holmes Test Report 102350.97-8-4-12 (Dec 2011)
- Guidelines for Road Design on Brownfield Sites (TMR, Jul 2013)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

SENTRYLINE II 4-rope TL-4

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

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Category: Longitudinal

Sub Category: Flexible

Main Material: Wire Rope

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

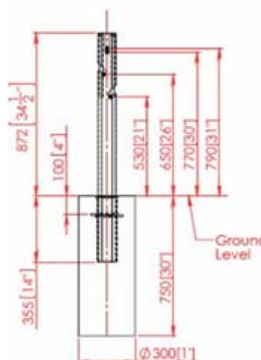
Permanent/Temporary: Permanent

Ownership:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au

Supplier:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au



Introduction:

Sentryline II (4-wire TL-4) is a proprietary flexible barrier system comprising four 19mm wire rope cables supported in notches in flat-sided hollow, oval section posts with two ropes placed in a central slot. Cable heights are 530mm, 650mm, 770mm and 790mm. Nominal cable tension is 25kN.

Note that despite what is depicted, posts should be white unless specified otherwise.

Practitioners should note that this system has two terminal options.

Test Level:

NCHRP Report 350 TL-4

Recommended End Treatments:

Two options:

SENTRYLINE II End Anchor TL-3

SENTRYLINE Terminal End III TL-3

Design:

Designers should consult with the supplier, particularly for configurations other than tested, to determine/verify the:

1. system length and post spacing and their effect on system deflection (and risk of vehicular penetration), and
2. minimum allowable length, and
3. maximum allowable length between end or intermediate anchors (as wire rope safety barriers may lose capability after an impact, it is recommended that the length of wire rope barrier installations do not exceed 1000m between end or intermediate anchors), and
4. product limitations, tolerances for installation, material specifications, etc.

Designers may consider the effect of site specific temperature fluctuation on wire rope tension (and hence deflection). Note that the system nominal tension is 25 kN. The TL-3 deflection was recorded on a 130 m long test article.

Note that the supplier may provide deflection information to support wider post spacing. Designers are urged to give consideration to the likely change in deflection when considering post spacing that differs from the nominal post spacing.

Terminal:

Designers should be aware that more than one end treatment configuration exists. Both are accepted for use on state-controlled roads in Queensland, so the designer must specify which terminal is required.

The Sentryline II terminal is a “releasing” terminal, is designed to release on impact and DOES NOT employ the use of a safety check rope. The system is deemed to be redirective 8.0 m from the anchor point.

The Sentryline III terminal is described as a non-releasing terminal. A “safety check” rope connected to the anchor to restrain the movement of the released rope if impacted is not mandated for this system, but may be supplied if specified. The system is deemed to be redirective 8.0 m from the anchor point.

Anchors shall be designed to suit site specific conditions. Refer section 3.3 of this document.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
820	20	100	1.28	1
2000	25	100	1.54	2
8,000	15	80	1.65	3,4

Notes	Test Length (m)	Post Spacing (m)	Test Tension (kN)
1. NCHRP350 4-10 102350.02-6 (Feb 2010)	120	3.0	-
2. NCHRP350 4-11 102350.02-6-311 (Aug 2009)	130	3.0	25
3. NCHRP350 4-12 102350.02-6-412 (Aug 2009)	130	3.0	25
4. Test vehicle impacted twice. First impact deflected 1.1m, 2nd impact deflected 1.65m.			

Limitations:

The preference is that the distance to the hinge point is sufficient to accommodate the design deflection. Placement of systems close to the hinge-point is discussed in the Guidelines for Road Design on Brownfield Sites document (section 5.1.13.1). Issues to consider are barrier performance (vehicle stability) and integrity of footings. Designer should seek advice from supplier regarding any testing of the Sentryline system when installed on or in close proximity to the hinge point.

All compliance testing is conducted in AASHTO standard soil. Refer to section 3.3 of this document.

The system is tested with posts installed in post sockets in concrete footings. Driven posts are not accepted.

Practitioners should be aware that there are two methods of connecting sections of wire rope. The accepted method is a fully swaged coupling. The spring-loaded coupling is not accepted for new installations.

References:

- AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Sentryline II Product and Installation Manual (ACP, Dec 2016)
- Sentryline II Terminal Manual (ACP, Jun 2016)
- Sentryline Terminal End III Manual (ACP, Feb 2017)
- Holmes Report ref. 102350.02-6 (Feb 2010)
- Holmes Report ref. 102350.02-6-311 (Aug 2009)
- Holmes Report ref. 102350.02-6-412 (Aug 2009)
- Guidelines for Road Design on Brownfield Sites (TMR, Jul 2013)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

MELT

TMR Std. Dwg. 1474

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Ownership:

Public Domain

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

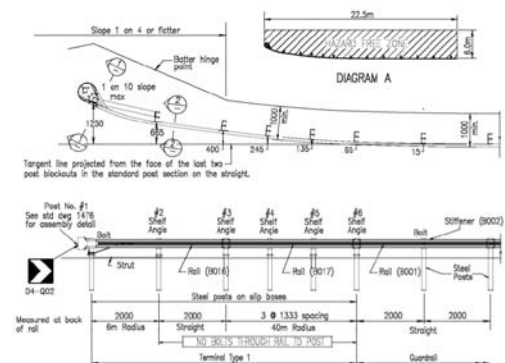
Non-Redirective

Permanent/Temporary:

Permanent

Supplier:

Various



Introduction:

The Modified Eccentric Loader Terminal (MELT) is a gating end terminal with a W-Beam profile which is installed with a parabolic flare on six slip-base posts. Redirection begins at the 3rd post from the approach end.

Test Level:

Deemed to meet NCHRP Report 350 TL3.

Recommended End Treatments:

Not Applicable.

Design:

- Design should be in accordance with TMR Standard Drawing no. 1474.
- Installation should be in accordance with TMR Standard Drawing no. 1474 and TMR Technical Specification MRTS14.
- As the end treatment is gating a run-out area in accordance with the requirements of AS/NZS 3845 Figure F11 should be provided.
- With regard to requirements for slip base post installation, refer to TMR Technical Specification MRTS14 cl. 20.6.3.

Deflection:

No information entered.

Limitations:

- Cannot be used on crossfalls steeper than 8%.
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- TMR Technical Specification MRTS14
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Departure End Terminal (DET)

TMR Std. Dwg. 1474

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Ownership:

Public Domain

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Supplier:

Various



Introduction:

Refer to Austroads Guide to Road Design Part 6, Section J.1.3.

The Departure End Terminal is a trailing terminal providing anchorage for w-beam longitudinal barrier installations. This terminal is not 'crashworthy' when impacted on the free end and thus must not be used when there is a practical chance of being impacted from opposing traffic. This situation will normally only occur on one way roads or on divided roads with a median barrier.

Test Level:

To be used with w-beam longitudinal barrier.

Recommended End Treatments:

Not Applicable.

Departure End Terminal (DET)

Page 2 of 2

Design:

W-beam with a DET is redirective up to the penultimate post
(Source: Austroads to Road Design Part 6).

Deflection:

Not applicable.

Limitations:

One way traffic departure end treatments are to be used on safety barriers only when there is no possibility of opposing traffic impacting them.

Designers/installers are referred especially to TMR Technical Specification MRTS14 cl. 20.6.3.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- TMR Specification MRTS14

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

"ACP" MELT

X350 Post System

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

Category: End Treatment

Gating/Non-Gating: Gating

Sub Category: Terminal

Redirective/Non-Redirective: Non-Redirective

Main Material: Steel

Permanent/Temporary: Permanent

Ownership:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au

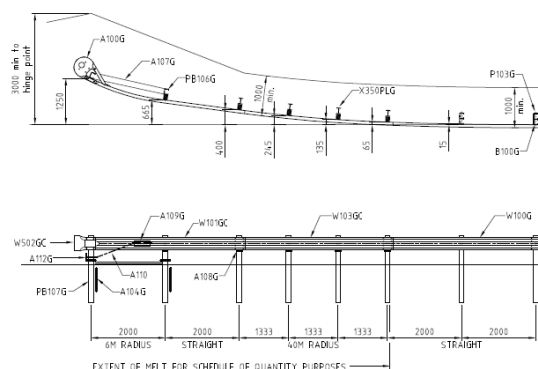
Supplier:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au



Introduction:

The ACP MELT (X350 Post System) is a proprietary flared gating W-beam profile guardrail terminal end treatment, comprising a combination of slip-base and yielding posts (SYT).



Test Level:

Deemed compliant with NCHRP 350 Test Level 3

Recommended End Treatments:

Not Applicable.

Design:

- Design and Installation to be in accordance with the ACP MELT Product Manual.
- Posts 1 and 2 are slip base posts as per Main Roads' Std. Dwg. 1474.
- Posts 3 to 6 are X350 Posts.
- As the end treatment is gating a run-out area in accordance with the requirements of AS / NZS 3845 Figure F11 should be provided.
- A "departure end" variant of this product does exist.

Deflection:

Not applicable.

Limitations:

- Cannot be used on crossfalls steeper than 8%.
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

"INGAL" MELT

SYT Post System

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Gating/Non-Gating:

Gating

Redirecive/Non-Redirecive:

Non-Redirecive

Permanent/Temporary:

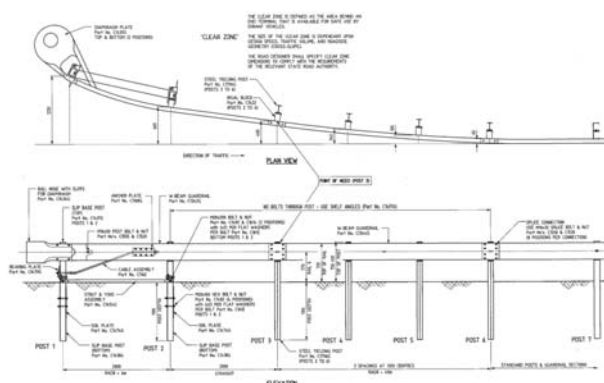
Permanent

Ownership:

Ingal Civil Products
57-65 Airs Road, Minto, NSW 2566
Ph: 02 9827 3333
Fax: 02 9827 3300
www.ingalcivil.com.au

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

The Ingal MELT (SYT Post System) is a proprietary flared gating W-beam profile guardrail terminal end treatment, comprising a combination of slip-base and yielding posts (SYT).

Test Level:

Deemed compliant with NCHRP 350 Test Level 3

Recommended End Treatments:

Not Applicable.

Design:

- Design and Installation to be in accordance with the Ingal Product Manual. Drawings CAB-STD-74 and CAB-STD-75 apply.
- As the end treatment is gating a run-out area in accordance with the requirements of AS / NZS 3845 Figure F11 should be provided.

Deflection:

Not applicable.

Limitations:

- Cannot be used on crossfalls steeper than 8%.
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

ET2000 Plus

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Ownership:

Trinity Industries

USA

www.highwayguardrail.com

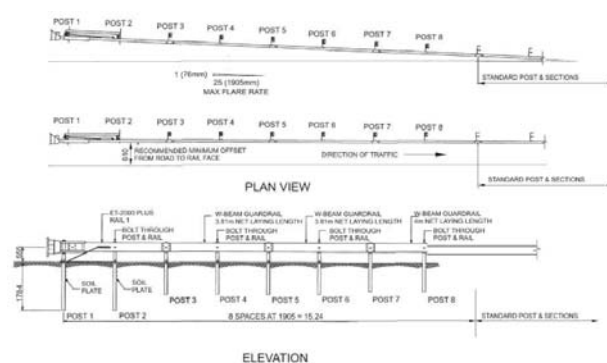
Supplier:

Ingal Civil Products

7 Nestor Drive, Meadowbrook QLD 4131

Ph: 3489 9120 Fax: 3489 9130

www.ingalcivil.com.au



Introduction:

The ET2000 Plus is an extruder-head gating end treatment with a W-Beam profile. When hit end on, the impact head is forced along the W-beam extruding the beam onto the verge side.

Test Level:

Tested to NCHRP Report 350 TL-2 and TL-3.

Recommended End Treatments:

Not Applicable.

Design:

- Design to be in accordance with the ET2000 Plus Design Manual provided by Ingal and in accordance with provisions of TMR Road Planning and Design Manual.
- Preferred plan layout is to install the terminal at a flare (25:1).
- In locations of constrained width or on high embankments where the cost to provide additional width is not warranted then the terminal may be installed parallel to the edge of the roadway.
- Consideration should be given to the risk especially to vulnerable road users as a result of the impact head intruding beyond the face of the barrier. Also see “motorcyclist protection” below.
- As the end terminal is gating, a run-out area in accordance with the requirements of AS/NZS 3845 Figure F11 should be provided.
- Length of need (L.O.N.) commences at 3rd post measured from the head of the system.

Installation & Repair

- Installation and repair to be in accordance with the ET2000 Plus Design Manual provided by Ingal.

Test Level:

- Tested in accordance with NCHRP Report 350 to Test Level 3 (TL-3) and Test Level 2 (TL-2).

Configuration:

- First post is a Hinged Breakaway (HBA) Post with the remaining posts being Steel Yielding Terminal (SYT) Posts
- Polymer offset blockouts are used.

Test Level (TL)	Length (m)
2	7.62
3	15.24

Motorcyclist Protection

The device may be deployed with plastic cover components for the head of the device when there is a relatively higher risk of motorcyclist impact, for example, roads that carry large numbers of motorcyclists or where there is evidence to suggest a higher potential for motorcycle related incidents. Accepted variants:

- Motorcyclist Protection Shield
- Head Cover

Deflection:

Information has not been entered.

Limitations:

- Maximum flare is 25:1.
- Cannot be used on crossfalls steeper than 8%.
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Ingal Civil Products ET2000 Plus Product Manual (08/14)
- FHWA memo ref. HSST dated 17-Jun-2014
- Austroads acceptance document dated 8-Jan-2016
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

FLEAT-SP

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Ownership:

Road Systems

Texas. USA

www.roadsystems.com

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Supplier:

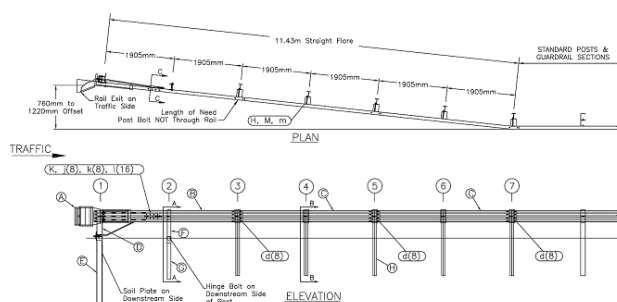
Safe Direction

Unit 2, 5 Simpson Close

Smeaton Grange NSW 2567

Ph. 1300 063 220

www.safedirection.com.au



Introduction:

The FLEAT is an extruder gating end treatment. When hit end on the impact head is forced along the W-beam extruding the beam onto the same side as the traffic.

Test Level:

Both variants satisfy the requirements of NCHRP Report 350 TL-2 and TL-3.

Variant	Acceptance
FLEAT-350	Out of Production May remain in use on State-controlled roads to be replaced at the end of service life.
FLEAT-SP	Current May be used on State-controlled road projects.

Recommended End Treatments:

Not Applicable.

Design:

- Design to be in accordance with the FLEAT-SP Design Manual provided by Safe Direction and in accordance with provisions of TMR Road Planning and Design Manual.
- Must be installed on a flare (straight taper).
- The flare of the terminal can be varied to suit site constraints.
- Consideration should be given to the risk especially to vulnerable road users as a result of the impact head intruding beyond the face of the barrier.
- As the end terminal is gating, a run-out area in accordance with the requirements of AS/NZS 3845 Figure F11 should be provided.
- Length of need (L.O.N.) commences at 3rd post measured from the head of the system.
- Designers should note that when impacted the FLEAT-SP extrudes rail onto the “traffic side” of the longitudinal barrier.

Installation & Repair

- Installation and repair to be in accordance with the FLEAT-SP Installation & Repair Manual provided by Safe Direction.

Test Level:

- Tested in accordance with NCHRP 350 to Test Level 3 (TL-3) and Test Level 2 (TL-2).

Configuration:

- The terminal features an anchor post at post location 1 and hinged breakaway post at post location 2. The remaining posts are steel line posts (I-beam) as specified in FHWA Letter CC-88B.
- Polymer offset blockouts are used instead of timber blockouts.

Test Level (TL)	Length (m)	Allowable Flare (m)
2	7.62	510 – 810mm
3	11.43	760 – 1220mm

Deflection:

Not applicable.

Limitations:

- Must be installed on a flare (straight taper). Shall not be used in situation where there is less than 2.9m between the impact head and the nearest edge of traffic lane.
- Cannot be used on crossfalls steeper than 8%.
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- FHWA letters ref. CC-46, CC-61 and CC-88 (various suffices)
- Safe Direction Product Manual ref. PM 018/02
- Safe Direction Installation and Repair Manual IM 002/02
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

SKT-SP

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Ownership:

Road Systems

Texas, USA

www.roadsystems.com

Supplier:

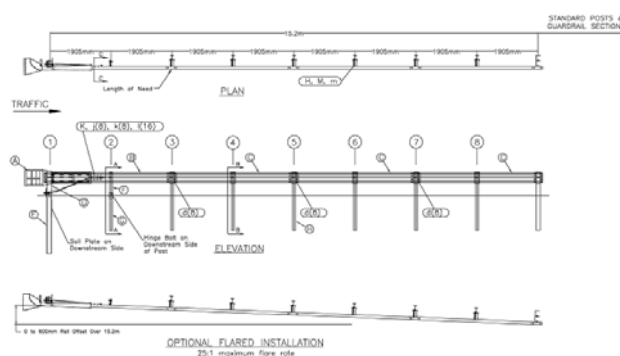
Safe Direction

Unit 2, 5 Simpson Close

Smeaton Grange NSW 2567

Ph. 1300 063 220

www.safedirection.com.au



Introduction:

The Sequential Kinking Terminal (SKT) is an extruder an extruder gating end treatment. When hit end on the impact head is forced along the W-beam extruding the beam onto the rear of the barrier.

Test Level:

Both variants satisfy the requirements of NCHRP Report 350 TL-2 and TL-3.

Variant	Acceptance
SKT-350	Out of Production May remain in use on State-controlled roads to be replaced at the end of service life.
SKT-SP	Current May be used on State-controlled road projects.

Recommended End Treatments:

Not Applicable.

Design:

- Design to be in accordance with the SKT-SP Design Manual provided by Safe Direction and in accordance with provisions of TMR Road Planning and Design Manual.
- Preferred plan layout is to install the terminal at a flare of 25:1 (straight taper).
- In locations of constrained width or on high embankments where the cost to provide additional width is not warranted then the terminal may be installed parallel to the edge of the roadway.
- Consideration should be given to the risk especially to vulnerable road users as a result of the impact head intruding beyond the face of the barrier.
- As the end terminal is gating, a run-out area in accordance with the requirements of AS/NZS 3845 Figure F11 should be provided.
- Length of need (L.O.N.) commences at 3rd post measured from the head of the system.

Installation & Repair

- Installation and repair to be in accordance with the SKT-SP Installation & Repair Manual provided by Safe Direction.

Test Level:

- Tested in accordance with NCHRP Report 350 to Test Level 3 (TL-3) and Test Level 2 (TL-2).

Configuration:

- The terminal features an anchor post at post location 1 and hinged breakaway post at post location 2. The remaining posts are steel line posts (I-beam) as specified in FHWA Letter CC-88B.
- Polymer offset blockouts are used instead of timber blockouts.

Test Level (TL)	Length (m)	Allowable Flare (m)
2	7.62	0 – 300mm
3	15.24	0 – 600mm

Deflection:

Not applicable.

Limitations:

- Maximum flare is 25:1.
- Cannot be used on crossfalls steeper than 8%.
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- FHWA letters ref. CC-46, CC-61 and CC-88 (various suffices)
- Safe Direction Product Manual ref. PM 017/02
- Safe Direction Installation and Repair Manual IM 002/02
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

MSKT

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Ownership:

Road Systems Inc
3616 Howard County Airport
Big Spring, Texas, USA
www.roadsystems.com

Supplier:

Safe Direction
Unit 2, 5 Simpson Close
Smeaton Grange NSW 2567
Ph. 1300 063 220
www.safedirection.com.au



Introduction:

The MASH Sequential Kinking Terminal (MSKT) is an extruder gating end treatment. When hit end on the impact head is forced along the W-beam extruding the beam onto the rear of the barrier.

Test Level:

MASH TL-3

Recommended End Treatments:

Not applicable.

Design:

- Design to be in accordance with the MSKT Design Manual provided by Safe Direction.
- Preferred plan layout is to install the terminal at a flare of 25:1 (straight taper).
- In locations of constrained width or on high embankments where the cost to provide additional width is not warranted then the terminal may be installed parallel to the edge of the roadway.
- Consideration should be given to the risk especially to vulnerable road users as a result of the impact head intruding beyond the face of the barrier.
- As the end terminal is gating, a hazard free zone behind the terminal should be provided.
- Length of need (L.O.N.) commences at 3rd post measured from the head of the system.

Height Transitions

- The rail height in the MSKT is 790mm. Transition to longitudinal w-beam systems of different heights shall be at least 8m long.

Test Level (TL)	Length (m)	Allowable Flare (m)
2	9.52	0 – 300mm
3	14.29	0 – 600mm

Deflection:

Not applicable.

Limitations:

- Maximum flare is 25:1.
- Cannot be used on crossfalls steeper than 10%.
- Installing in proximity to kerbs is not recommended.

References:

- Australian Standard AS/NZS 3845
- QTMR RPDm 2nd Edition Volume 3 Part 6
- SafeDirection letter dated 18-Dec-2018
- MSKT Product Manual – Safe Direction; Ref: PM022/01

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

TREND-350

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Jul 2015

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Ownership:

Trinity Industries

USA

www.highwayguardrail.com

Supplier:

Ingal Civil Products

7 Nestor Drive, Meadowbrook QLD 4131

Ph: 3489 9120 Fax: 3489 9130

www.ingalcivil.com.au



Introduction:

The TREND-350 is a tangential gating end-treatment for w-beam guardrail. It has met the requirements of NCHRP Report 350 test level TL-3.

The length of effective barrier commences at Post 3, 4.25 metres "downstream" of the impact head.

The device is 11.9m long overall.



Test Level:

Tested in accordance with NCHRP 350 to TL-3.

Recommended End Treatments:

Not Applicable.

Design:

- Design to be in accordance with the TREND-350 Design Manual (Nov 2014) provided by Ingal Civil Products and in accordance with provisions of TMR Road Planning and Design Manual.
- Consideration should be given to the risk especially to vulnerable road users as a result of the impact head intruding beyond the face of the barrier.
- As the end terminal is gating, a run-out area in accordance with the requirements of AS/NZS 3845 Figure F11 should be provided.
- Length of need (L.O.N.) commences at 3rd post measured from the head of the system.

Installation & Repair

- Installation and repair to be in accordance with advice from Ingal Civil Products.

Test Level:

- Tested in accordance with NCHRP Report 350 to Test Level 3 (TL-3).

Configuration:

- First post is a Hinged Breakaway (HBA) Post with post #2 being a Steel Yielding Terminal (SYT) Post. See p19 of Manual.
- Posts 3-7 are W6x8.5 Line Posts.
- System length 11.9m
- Installation has been assessed and accepted on the basis that it is installed tangential/parallel (i.e., without a flare).

Deflection:

Information has not been entered.

Limitations:

- Cannot be used on crossfalls steeper than 10%.
- 2.7 metres minimum distance between post and the edge of an excavation.
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Austroads acceptance document (11-Mar-2015)
- Trend 350 Tangent Manual (Issue Nov 14)
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

X-Tension 350

Also identified as X350.

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

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Category: End Treatment

Sub Category: Terminal

Main Material: Steel

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Ownership:

Amorflex

<http://www.armorflex.co.nz/>

Supplier:

Australian Construction Products (ACP)

339 Horsley Road, Milperra, NSW 2214

Ph. 1800 724 172

www.acprod.com.au



Introduction:

The X-Tension is a gating end-treatment whose length of need commences 600mm "downstream" of the first post. There is a single-sided version and a double-sided median version of this product.

Useful Product Data:

Overall physical length of system	13.0 m
Width (single-sided variant)	0.48 m
Width (double-sided variant)	0.76 m
Height	710 mm
Maximum flare	1200 mm

Test Level:

Tested in accordance with NCHRP 350 to TL-3.

Recommended End Treatments:

Not Applicable.

Design:

- The full length of the terminal 600mm “downstream” of post 1 may be placed inside the length of need for the hazard being protected.
- A hazard free zone in accordance with the requirements of AS3845 Figure F11 is required.
- The X-Tension must be installed and maintained in accordance with the product installation/ maintenance manual.

Offset from Trafficked Lane

- Straight and flared variants of this product exist.
- The flared variant can accommodate a straight flare of 1200mm over its full length.
- The designer should also note the requirements of RPDM Table 8.12 with regard to flare rate.
- The head assembly is proud of the face of the rail. If the system is installed parallel to the road the barrier should be offset to ensure the head assembly is clear of the shoulder. This applies especially where the device is used as a departure treatment.

Interaction with Kerbs

- Refer RPDM 8.2.2.2 for installations in proximity to kerbing.

Installation

- Wire rope components shall be pre-stretched, have a minimum galvanizing coating of 400g/m² and have documentation identifying the source of supply.
- Yellow “nose cone” cowling is NOT optional and is to be used in all installations of this product.

Maintenance

- Units may need to be repaired or replaced after impact depending on the extent of damage. Product is to be installed and repaired after impact in accordance with manufacturer’s specifications and guidelines.

Deflection:

Information has not been entered.

Limitations:

- Maximum longitudinal and cross-sectional slope of 15H:1 (7%).
- Installing in proximity to kerbs is not recommended. Consult Austroads Guide to Road Design Part 6/6.3.22.

References:

- AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- ACP Installation Manual (Dec 2015)
- Guide to Road Design Part 6 (Austroads, 2009)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

QUADGUARD

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Attenuator

Main Material: Steel

Gating/Non-Gating:

Non-Gating

Redirecive/Non-Redirecive:

Redirecive

Permanent/Temporary:

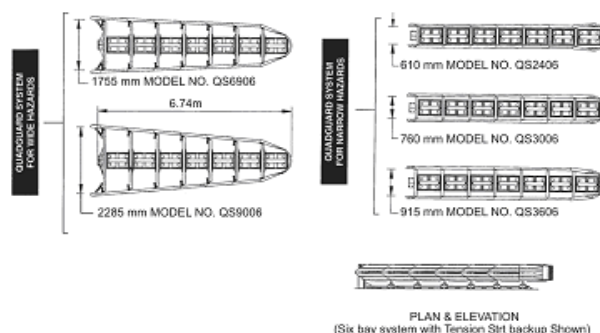
Permanent or Temporary

Ownership:

Energy Absorption Systems
Chicago, Illinois
www.energyabsorption.com

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

The Quadguard is a redirecive, non-gating crash attenuator suitable for shielding hazards ranging in width from 610 mm to 2,285 mm. It employs crushable cartridges to absorb the energy of impact.

This product may be used as a permanent installation or can be installed in a construction zone configuration (for details refer Quadguard Product Manual).

The family includes:

- Quadguard/Quadguard Wide
- Quadguard CZ (construction zone)

Practitioners should note that the Quadguard system is a different device to the Quadguard High Speed (HS) and Quadguard Elite devices.

Test Level:

Tested to NCHRP350 test levels TL-2 and TL-3.

Practitioners may note that a nine-bay configuration of **regular** Quadguard has been tested to ~117 km/h with a 2,000 kg vehicle (FHWA letter HSA-1/CC35D dated 13 October 2000). The FHWA letter states: "...we conclude that the nine-bay Quadguard, as tested, remains an acceptable TL-3 crash cushion, but one which has additional capacity for some impacts at higher speeds with vehicles in the 2000-kg weight range and higher. We also agree with your conclusion that the longer unit will not likely satisfy all vehicle trajectory or occupant injury criteria when struck at the higher speed with the smaller 820-kg (1800-pound) car...".

Quadguard High Speed (HS) is a different product.

Recommended End Treatments:

Not applicable.

Design:

Design to be in accordance with the relevant Quadguard Product Manual provided by the supplier.

Quadguard uses two types of crushable cartridge (Types I and II).

System is available in various widths up to 2,285 mm.

Designer to specify the number of bays and system width as appropriate for the impacts to be managed and the hazard to be shielded.

In situations where traffic may approach the system in the reverse direction the appropriate transition arrangement should be specified by the designer.

Design should provide for accommodation of any movement of side panels and other moving parts during impact.

Designer should nominate required nose-markings.

Deflection:

Not applicable.

Limitations:

Should not be used on crossfalls steeper than 8%.

Elevated kerbs, islands, drainage structures or any other item that can affect the height at which a vehicle could impact the unit should not be placed in advance of the unit or along the length of the unit.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- FHWA letters ref. CC-35 (various suffixes)
- Austroads Quadguard acceptance document (13 Apr 2015)
- Austroads Quadguard WIDE acceptance document (30 Jun 2014)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

QUADGUARD High Speed

Created: Monday, 29 April 2019

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Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

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Category: End Treatment

Sub Category: Attenuator

Main Material: Steel

Gating/Non-Gating: Non-Gating

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Energy Absorption Systems
Chicago, Illinois
www.energyabsorption.com

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au

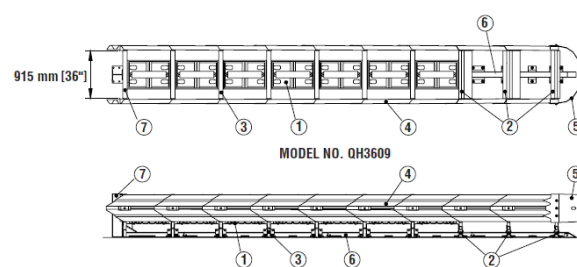


Figure 1
Plan and Elevation
(QuadGuard® HS with Tension Strut Backup shown)

Introduction:

The Quadguard High Speed (HS) is a redirective, non-gating crash attenuator suitable for shielding hazards ranging in width from 610 mm to 2,285 mm. It employs crushable cartridges to absorb the energy of impact.

Practitioners should note that this is a different system to the regular Quadguard system.

Test Level:

Tested to NCHRP Report 350 TL3+.

Test Configuration, test vehicle and impact speed

3-31	2,000 kg utility	111.9 km/h
3-32	820 kg car	111.9 km/h
3-33	2,000 kg utility	115.5 km/h
3-36	820 kg car	113.7 km/h
3-37	2,000 kg utility	112.8 km/h
3-38	2,000 kg utility	114.6 km/h
3-39	2,000 kg utility	113.7 km/h

Recommended End Treatments:

Not Applicable.

Design:

Design to be in accordance with the Quadguard HS Design Manual provided by the supplier.

System is available in various widths up to 2,285 mm.

Designer to specify the number of bays and system width as appropriate for the impacts to be managed and the hazard to be shielded.

In situations where traffic may approach the system in the reverse direction the appropriate transition arrangement should be specified by the designer.

Design should provide for accommodation of any movement of side panels and other moving parts during impact.

Designer should nominate required nose-markings.

Deflection:

Information has not been entered.

Limitations:

Should not be used on crossfalls steeper than 8%.

Elevated kerbs, islands, drainage structures or any other item that can affect the height at which a vehicle could impact the unit should not be placed in advance of the unit or along the length of the unit.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- Austroads acceptance document (15-Sep-2014)
- Trinity Quadguard HS Installation Manual (Rev. B 3/4/10)
- Trinity Quadguard HS Product Manual (Rev. A 02/25/10)
- FHWA letter ref. CC-35E (13 Oct 2000)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

QUADGUARD ELITE

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12:59 PM

Page 1 of 2

Status*: Accepted

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Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Attenuator

Main Material: Steel

Gating/Non-Gating: Non-Gating

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Trinity Highway Products

Dallas, Texas

www.trinityhighway.com

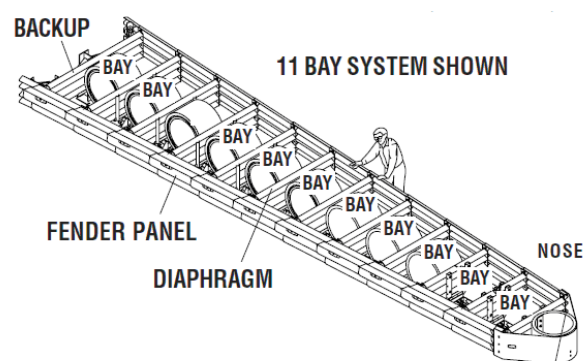
Supplier:

Ingal Civil Products

7 Nestor Drive, Meadowbrook QLD 4131

Ph: 3489 9120 Fax: 3489 9130

www.ingalcivil.com.au



Introduction:

The Quadguard Elite is a redirective, non-gating crash attenuator suitable for shielding hazards ranging in width from 610 mm to 2,285 mm. It employs energy absorbing cylinders to absorb the energy of impact.

The product is similar in many ways to the basic Quadguard system except that the Quadguard Elite is highly reusable and is more suited to more frequent impacts.

Practitioners should be aware that energy absorbing cylinders may retain residual energy after impact.

Test Level:

Tested to NCHRP350 test levels TL-2 and TL-3.

Recommended End Treatments:

Not Applicable.

Design:

Design to be in accordance with the Quadguard Elite Design Manual provided by the supplier.

System is available in various widths up to 2,285 mm.

Designer to specify the number of bays and system width as appropriate for the impacts to be managed and the hazard to be shielded.

In situations where traffic may approach the system in the reverse direction the appropriate transition arrangement should be specified by the designer.

Design should provide for accommodation of any movement of side panels and other moving parts during impact.

Designer should nominate required nose-markings.

Practitioners should be aware that energy absorbing cylinders may retain residual energy after impact.

Deflection:

Not applicable.

Limitations:

Should not be used on crossfalls steeper than 8%.

Elevated kerbs, islands, drainage structures or any other item that can affect the height at which a vehicle could impact the unit should not be placed in advance of the unit or along the length of the unit.

References:

- AS/NZS 3845
- NCHRP Report 350
- QuadGuard Elite Product Manual (Rev F Aug 2014)
- QuadGuard Elite Assembly Manual (Rev F Aug 2014)
- Ingal Civil Products Manual Supplement (Dec 2015)
- FHWA letters CC-57 (various suffixes)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

SMART Cushion

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Aug 2014

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Attenuator

Main Material: Steel

Gating/Non-Gating:

Non-Gating

Redirective/Non-Redirective:

Redirective

Permanent/Temporary:

Permanent

Ownership:

LB Australia Pty Ltd
www.lbaustralia.com.au

Supplier:

LB Australia Pty Ltd
www.lbaustralia.com.au



Introduction:

The SMART Cushion is a restorable/reusable crash attenuator suitable for shielding the blunt ends of single slope and Type F concrete road safety barriers. It employs friction and a hydraulic cylinder to absorb the energy of impact.

Two variants are accepted:

- SMART CUSHION SCI100GM
- SMART CUSHION SCI70GM

Test Level:

- SMART CUSHION SCI100GM has been tested to:
 - MASH test level TL-3, and
 - NCHRP Report 350 test level TL-3
- SMART CUSHION SCI70GM has been tested to:
 - NCHRP Report 350 test level TL-2

Recommended End Treatments:

Not Applicable.

Design:

The SMART Cushion must be installed and maintained in accordance with the SMART Product Manual provided by the supplier.

Configuration	Length	Width
TL-3 (SCI100GM)	6,550 mm	0.96 m
TL-2 (SCI70GM)	4,118 mm	0.88 m

In situations where traffic may approach the system in the reverse direction the appropriate transition arrangement should be specified by the designer.

Design should provide for accommodation of any movement of side panels and other moving parts during impact.

Designer should nominate required nose-markings.

Deflection:

Not applicable.

Limitations:

Should not be used on crossfalls steeper than 10%.

Elevated kerbs, islands, drainage structures or any other item that can affect the height at which a vehicle could impact the unit should not be placed in advance of the unit or along the length of the unit.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- Austroads Acceptance Conditions Document (30-Jun-2014)
- SMART Cushion Product Manual dated July 2012
- FHWA letter ref. CC-85 dated 12-Sep-2003
- FHWA letter ref. CC-85A dated 2-Feb-2005
- KARCO MASH Test Report No. TR-P36055-01-A, TR-P35022-01-B, TR-P36056-01-A, TR-P36051-01-A, TR-P36054-01-A, TR-P36053-01-A, TR-P36052-01-A, TR-P36021-01-A, TR-P36142-01-NC

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

TRACC

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Attenuator

Main Material: Steel

Gating/Non-Gating: Non-Gating

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Trinity Industries

USA

www.highwayguardrail.com

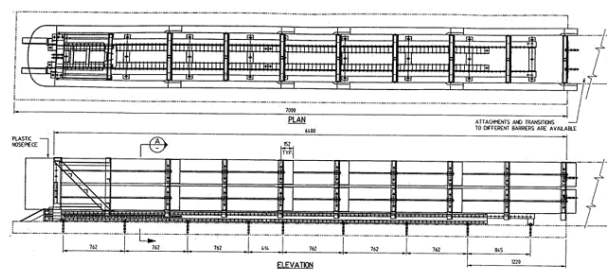
Supplier:

Ingal Civil Products

7 Nestor Drive, Meadowbrook QLD 4131

Ph: 3489 9120 Fax: 3489 9130

www.ingalcivil.com.au



Introduction:

The TRACC (Trinity Attenuating Crash Cushion) is a redirective, non-gating crash attenuator suitable for shielding hazards ranging in width from 610 mm to 1,470 mm. It employs a system of "rip plates" to absorb the energy of impact.

The TRACC family comprises three variants:

TRACC

FASTRACC

WIDE TRACC

Test Level:

Standard TRACC is tested in accordance with NCHRP Report 350 to TL-2 and TL-3.

WIDE TRACC is deemed to have met the requirements of NCHRP Report 350 to TL-3 (FHWA letter CC-54D dated 5 Sep 2002).

FHWA letter CC-54H dated 9 Jun 2005 notes that the longer FASTRACC has been tested with a 2,000 kg utility head-on at a speed of 112.2 km/h.

Recommended End Treatments:

Not Applicable.

Design:

Design to be in accordance with the relevant TRACC Product Manual provided by the supplier.

Configuration	Length	Width
TRACC TL-3	6.5 m	0.61 m
TRACC TL-2	4.3 m	0.61 m

WIDETRACC system is available in various widths up to 1470 mm.

FASTRACC differs from the TRACC system in length only. Effective length of FASTRACC is 7,925mm long compared to standard TRACC which is 6,477mm.

Designer to specify configuration as appropriate for the impacts to be managed and the hazard to be shielded.

In situations where traffic may approach the system in the reverse direction the appropriate transition arrangement should be specified by the designer.

Design should provide for accommodation of any movement of side panels and other moving parts during impact.

Designer should nominate required nose-markings.

Deflection:

Not applicable.

Limitations:

Should not be used on crossfalls steeper than 8%.

Elevated kerbs, islands, drainage structures or any other item that can affect the height at which a vehicle could impact the unit should not be placed in advance of the unit or along the length of the unit.

References:

- AS/NZS 3845:1999
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Ingal Product Manual Release 004
- NSW RMS TRACC acceptance document (05-Aug-2011)
- NSW RMS WIDE TRACC acceptance document (05-Aug-2011)
- NSW RMS FASTRACC acceptance document (13-Mar-2011)
- FHWA letters CC-54 (various suffixes)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Universal TAU II

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12:59 PM

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Category: End Treatment

Sub Category: Attenuator

Main Material: Steel

Gating/Non-Gating: Non-Gating

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent or Temporary

Ownership:

Barrier Systems

3333 Vaca Valley Pkwy, Ste. 800, Vacaville, CA 95688, USA

www.barriersystemsinc.com

Supplier:

Australian Construction Products (ACP)

339 Horsley Road, Milperra, NSW 2214

Ph. 1800 724 172

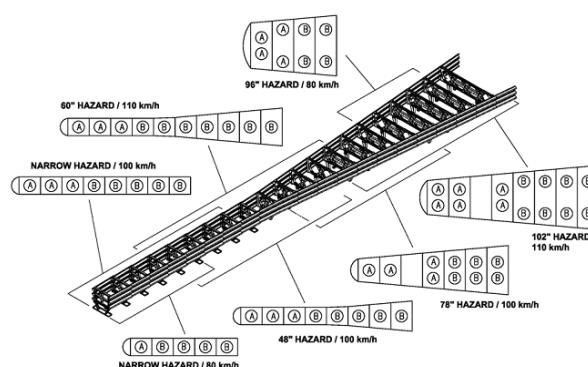
www.acprod.com.au



Introduction:

The Universal TAU-II is a proprietary redirective, non-gating crash attenuator for hazards ranging in width from 700 mm to 2,600 mm. It employs crushable cartridges to absorb the energy from impact.

This product may be used as a permanent installation or can be installed in a construction zone configuration.



Test Level:

Tested in accordance with NCHRP Report 350 to TL-2 and TL-3.

FHWA letter CC-75A dated 20 Dec 2002 notes that a ten-bay (8978mm long) variant of the Universal TAU-II has been tested with a nominal 2,000 kg utility head-on at a speed of 109.4 km/h.

Recommended End Treatments:

Not Applicable.

Design:

Design to be in accordance with the relevant Universal TAU-II Product Manual provided by the supplier.

Universal TAU-II uses two types of crushable cartridge (A & B).

System	Bays with Type A	Bays with Type B
Universal TAU-II TL-3	1	3
Universal TAU-II TL-2	3	5

Universal TAU-II system is available in various widths up to 2,600 mm. **Devices with more than one cartridge in the bay at the nose end of the system are not an accepted variant.**

Designer to specify configuration as appropriate for the impacts to be managed and the hazard to be shielded.

In situations where traffic may approach the system in the reverse direction the appropriate transition arrangement should be specified by the designer.

Design should provide for accommodation of any movement of side panels and other moving parts during impact.

Designer should nominate required nose-markings.

Deflection:

Not applicable.

Limitations:

Should not be used on crossfalls steeper than 8%.

Elevated kerbs, islands, drainage structures or any other item that can affect the height at which a vehicle could impact the unit should not be placed in advance of the unit or along the length of the unit.

References:

- AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Austroads acceptance document dated 30 March 2016
- FHWA letters CC-75 (various suffixes)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

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THRIE-beam Bullnose

Created: Monday, 29 April 2019

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Category: End Treatment

Sub Category: Attenuator

Main Material: Steel

Ownership:

Public Domain

Gating/Non-Gating:

Non-Gating

Redirective/Non-Redirective:

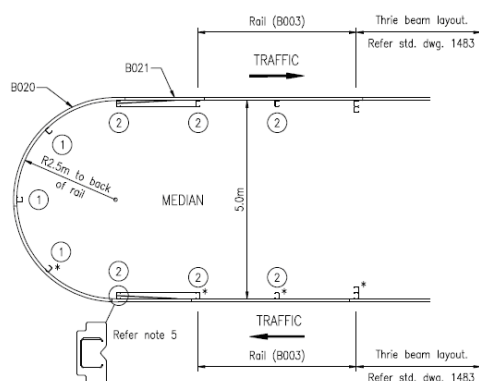
Non-Redirective

Permanent/Temporary:

Permanent

Supplier:

Various



Introduction:

The Thrie Beam Bullnose attenuator is a non-proprietary crash attenuator suitable as an end treatment for Thrie Beam barriers and with appropriate transitions for other systems (W-Beam) for use in median or gore area applications.

Test Level:

Tested in accordance with NCHRP Report 350 to TL3.

Recommended End Treatments:

Not Applicable.

Design:

- To be constructed in accordance with Main Roads' Standard Drawing 1488.
- Used in median locations to protect the ends of two separate barrier systems.
- Although shown to be used with a separation of 5.0 m between the face of the barrier systems can be used where the separation between the barriers is greater by flaring the barriers into an offset of 4.5 m at flare rates in accordance with AS/ NZS 3845 Table B2.
- May also be used to link two "non-parallel" barrier ends.
- Hazard free zone between trailing barriers measured 19m from apex of bullnose should be maintained traversable and free from non-frangible objects.

Configuration:

- To be constructed in accordance with Main Roads' Standard Drawing 1488.

Deflection:

Not applicable.

Limitations:

Elevated kerbs, islands, drainage structures or any other item that can affect the height at which a vehicle could impact the unit should not be placed 15m prior to the unit or along the length of the unit. Refer RPDM Ch.8/8.2.2.2 for further discussion.

References:

- AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- TMR Standard Drawing no. 1488 rev. A

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

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Precast Concrete Barrier (PCB)

TMR Standard Drawing 1473

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

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Status Commencement Date: Not Set

Status Expiry Date*: Not Set

Category: Longitudinal

Gating/Non-Gating:

Not Applicable

Sub Category: Semi-Rigid

Redirective/Non-Redirective:

Redirective

Main Material: Concrete

Permanent/Temporary:

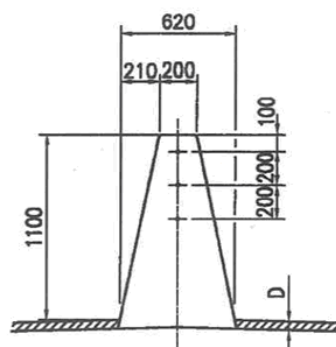
Permanent or Temporary

Ownership:

Supplier:

Public Domain

Various



Introduction:

The Precast Concrete Barrier (PCB) is a concrete barrier with a single-slope profile.

Test Level:

Deemed to meet the requirements of NCHRP report 350 test level TL-3 when properly connected in accordance with QTMR standard drawing 1473.

Useful Product Data:

Unit length	-	7250mm
Unit width (base)	-	620mm
Unit height	-	1050mm

Note limitations regarding lifting: seek latest advice from TMR Structures Branch

Recommended End Treatments:

Quadguard CZ; TAU II; Triton CET ($\leq 70\text{km/h}$); Absorb 350 ($\leq 70\text{km/h}$): (requires transition in concrete barrier to maximum height of 812mm).

Design:

Minimum Length: 36 m

Recommended Minimum Radius: R150m

Interaction with Kerbs

- In unrestrained configurations, the system cannot be placed adjacent to kerbs or other objects within the deflection limits of the barrier that may prevent lateral displacement.

End Treatments:

- A proprietary end treatment should be installed wherever any risk exists that the blunt end could be impacted.
- Any proprietary end treatment system must be specifically designed or adapted for use with "single slope" shape barrier and must be installed and maintained strictly in accordance with the manufacturer's instructions.
- Barrier flare rate should not exceed 1:10.

Vehicle Roll:

- Where the hazard being protected by a barrier extends above the height of the barrier the Designer should ensure that adequate separation from the face of the barrier to the hazard is provided to allow for the roll of high vehicles (such as trucks) hitting the hazard.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
2000	15	100	0.18	1
2000	15	100	0.15	2

Notes:

1. Beason et al (1989) test ref. 9429C-1, 36.4m installation (4 x 9.1m units)
2. Beason et al (1989) test ref. 9429K-1, 54.6m installation (6 x 9.1m units)

Actual clearance distance to workzone should be determined by risk assessment prior to installation.

Limitations:

- Refer TMR std. dwg. 1473 [Check for currency of revision].
- Placement of barriers and effects on surface drainage are to be considered.

Maintenance:

- Inspect units for damage after impact. Damaged units to be replaced.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Main Roads Standard Drawing 1473 (rev. F)
- Beason et al (1989) Development of a Single Slope Concrete Median Barrier, TTI
- Barrier Systems Inc letter dated 23 March 2004

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

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DB80

Created: Monday, 29 April 2019

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Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Concrete

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Temporary

Ownership:

Deltabloc International
28 Industristrasse, Sollenau, 2601, Austria
www.deltabloc.com/en

Supplier:

Orange Hire
71 Lavarack Ave, Eagle Farm, QLD 4009
www.orangehire.com.au



Introduction:

DB80 is an F-shape steel reinforced concrete temporary barrier with K150 tension bar coupling system and joint rotation limiting wedges ("butt inserts").

Variants accepted are:

- 4m unit: Free Standing
- 6m unit: End Anchored (no intermediate ground anchors).

The variants NOT accepted are:

- Systems with intermediate ground attachment
- Systems without joint rotation limiting wedges
- Profiles other than F-shape.



Test Level:

4m units are demonstrated to meet the requirements of MASH TL-3.

6m units have been crash tested to EN1317-2 test level H1.

Note that 'F' type profile concrete barriers are only acceptable Queensland for use on state-controlled roads in Queensland with speed limits of 80 km/h or less.

Recommended End Treatments:

Tau II; Quadguard; Absorb 350 (<=70km/hr)

Design:

Designers should note that deflection and capacity are a function of the tension bar connectors between units. Seek advice from supplier on site specific requirements. The tension bar for this system is the K150.

Point of Redirection:

Point of redirection is 36m from the interface between the terminal and the barrier.

Interaction with Kerbs:

- Barriers should be placed at the same level as the travelling surface and should not be placed behind or on top of kerbing.
- If placed in front of kerbs, maximum expected deflection distance between face of kerb and back of barrier must be maintained.

End Treatments:

- A proprietary end treatment should be installed wherever any risk exists that the blunt end could be impacted.
- Any proprietary end treatment system must be specifically designed or adapted for use with "F" type barriers and must be installed and maintained strictly in accordance with the manufacturer's instructions.
- Supplier should be contacted for details of connection to an anchored crash cushion. If units are freestanding, then the system is not effective from the nose of the cushion and possibility of reverse direction impacts is not acceptable.
- Barrier flare rate should not exceed 1:10.

Maintenance:

Units may need to be repaired or replaced after impact depending on the extent of damage.

Minimum Length of Barrier:

Variant	Test Level	Minimum Length (m)	Note
4.0m K150 Free Standing	MASH TL-3	60	1,2
6.0m K150 End Anchored	EN1317 H1	108	1,2

Notes:

- Not including terminals
- Tested Article Length

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
1500	20	110	0.38	1
10000	15	70	0.63	2
1100	25	100	0.57	3
2270	25	100	1.44	

Notes

- LIER report ref. DBE/SMV-03/870B (2005), 6m units
- LIER report ref. DBE/SMV-05/872B (2005), 6m units
- MwRSF report ref. TRP-030245-10 (2010), 4m units

Actual clearance distance to workzone should be determined by risk assessment prior to installation.

Limitations:

Sloped end terminals are not permitted.

Note that 2m units are available to be used only to resolve difficult geometric configurations such as tight radius curves and emergency openings. Designer must be cognisant that shorter units may have increased deflection characteristics and lower containment capacity. Seek advice from supplier.

References:

- Australian Standard AS/NZS 3845
- Manual for Assessing Safety Hardware
- European Normative EN1317
- TMR Road Planning and Design Manual
- Austroads letter dated 12 December 2016
- Austroads conditions (2-Feb-2015)
- LIER report ref. DBE/SMV-03/870B (2005)
- LIER report ref. DBE/SMV-05/872B (2005)
- MwRSF report ref. TRP-030245-10

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

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J-J Hooks

Created: Monday, 29 April 2019

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Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Concrete

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

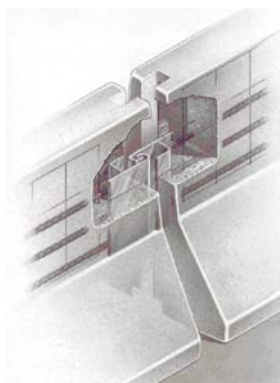
Permanent/Temporary: Temporary

Ownership:

Easi-Set Industries
Midland Virginia

Supplier:

Australian Road Barriers
RMB H535, Old Creswick Rd, Ballarat Victoria 3352
Ph: 1800 003 826 Fax: (03) 5339 9273
www.roadbarriers.com.au



Introduction:

J-J Hooks is a temporary concrete barrier system which has an 'F' type profile.

Useful Product Data

- 3.6 metre barrier unit, 2.5 tonnes
- 6.0 metre barrier unit, 4.3 tonnes

Test Level:

Partially tested (capacity test only) in accordance with AS/NZS 3845 to NCHRP 350 TL-3.

Note that Type 'F' profile concrete barriers are only accepted for use on state-controlled roads in Queensland where the speed limit is 80 km/h or lower.

Recommended End Treatments:

Absorb 350 (<=70km/hr); Quadguard CZ.

Design:

Minimum length:

- For freestanding configurations, a minimum of 30 metres of barrier should be placed on the approach to and departure from the point at which the test deflection is to be achieved, i.e., minimum length of barrier = 60 metres plus length of need.

Interaction with Kerbs

- Barriers should be placed at the same level as the travelling surface and should not be placed behind or on top of kerbing.
- If placed in front of kerbs, maximum expected deflection distance between face of kerb and back of barrier must be maintained.

End Treatments:

- A proprietary end treatment should be installed wherever any risk exists that the blunt end could be impacted.
- Any proprietary end treatment system must be specifically designed or adapted for use with "F" type barriers and must be installed and maintained strictly in accordance with the manufacturer's instructions.
- Supplier should be contacted for details of connection to an anchored crash cushion. If units are freestanding, then the system is not effective from the nose of the cushion and possibility of reverse direction impacts is not acceptable.
- Barrier flare rate should not exceed 1:10.

Maintenance:

- Units may need to be repaired or replaced after impact depending on the extent of damage. **Australian Road Barriers state that incidents resulting in damage to the barriers should be reported for investigation and/or replacement of the damaged barrier.**

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Dynamic Deflection (m)	Note
2000	25	100	1.30	1

Notes:

- Test ref. 400001-ESI1 dated 5-Feb-1999 conducted by TTI. Test was conducted on a 58m installation length of 3.66m units.

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

Limitations:

- The crossfall between the edge of travelled way and the barrier, and the area immediately behind the barrier for the full width of the deflection shall not exceed 6%.
- Barriers can accommodate:
 - a horizontal curvature of approximately 30 metres radius,
 - a vertical curvature of 30 metres radius in sag, and
 - a 53 metres radius on a crest.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- JJ Hooks Installation Manual Rev 7 A1 (Oct 2013)
- TTI Test report no. 400001-ES11 March 1999
- FHWA letter HSA-1/B52A dated 8-Dec-2000
- Proud & Ass. letter ref. 10-Dec-2013
- Austroads acceptance document (19-Aug-2014)

Department of Transport and Main Roads

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T-LOK

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Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Concrete

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

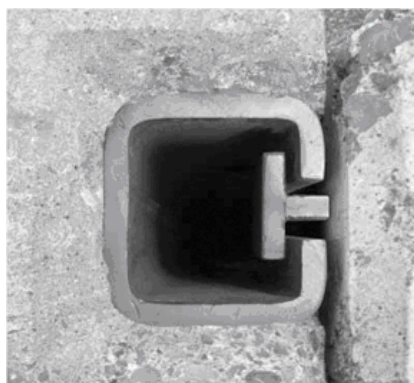
Permanent/Temporary: Temporary

Ownership:

Rockingham Pre-Cast

Supplier:

Saferoads
39 Weerong Road
Drouin VIC 3818
Ph: (03) 5625 6600
Fax: (03) 5625 4986
www.saferoads.com.au



Introduction:

T-Lok is a semi-rigid temporary concrete barrier system which has a Type F profile. Two variants are accepted for use:

- T-Lok MASH
- T-Lok 350

Installations shall comprise either but not both types of units.

Useful Product Data

- Unit height 810mm
- Unit width (base) 610mm
- 3.6 metre barrier unit, 2.6 tonnes
- 5.4 metre barrier unit, 3.9 tonnes

Test Level:

Two variants are accepted:

T-Lok 350 tested to NCHRP report 350 test level TL-3.

T-Lok MASH tested to MASH test level TL-3.

Note that Type 'F' profile concrete barriers are only accepted for use on state-controlled roads in Queensland where the speed limit is 80 km/h or lower.

Recommended End Treatments:

Quadguard CZ

Design:

Minimum length:

- The minimum length of freestanding T-Lok Barrier is 48 metres. This length may be reduced as a function of end anchorage.

Interaction with Kerbs

- Barriers should be placed at the same level as the travelling surface and should not be placed behind or on top of kerbing.
- If placed in front of kerbs, maximum expected deflection distance between face of kerb and back of barrier must be maintained.

End Treatments

- A proprietary end treatment should be installed wherever any risk exists that the blunt end could be impacted.
- Any proprietary end treatment system must be specifically designed or adapted for use with “F” type barriers and must be installed and maintained strictly in accordance with the manufacturer’s instructions.
- Supplier should be contacted for details of connection to an anchored crash cushion. If units are freestanding, then the system is not effective from the nose of the cushion and possibility of reverse direction impacts is not acceptable.
- Barrier flare rate should not exceed 1:10.

Maintenance:

- Units may need to be repaired or replaced after impact depending on the extent of damage.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Dynamic Deflection (m)	Note
2270	25	100	1.27	1
820	20	100	0.20	2
2000	25	100	1.24	3

Notes

1. MASH test ref. 400001-RPC4 conducted 5-May-2009 by TTI. Note that a working width of 1.82m was recorded. Test was conducted on a 58m installation length of 3.66m units.
2. NCHRP Report 350 test 400001-RPC1 conducted 22-Jan-1997 by TTI.
3. NCHRP Report 350 test 400001-RPC3 conducted 17-Jun-1997 by TTI.

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

Limitations:

- The crossfall between the edge of travelled way and the barrier, and the area immediately behind the barrier for the full width of the deflection shall not exceed 5%.
- T-Lok barriers can be installed on longitudinal slopes up to 5%.
- Barriers can accommodate:
 - a horizontal curvature of 30 metres radius,
 - a sag up to 20:1
 - a crest up to 20:1.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- Manual for Assessing Safety Hardware (MASH)
- TMR Road Planning and Design Manual
- T-Lok Installation Manual Version 4.1.2 Oct 2008
- TTI Test report 400001-RPC4 dated July 2009
- FHWA letter HNG-14 dated 20-Oct-1997
- Austroads acceptance conditions documents (both 7-Aug-2014)
- Saferoads T-Lok Manual (ver. 4.1.6 dated Aug-2013)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

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BG800

Created: Monday, 29 April 2019

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Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

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Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent or Temporary

Ownership:

Highway Care International

<http://www.highwaycareint.com>

Supplier:

Ingal Civil Products

7 Nestor Drive, Meadowbrook QLD 4131

Ph: 3489 9120 Fax: 3489 9130

www.ingalcivil.com.au



Introduction:

BG800 is a steel semi-rigid portable steel safety barrier system which may be deployed in either temporary or permanent configurations.

BG800 is available in the following variants:

- BG800 Standard
- BG800 MDS (Minimum Deflection System)
- BG800 LDS (Limited Deflection System)

Major components comprise:

- 12m units and 6m longitudinal barrier units.
- Anchored terminal end units.
- Short radius units (0.61m).

Test Level:

Standard System: NCHRP Report 350 TL-2, TL-3 and TL-4 and MASH TL-3.

Limited Deflection System (LDS): NCHRP Report 350 TL-3.

Minimum Deflection System (MDS): NCHRP Report 350 TL-3.

Recommended End Treatments:

Quadguard CZ; SMART Cushion; Tau II.

Absorb 350 for temporary use only.

(See respective product information sheets.)

Note that flaring outside the clear-zone and ramped ends are not accepted end treatment solutions.

Design:**General**

BG800 has the following variants:

- i) The standard configuration has end anchors and intermediate anchors at 60m spacing.
- ii) The LDS configuration has end anchors and intermediate anchors at 12m spacing.
- iii) The MDS configuration has end anchors and intermediate anchors at 6m spacing. It also requires the addition of T-Top sections to the top of the barrier.

Minimum Length

- Barrier length requirements should be determined by the "Length of Need" methodology.
- Standard System: 60 m between anchors.
- Limited Deflection System (LDS): 60 m,
- Minimum Deflection System (MDS): 48 m.

Anchor Spacings/Deflections

- Standard system: Maximum anchor spacing is nominated as 480 m. Closer anchor spacing (60 m) would be required to replicate test conditions. Designers should consider that, for the same impact, wider anchor spacing will result in greater deflections, and that closer anchor spacing will result in smaller deflections.
- Limited deflection system: Anchor spacing = 12m.
- Minimum deflection system: Anchor spacing = 6m.

Offset from Trafficked Lane:

- The offset between the barrier and the travelled lane should be not less than 500 mm.
- Flare rates shall be as per TMR Road Planning & Design Manual.

Interaction with Kerbs

- Cannot be placed adjacent to kerbs or other objects within the deflection limits of the barrier, which may prevent lateral displacement.

Vehicle Roll:

- Where the hazard being protected by a barrier extends above the height of the barrier the Designer should ensure that adequate separation from the face of the barrier to the hazard is provided to allow for the roll of high vehicles (such as trucks) hitting the hazard.

Maintenance:

- Units may need to be repaired or replaced after impact depending on the extent of damage.

Deflection:

Measured (Crash Test) Deflections:

System Type	Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
Standard 60m anchor spacing	2270	25	100	1.70	1
Standard 60m anchor spacing	8000	15	80	1.74	2
Standard 60m anchor spacing	2000	25	100	1.60	3
Standard 60m anchor spacing	2000	25	70	1.36	4
LDS 12m anchor spacing	2000	25	100	0.89	5
MDS 6m anchor spacing	2000	25	100	0.305 Top 0.076 Toe	6

Notes:

1. MASH TL-3 (Test#BG1302)
2. NCHRP Report 350 TL-4 (Test#P0206)
3. NCHRP Report 350 TL-3 (Test#BG1303)
4. NCHRP Report 350 TL-2 (Test#1506)
5. NCHRP Report 350 TL-3 (Test#BG804)
6. NCHRP Report 350 TL-3 (Test#BG808)

Actual clearance distance between barrier and work area/hazard should be determined by risk assessment

Limitations:

- The crossfall between the edge of travelled way and the barrier should not exceed 8%.
- Special units may be required for small radius curves.

References:

- NCHRP Report 350 & MASH
- FHWA letter ref. HSA-10/B-127 dated 30-Nov-2004
- BarrierGuard 800 Product Manual – Permanent rev. 5c0716 dt. 5-Jul-2016 – Highway Care International
- BarrierGuard 800 Product Manual – Temporary rev. 2c0716 dt. 5-Jul-2016 – Highway Care International
- BarrierGuard 800 Installation Manual – Laura Metaal, Version 2.6
- Austroads acceptance documents dated 06-Mar-2018 (Temporary, Permanent, LDS,MDS)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Defender Barrier

Temporary Steel Barrier

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Steel

Gating/Non-Gating:

Not Applicable

Redirective/Non-Redirective:

Redirective

Permanent/Temporary:

Temporary

Ownership:

Safe Barriers PTE LTD
PO Box 148
Novena Post Office
Singapore
913017

Supplier:

Safe Barriers Pty. Ltd.
PO Box 7178
Hemmant, QLD 4174
Ph: 1800 169 799
www.safebarriers.com



Introduction:

Defender Barrier is a steel barrier for temporary use at work zones.

Defender Barrier is available in the following variant:

- Defender Barrier 70
- Defender Barrier 100 LDS
- Defender Barrier 100 HC
- Defender Barrier 100 FS

Defender Barrier 70 is a freestanding, concrete ballasted steel barrier.

Defender Barrier 100 LDS is a steel barrier that is ground anchored every 9.15 meters.

Defender Barrier 100 HC is a steel barrier that is ground anchored every 48.15 meters.

Defender Barrier 100 FS is a free standing, concrete ballasted steel barrier with an increased minimum length (than Defender Barrier 70) and an anchored end terminal (s).

The system consists of interlocking 3900mm long (effective length) units that are secured in place by a connection pin.

Test Level:

Defender Barrier 70 has been tested to MASH test level TL-2. Defender Barrier 100 LDS has been tested to MASH test level TL-3.

Defender Barrier 100 HC has been tested to MASH test level TL-4.

Defender Barrier 100 FS has been tested to MASH test level TL-3.

Recommended End Treatments:

Absorb 350 for Defender Barrier 70, and Universal TAU-II for Defender Barrier 100 LDS, HC and FS systems.

Designer to consult supplier for details of transitions to these terminals.

Design:

Point of Need:

The Defender Barrier 70 system is considered to be redirective 10 barrier units or 39.0m from leading or trailing end, not including terminals.

The Defender Barrier 100 LDS system is considered to be redirective from first post, when connected with redirective end terminal.

The Defender Barrier 100 HC system is considered to be redirective from first post, when connected with redirective end terminal.

The Defender Barrier 100 FS system is considered to be redirective from first post, when connected with redirective end terminal.

Pavement:

This system was tested on a flat asphalt surface.

End Treatment:

The Defender Barrier 70 system has been successfully crash tested with ABSORB 350 end terminal.

The Defender Barrier 100 system has been successfully crash tested with Universal TAU-II crash cushion.

Please refer to an ABSORB 350 and Universal TAU-II information sheet in this document for product information.

Minimum Length of Barrier:

Variant	MASH Test Level	Minimum Length (m)	Note
Defender Barrier 70	TL -2	105.3	1
Defender Barrier 100 LDS	TL-3	78.0	1
Defender Barrier 100 HC	TL-4	97.5	1
Defender Barrier 100 FS	TL-3	156.0	1

Notes:

1. Not including terminals

Deflection:

Measured (Crash Test) Deflections and Working Widths:

Variant	Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Working Width (m)
Defender Barrier 70	1100 ¹	25	70	0.74	1.42
	2270 ¹	25	70	1.20	1.88
Defender Barrier 100 LDS	1100 ²	25	100	0.56	1.24
	2270 ²	25	100	0.88	1.56
Defender Barrier 100 HC	1100 ³	25	100	1.80	2.48
	2270 ³	25	100	2.30	2.98
	10000 ³	15	90	2.47	3.15
Defender Barrier 100 FS	1100 ²	25	100	1.1	1.78
	2270 ²	25	100	1.9	2.58

Notes:

1. MASH TL-2 compliance testing
2. MASH TL-3 compliance testing
3. MASH TL-4 compliance testing

Operators, designers and supervisors of work zones must be cognisant that deflections outside the point of redirection are typically greater.

MASH TL-2 compliance transition testing on Defender Barrier 70, and MASH TL-3 compliance transition testing on Defender Barrier 100 were conducted at the transition of the barrier and terminal system .

Variant	Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Transition Deflection (m)	Working Width (m)
Defender Barrier 70	1100	25	70	1.20	1.88
	2270	25	70	2.80	3.48
Defender Barrier 100	2270	25	100	0.31	0.99

Limitations:

- The crossfall between the edge of travelled way and the barrier should not exceed 10%.
- This system may be installed to a minimum horizontal and vertical curvature of 230m.

References:

- NCHRP Report 350 & MASH
- Defender Barrier 70 Product Manual – 28-June-2017
- Defender Barrier 100 LDS Product Manual – July 2018
- Defender Barrier 100 HC Product Manual - July 2018
- Defender Barrier 100 FS Product Manual – April 2018
- Austroads acceptance documents dated 06-Dec-2017, 05-June-2018 and 29 October 2018
- Holmes Solutions MASH Compliance Testing Reports: 131393.01RP.051(v1.2), 131393.03RP.1017(v1.3), 131393.05RP.0917(v1.2), 131393.02RP.0717(v1.2), 131393.00 (v1.2)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Ironman

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

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* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Steel

Gating/Non-Gating:

Not Applicable

Redirective/Non-Redirective:

Redirective

Permanent/Temporary:

Temporary

Ownership:

Saferoads
39 Weerong Road
Drouin VIC 3818
Ph: (03) 5625 6600
Fax: (03) 5625 4986
www.saferoads.com.au

Supplier:

Saferoads
39 Weerong Road
Drouin VIC 3818
Ph: (03) 5625 6600
Fax: (03) 5625 4986
www.saferoads.com.au



Introduction:

Ironman is a steel semi-rigid temporary safety barrier system, which is available in a number of variants:

Variant	Acceptance
Original (galvanized bulkhead)	Available in 4 m and 12 m units. Accepted for use as TL-2 (freestanding) or TL-3 (anchored). A single temporary barrier installation should comprise units of only one type.
"Heavy Duty" (orange bulkhead)	
Hybrid (with concrete ballast blocks)	4m units with concrete ballast blocks. Accepted for use where posted speed is 80 km/h or lower when end anchored. Accepted for use where posted speed is 60 km/h or lower when freestanding.

Test Level:

Both Ironman and Ironman Hybrid have demonstrated capacity to contain an NCHRP 350 test level TL-3 impact.

No Ironman system is accepted as a test level TL-4 system.

Recommended End Treatments:

See design notes over page.

Design:**Minimum Length:**

- Barrier length requirements should be determined by the "Length of Need" methodology.

Variant	Configuration	Minimum Length
Ironman	Freestanding	264 m (1)
	End anchored	58 m between anchorage pts
Ironman Hybrid	Freestanding	116 m (2)
	End anchored	20 m between terminals

(1) includes 95 m of development length at each end.

(2) includes 44m of development length at each end.

End Treatments:

Variant	Configuration	End Treatment
Ironman	Freestanding	Triton CET
	End anchored (1)	Quadguard CZ
Ironman Hybrid	Freestanding	Absorb 350
	End anchored (1)	Quadguard CZ

Notes

- (1) Where reverse direction impacts are possible, end units must be fixed to ground to mitigate against risk of reverse direction pocketing. Refer to Supplier for details.

Vehicle Roll:

- Where the hazard being protected by a barrier extends above the height of the barrier the Designer should ensure that adequate separation from the face of the barrier to the hazard is provided to allow for the roll of high vehicles (such as trucks) hitting the hazard.

Maintenance:

- Units may need to be repaired or replaced after impact depending on the extent of damage.

General

- Deflection limiting spacers shall be used. It is noted that omitting these spacers will permit greater deflections to occur.
- Constituent units are connected together using 48mm (OD) connector pins.

Deflection:

Measured (Crash Test) Deflections:

Ironman

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Nominated Deflection (m)	Note
2000	25	70	2.82	1
2000	25	100	2.1	2

Notes:

- Freestanding (4 m units) 224 m long installation
- 58 m between anchorage points (4 m units)

Ironman Hybrid

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Nominated Deflection (m)	Note
2000	25	70	1.25	3
2000	25	100	1.9	4

Notes:

- Freestanding 120 m long test installation.
- Freestanding 249.4m long test installation.

- Deflection characteristics for given impact conditions are a function of the anchorage conditions and the length of the system. For anchored systems, wider anchor spacings may result in greater deflections.
- Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

Limitations:

- Ironman barrier may not be used where cross slope exceeds 5%.
- Ironman barrier can be installed on longitudinal slopes up to but not exceeding 5%.
- 4m units may be rotated maximum 3° at each joint to derive a min horizontal curve of R~78m.
- (R ~230m for 12m units).

Interaction with Kerbs

- Cannot be placed adjacent to kerbs or other objects within the deflection limits of the barrier, which may prevent lateral displacement.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Ironman Installation Manual
- Ironman Hybrid Product Manual ver. 1.1.3 (Oct 2014)
- E-Tech test report 01-8430-004 dated 29-Aug-2005
- FHWA approval letters ref. B-134 (various suffixes)
- Austroads acceptance for Ironman Hybrid (26-May-15)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Zoneguard

Temporary Steel Barrier

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Mar 2013

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Temporary

Ownership:

Hill and Smith Pty Ltd
1/242 New Cleveland Rd Tingalpa. Q 4173
PO Box 9406 Wynnum Plaza, Wynnum West. Q 4178
Phone 1300 277 683
www.hillandsmith.com.au

Supplier:

Hill and Smith Pty Ltd
1/242 New Cleveland Rd Tingalpa. Q 4173
PO Box 9406 Wynnum Plaza, Wynnum West. Q 4178
Phone 1300 277 683
www.hillandsmith.com.au



Introduction:

Zoneguard is Steel Barrier for Temporary use at Work Zones and is required to be anchored to the pavement.

Zoneguard is available in two variants:

- Zoneguard
- Zoneguard 'Minimum Deflection System'

Useful Product Data:

- It comprises of 12m long steel units.

Test Level:

NCHRP350 TL-4 / MASH TL-3 when anchored with end and intermediate anchors only.

MASH TL-3 when fully anchored (i.e., the Minimum Deflection System).

Recommended End Treatments:

Absorb 350 (≤ 70 km/hr); Tau II; Quadguard CZ

Note that flaring outside the clear-zone and ramped ends are not accepted end treatment solutions.

Zoneguard

Design:

General

Zoneguard has two variants:

- (i) The standard configuration has end anchors and intermediate anchors.
- (ii) The Minimum Deflection System which is continuously anchored (10.2m spacings).

Minimum Length

- Barrier length requirements should be determined by the "Length of Need" methodology.
- Standard System: 75m.
- Minimum Deflection System: 60m.

Anchor Spacings/Deflections

- The minimum run length of the standard system is 75m, any extension of barrier above this length will require intermediate anchors every 72m.
- The Zoneguard minimum deflection system is anchored every 10.2m.
- Designers should consider that, for the same impact, wider anchor spacing will result in greater deflections, and that closer anchor spacing will result in smaller deflections.

Offset from Trafficked Lane:

- The offset between the barrier and the travelled lane should be not less than 500 mm.
- Flare rates shall be as per TMR Road Planning & Design Manual.

Interaction with Kerbs

- Cannot be placed adjacent to kerbs or other objects within the deflection limits of the barrier, which may prevent lateral displacement.

Vehicle Roll:

- Where the hazard being protected by a barrier extends above the height of the barrier the Designer should ensure that adequate separation from the face of the barrier to the hazard is provided to allow for the roll of high vehicles (such as trucks) hitting the hazard.

Maintenance:

- Units may need to be repaired or replaced after impact depending on the extent of damage.

Deflection:

Measured (Crash Test) Deflections:

Standard Zoneguard (TL-4)

65m between anchors

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
2000	25	100	1.65 (Base)	1
2270	25	100	1.88 (Base)	2
8000	15	80	1.27 (Base)	3

Note:

1 = NCHRP350 3-11; 2 = MASH 3-11; 3 = NCHRP350 4-12

Minimum Deflection System Zoneguard (TL-3)

Anchors at 10.2m spacings

Test Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
1065	25	100	0.10 (Base)	-
2118	25	100	0.05 (Base)	-
2208	25	100	0.41 (Top) 0.13 (Base)	4

Note:

- 4. Designers should note the base is 271 mm wider horizontally (on each side) than the top. In this test the maximum intrusion into the work zone was recorded at the top of the barrier rather than the base.

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

Limitations:

- The crossfall between the edge of travelled way and the barrier should not exceed 15H: 1V.
- Special units may be required for small radius curves.
- **Seek advice from supplier regarding anchorages if considering installation on concrete surfaces.**

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- NSW RMS Design Report dated 15-Mar-2013
- FHWA letter ref. HSSD/B-176A dated 17-Jul-2008
- FHWA letter ref. HSSD/B-176 dated 27-Jun-2008
- ZoneGuard Specification Manual Metric Australian Version October 2013, Rev 5
- Austroads letter dated 6-Sep-2016

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Armorzone MASH

Plastic Water Filled Barrier System

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: April 2019

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Other

Main Material: Plastic

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Temporary

Ownership:

Valmont Highway Distribution
lbrown@valmonthighway.com

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

Armorzone MASH is a Plastic Water Filled Barrier Type Device for Temporary Use at Work Zones.

Standard longitudinal units are 2.0m ORANGE coloured and to be operational must be filled with the appropriate volume of water in accordance with the Installation/Maintenance manual.

The Terminal Unit is 2.0m YELLOW coloured and must be maintained empty.

ArmorZone MASH units must not be interchanged with ArmorZone (NCHRP350) units.



Test Level:

MASH TL-2

Recommended End Treatments:

This temporary system self terminates. Refer to system Product Manual. The terminal unit is YELLOW and must be maintained EMPTY.

Design:

The system is considered to be redirective 24m past the leading unit and 26m before the trailing unit.

Minimum Length of Barrier:

MASH Test Level	Minimum Length (m)
TL-2	50.0*

*Not including terminals

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Recorded Working Width (m)
1,100 ¹	25	70	2.02	2.47
2,270 ¹	25	70	4.1	4.6

1. MASH TL-2 Test

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

These deflections in the table above are not applicable in the vicinity of terminals.

Limitations:

Information has not been entered.

References:

- Australian Standard AS/NZS 3845
- MASH 2016
- TMR Road Planning and Design Manual
- ArmorZone MASH TL-2 Temporary Safety Barrier Product Manual (Release 03/19)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Armorzone (NCHRP350)

Plastic Water Filled Barrier System

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Page 1 of 2

Status*: Accepted

Status Commencement Date: Nov 2012

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Other

Main Material: Plastic

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Temporary

Ownership:

Valmont Highway Distribution
lbrown@valmonthighway.com

Supplier:

Valmont Highway Distribution
jannison@valmonthighway.com



Introduction:

Armorzone is a Plastic Water Filled Barrier Type Device for Temporary Use at Work Zones.

Standard longitudinal units are ORANGE coloured and to be operational must be filled with the appropriate volume of water in accordance with the Installation/Maintenance manual. The Terminal Unit is YELLOW coloured and must be maintained empty.

ArmorZone (NCHRP350) units must not be mixed with ArmorZone MASH units.



Test Level:

NCHRP Report 350 test level TL-1.

While this system is rated test level TL-1 here, it has demonstrated some capacity to contain a test level TL-2 impact and may, **subject to detailed site-specific risk assessment**, be used to shield work-sites where the posted speed through the work-site both during and outside work hours does not exceed 70 km/h. Such a risk assessment would identify for example (among other things) the rationale for selecting this system as opposed to any other barrier system and would include an indication of how the expected deflection of the system will be managed within the work zone and will indicate how operating speed is to be managed.

Recommended End Treatments:

This temporary system self terminates. Refer to system Product Manual. The terminal unit is YELLOW and must be maintained EMPTY.

Design:

End Treatments:

- This system has an end treatment that has been successfully crash tested.
- Under TL-1 impact conditions, the system is considered to be redirective from a point 16m from the head of the system.

Minimum Length:

- 52m between terminals, 56m total.
- Designers of work zones should refer to the suppliers' installation manual for further guidance on hazard free zones and deflection.

Deflection:

For TL-1 impacts:

- When measured from the head of the system, the first 16m is considered to be gating/non-redirective.
- Between 16m and 28m (measured from both the upstream and the downstream end) the expected deflection distance is 2.4m.
- Downstream of 28m (up to a point 28m from the downstream end), the expected deflection distance is 1.51m.
- For a minimum length installation (56m) the system is "redirective" between 16m and 40m from the end, and the expected deflection distance for a TL-1 impact in this zone is taken as 2.4m.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
820	20	70	1.05	-
1500	20	70	1.51	-

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

Limitations:

Information has not been entered.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- FHWA letter ref. HSST/B-223 dated 22 Aug 2011
- Armorzone Plastic Barrier Product Manual (ref 300812)
- Armorzone End Treatment Product Manual (ref 300812)
- NSW Transport RMS Safety Barrier Design Report 11M965 (29-Aug-2012)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Ricochet

Plastic Water Filled Barrier System

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

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* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Other

Main Material: Plastic

Gating/Non-Gating: Non-Gating

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Temporary

Ownership:

Advantage Plastics

254 Easterbrook Road, RD1 Kaiapoi 7691, NZ

Ph: 0800 668 534 Mob: 021 228 5284

www.advantageplastics.co.nz

Supplier:

TFH Hire

8-14 Eurora Street, Kingston, QLD 4114

www.tfh.com.au



Introduction:

Ricochet is a Plastic Water Filled Barrier Type Device for Temporary Use at Work Zones.

The barrier system consists of a series of interlocking 2m plastic barrier units.

Standard longitudinal units are orange coloured. Orange units must be filled with the appropriate volume of water in accordance with the Installation/Maintenance manual.

The terminal consists of two 2m yellow coloured units plus a 0.55m yellow end cap, and ALL yellow coloured units must be maintained empty.

Test Level:

MASH TL-1

Recommended End Treatments:

This temporary system self terminates. Refer to system Product Manual. The terminal units are YELLOW are NOT filled with water.

Design:

The system is considered to be redirective 20m past the leading unit and 20m before the trailing unit.

Minimum Length of Barrier:

MASH Test Level	Minimum Length (m)
TL -1	40.0*

*Not including terminals

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Recorded Working Width (m)
1,100 ¹	25	70	2.50	3.08
2,270 ²	25	50	2.28	2.86

1. This is a small car MASH TL-2 test instead of a MASH TL-1. Recorded Deflection and Working Width are not applicable to TL-1 impacts.
2. MASH TL-1 Test

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

These deflections in the table above are not applicable in the vicinity of terminals.

Limitations:

Information has not been entered.

References:

- Australian Standard AS/NZS 3845
- MASH 2016
- TMR Road Planning and Design Manual
- Ricochet Waterfilled Barrier System – MASH (06/03/2019)
- Holmes Solutions report ref.131677.00(v1.1)
- Holmes Solutions Report. Ref 102350.15-1-1A (v1.2)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Shield I

Plastic Water Filled Barrier System

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Page 1 of 2

Status*: Accepted

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

Category: Longitudinal

Gating/Non-Gating: Not Applicable

Sub Category: Other

Redirective/Non-Redirective: Redirective

Main Material: Plastic

Permanent/Temporary: Temporary

Ownership:

National Plastic Group
5 Christensen Road, Stapylton QLD 4207
Ph: 3807 0055 Fax: 3807 2315
www.nationalplasticsgroup.com.au

Supplier:

National Plastic Group
5 Christensen Road, Stapylton QLD 4207
Ph: 3807 0055 Fax: 3807 2315
www.nationalplasticsgroup.com.au



Introduction:

Shield I is a Plastic Water Filled Barrier Type Device for Temporary Use at Work Zones.

Test Level:

MASH TL-1

The barrier system consists of a series of interlocking 2m plastic barrier units.

Standard longitudinal units are orange coloured. Orange units must be filled with the appropriate volume of water in accordance with the Installation/Maintenance manual. The terminal unit is yellow coloured and must be maintained empty.

Recommended End Treatments:

This system self terminates. The terminal unit is YELLOW and must be maintained EMPTY.

Shield I

Design:

The system is considered to be redirective past 13 leading orange units and before 9 trailing orange units.

End Treatments:

This system self terminates and has been successfully crash tested.

Minimum Length of Barrier:

MASH Test Level	Minimum Length (m)	Note
TL -1	44	1

Notes:

1. Not including terminals

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)
1,100 ¹	25	50	1.37
2,270 ¹	25	50	2.19

Notes:

1. MASH TL-1 compliance testing on Shield I system.

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

These deflections in the table above are not applicable in the vicinity of terminals.

Limitations:

Information has not been entered.

References:

- Australian Standard AS/NZS 3845
- MASH 2009
- TMR Road Planning and Design Manual
- Shield I Plastic Barrier Product Manual
- Holmes Solutions report ref.110971.01RP.0217(v1.2)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Triton

Plastic Water Filled Barrier System

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Other

Main Material: Plastic

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Temporary

Ownership:

Energy Absorption Systems
Chicago, Illinois
www.energyabsorption.com

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

The Triton barrier is a portable water-filled temporary barrier system, with an internal steel frame.

Useful Product Data:

Physical Length	2130mm
Effective Length	2000mm
Width	530mm
Height	810mm
Mass empty	65kg
Mass (full of water)	610kg

Note:

- The Triton TL-3 variant (i.e. mounted on pedestals) is no longer supported by TMR as a longitudinal barrier system.
- The Triton TL-0 variant (i.e. without the internal steel frame) is no longer accepted by TMR for use as a road safety barrier on state-controlled roads in Queensland.

Test Level:

NCHRP Report 350 test level TL-1.

While this system is rated test level TL-1 here, it has demonstrated some capacity to contain a test level TL-2 impact and may, **subject to detailed site-specific risk assessment**, be used to shield work-sites where the posted speed through the work-site both during and outside work hours does not exceed 70 km/h. Such a risk assessment would identify for example (among other things) the rationale for selecting this system as opposed to any other barrier system and would include an indication of how the expected deflection of the system will be managed within the work zone and will indicate how operating speed is to be managed.

Recommended End Treatments:

Refer to 'Design' in this data sheet and the manufacturers' manual for terminal configuration.

Note: Triton CET (Concrete End Terminal) is not a suitable end treatment for the Triton longitudinal barrier system.

Design:

Minimum Length:

Barrier Configuration	Minimum Overall Length
TL-1 (50 km/h)	30 m *
TL-2 (70 km/h)	90 m

* See FHWA eligibility letter ref. HSSD/B-179 dated 11-Jul-2008.

End Treatments:

- End treatment comprises ten regular units, five of which are to occur prior to the beginning of the length of need. First unit only is not water-filled, and pin is removed from exposed end.

Maintenance:

- Units may need to be repaired or replaced after impact depending on the extent of damage.
- Units need to be routinely checked to ensure that they remain water-filled. Leaking units should be repaired/replaced.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
2000	25	50	2.7	1
820	20	70	1.0	2
2000	25	70	3.9	

Notes

- Test Level TL-1 conditions based FHWA eligibility letter ref. HSSD/B-179 dated 11-July-2008.
- Test level TL-2 conditions These are deflections recorded during crash testing. 3.9m was recorded in crash test 147-043 which comprised an 89.1m long installation.

Actual clearance distance between the barrier and work area/hazard should be determined by risk assessment prior to installation.

Limitations:

- Barriers may be placed on cross slopes up to 5%.
- Barriers can be placed on longitudinal slopes up to 5%.
- Barriers can accommodate a longitudinal change in grade of 5%.
- Cannot be used on radii smaller than 11.3m.
- Cannot be placed adjacent to kerbs or other objects within the deflection limits of the barrier, which may prevent lateral displacement.
- Units are not symmetrical. Units should generally be oriented so that the release valve is located away from the trafficked face of the barrier.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Triton Barrier Crash Test Report 147-043
- Triton Barrier Crash Test Report 147-044
- FHWA letter ref. HNG-14 dated 27 Nov 1992
- FHWA letter ref. HNG-14 dated 27 Sep 1994
- Triton Barrier Product Installation Manual (# 619487B rev. E April 2012)
- FHWA letter ref. HSSD/B-179 dated 11-Jul-2008

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Mobile Barriers MBT-1

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Other

Sub Category: Other

Main Material: Other

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Temporary

Ownership:

Mobile Barriers LLC
24918 Genesee Trail Road
Golden, Colorado 80401
USA

Supplier:

Mobile Barriers LLC
24918 Genesee Trail Road
Golden, Colorado 80401
USA
Ph 0432 931 981



Introduction:

The Mobile Barriers MBT-1 is a mobile barrier system that provides a mobile work zone for personnel at applicable maintenance and construction sites.

The system includes the following:

- The Mobile Barriers MBT-1 trailer
- A suitable tractor unit
- A speed appropriate TMA

Test Level:

Mobile Barriers MBT-1 has been tested to:
MASH TL-3

Recommended End Treatments:

Rear of the Mobile Barriers MBT-1 must be fitted with a speed appropriate TMA.

Design:

The Mobile Barriers MBT-1 is a mobile temporary work zone barrier.

Length and Dimensions

Subject to registration and permit requirements the system can be assembled in three configurations

- two platforms and one wall section, or
- two platforms and two wall sections, or
- two platforms and three wall sections.

Each wall section is 6.1 m long. Length with two platforms and three wall sections (not including tractor or TMA) is 31m. Road clearance is 300mm.

Ballast

The Mobile Barriers MBT-1 was ballasted in the crash test, and thus operators, designers and supervisors of work zones must be cognisant of the ballast when in use to protect a work zone.

The supplier should be consulted on the expected system performance for configurations different to the crash tested configuration.

Truck Mounted Attenuator

Selection of a suitable TMA for the Mobile Barriers MBT-1 should undergo a separate acceptance process. The rated test level of the attached TMA will assist in defining the acceptable operating conditions, e.g. speed environment.

Configuration

The Mobile Barriers MBT-1 configuration (e.g. number of assembled wall sections) may affect the operation of the device, such as:

- Available work zone area
- Vehicle swept path and crest or sag traversability
- Mass of the system in comparison to crash test

Site Conditions

Surface type and geometry may affect the performance of the system.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
2,270	25	100	0.61	1

Notes:

1. SwRI Test No. MBT-1 (April 2008). Test was on longest configuration (two platforms and three wall sections) of the system, fully ballasted with the system stationary on a concrete surface including a tractor but not with a TMA. The mass of the tested article was 29.5 tonnes.
2. Actual clearance distance between barrier and work zone should be determined by risk assessment.

Limitations:

1. The use of Mobile Barriers MBT-1 on the Queensland state-controlled road network is subject to fulfillment of legislated requirements to be registered as a vehicle and any other permit requirements pursuant to such registration.
2. This document does not connote any acceptance of the Mobile Barriers MBT-1 to operate as a Truck Mounted Attenuator.
3. This document does not connote any acceptance for use of the device in accordance with the Queensland MUTCD requirements.

References:

- AS/NZS 3845
- MASH (AASHTO, 2009)
- Austroads conditions document (17-Feb-2015)
- FHWA eligibility letter ref. HSSD/B-178 (5-Jun-2008)
- SwRI Test No. MBT-1 (Apr-2008)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Absorb 350

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Attenuator

Main Material: Plastic

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Temporary

Ownership:

Barrier Systems

3333 Vaca Valley Pkwy, Ste. 800, Vacaville, CA 95688, USA

www.barriersystemsinc.com

Supplier:

Australian Construction Products (ACP)

339 Horsley Road, Milperra, NSW 2214

Ph. 1800 724 172

www.acprod.com.au



Introduction:

Absorb 350 is a water filled non-redirective, gating LDPE/Steel crash attenuator that attaches to temporary concrete barriers.

Useful Product Data

Unit Length	- 1m
Unit Width	- 0.61m
Unit Height	- 0.8m
Unit Weight	- 39kg empty, 326kg full.

Test Level:

Restricted to use at work zones that are posted ≤ 70 km/h both during and outside work hours, with placement in higher speed zones subject to site specific risk assessment noting that the system may be used only where high speed side impacts are unlikely, penetration behind the barrier is acceptable and use of a redirecting impact attenuator (a crash cushion) is not feasible for reasons other than cost or convenience. Such a risk assessment would identify for example (among other things) the rationale for selecting this system as opposed to any other system and would include an indication of how operating speed is to be managed.

Note that configuration varies when intended for use in higher speed zones.

Recommended End Treatments:

Not Applicable.

Design:

- Design shall be in accordance with the Absorb 350 Installation and Maintenance Manual.
- As the system is gating, a run-out area in accordance with the requirements of AS/NZS 3845 Figure F11 should be provided.
- A proprietary transition from the Absorb 350 to a concrete barrier is required.

Offset from Trafficked Lane:

- The offset between the barrier and the travelled lane should be not less than 500 mm (RPDM 8.3.4.4).

Installation and Maintenance Requirements:

- The product shall be installed and repaired after impact in accordance with the Absorb 350. Installation and Maintenance Manual by Barrier Systems Inc.
- TL-2 compliant system is 5.9m (5 units) long.

Designers are strongly encouraged to read the FHWA letters referred below.

Deflection:

Information has not been entered.

Limitations:

- As the system is non-redirective, a vehicle may penetrate the system. A run-out area in accordance with the requirements of AS3845 Figure F11 shall be provided.
- System shall not be used in a permanent application.
- All kerbs, islands and elevated objects greater than 100mm high that would be beneath, beside or less than 15m in front of the unit or along the length of the unit should be removed.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Absorb 350 Crash Cushion ACP Installation Manual
- FHWA letters ref. HSA-CC66, HSA-CC66A and HSA-10/CC66B

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Triton Concrete End Terminal (CET)

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: End Treatment

Sub Category: Attenuator

Main Material: Plastic

Gating/Non-Gating:

Gating

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Temporary

Ownership:

Barrier Systems

3333 Vaca Valley Pkwy, Ste. 800, Vacaville, CA 95688, USA

www.barriersystemsinc.com

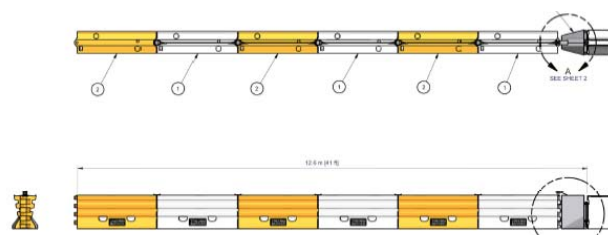
Supplier:

Ingal Civil Products

7 Nestor Drive, Meadowbrook QLD 4131

Ph: 3489 9120 Fax: 3489 9130

www.ingalcivil.com.au



Introduction:

The Triton Concrete End Treatment (CET) System is a portable water filled gating crash attenuator. It is available in a TL 2 configuration.

Test Level:

Restricted to use at work zones that are posted ≤ 70 km/h both during and outside work hours, with placement in higher speed zones subject to site specific risk assessment noting that the system may be used only where high speed side impacts are unlikely, penetration behind the barrier is acceptable and use of a redirecting impact attenuator (a crash cushion) is not feasible for reasons other than cost or convenience. Such a risk assessment would identify for example (among other things) the rationale for selecting this system as opposed to any other system and would include an indication of how operating speed is to be managed.

Note that configuration varies when intended for use in higher speed zones.

Recommended End Treatments:

Not Applicable.

Design:

Design

- Design to be in accordance with the Product Manual by Boylan Group.
- As the system is gating, a run-out area in accordance with the requirements of AS/NZS 3845 Figure F11 should be provided.

Configuration

TL-2

6 sections in length = 12.6m

No pedestals

First section empty

First section right side up

First section has no pedestal

If used beyond TL-2 conditions, configuration will vary – seek advice from supplier.

Offset from Trafficked Lane:

- The offset between the barrier and the travelled lane should be not less than 500 mm.

Installation and maintenance requirements:

- The product shall be installed and in accordance with the relevant Boylan Group Installation and Maintenance Manual.
- Every unit must be filled with water except the first.
- All units are to be connected by supplied connecting pins.
- The last unit is to be connected to the concrete barrier via the proprietary transition piece.

Designers are strongly encouraged to read the FHWA letters referred below.

Deflection:

Information has not been entered.

Limitations:

- As the system is non-redirective, a vehicle may penetrate the system. A run-out area in accordance with the requirements of AS3845 Figure F11 shall be provided.
- System shall not be used in a permanent application.
- Cannot be placed adjacent to kerbs or other objects, which may prevent lateral displacement.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Triton CET Installation and Maintenance Manual
- FHWA Letters ref. HSA-10/CC47A, HSA-10/CC-47B and HSSD/CC-47C

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Armorguard Gate

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Barrier Systems

3333 Vaca Valley Pkwy, Ste. 800, Vacaville, CA 95688, USA

www.barriersystemsinc.com

Supplier:

Australian Construction Products (ACP)

339 Horsley Road, Milperra, NSW 2214

Ph. 1800 724 172

www.acprod.com.au



Introduction:

Armorguard Gate is a hinged steel barrier "gate" to span between permanent openings in concrete barrier.



Test Level:

NCHRP Report 350 TL-3

Recommended End Treatments:

No end treatment as the gate is embedded into longitudinal barrier system.

Armorguard Gate

Page 2 of 2

Design:

May only be installed in a maximum total opening of 16m, including hinge sections.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
2,000	25	100	0.57	1

Note:

1 = NCHRP 350 3-21

Limitations:

May only be installed in a gap in rigid concrete barrier.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- NSW RMS Acceptance Document dated 03/08/2013
- FHWA letter Ref: HSA-10/B87

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

BG800 Steel Gate

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Page 1 of 2

Status*: Accepted

Status Commencement Date: Jun 2014

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Longitudinal

Sub Category: Semi-Rigid

Main Material: Steel

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective: Redirective

Permanent/Temporary: Permanent

Ownership:

Highway Care International

<http://www.highwaycareint.com>

Supplier:

Ingal Civil Products

7 Nestor Drive, Meadowbrook QLD 4131

Ph: 3489 9120 Fax: 3489 9130

www.ingalcivil.com.au



Introduction:

BarrierGuard 800 Steel Gate is a hinged steel barrier "gate" intended primarily to provide openings in permanent concrete barrier and to provide construction access in runs of temporary BarrierGuard 800.



Test Level:

NCHRP Report 350 TL-3

Recommended End Treatments:

No end treatment as the gate is embedded into longitudinal barrier system.

Design:

BarrierGuard 800 Steel Gate is a hinged steel gate comprising 6 metre and 12 metre sections of BarrierGuard 800 steel barrier with “T-Top” attachments.

The system is 540 mm wide, and 915 mm high.

The maximum length of gate is 30 metres (on the basis of operational manageability). The system is tested on longer lengths.

The system should be installed on smooth level ground. The intended sweep of the gate should be free from kerbs or rapid changes in gradient. Designer should check with supplier for site specific foundation requirements.

Deflection:

Measured (Crash Test) Deflections:

Nominal Mass (kg)	Nominal Angle (deg)	Nominal Speed (km/h)	Recorded Deflection (m)	Note
2,000	25	100	1.162	1

Note:

1 = NCHRP 350 3-21 test ref. BG807. This test comprised a 60 metre length of “free barrier” between anchors. Shorter lengths between ground anchors are likely to result in lower deflections. Designer should consult with supplier for performance of different configurations.

Limitations:

Wheels must be fully retracted when not in use.

Posted speed should be restricted to 40 km/h when gate is open unless exposed barrier ends can be otherwise shielded.

References:

- Australian Standard AS/NZS 3845
- NCHRP Report 350
- TMR Road Planning and Design Manual
- Austroads determination letter dated 14 March 2014
- NSW RMS Acceptance Document dated 14 March 2014
- FHWA letter Ref: HSSD/B-159 dated 8 May 2007
- BarrierGuard 800 Installation Manual – Laura Metaal, Version 2.6
- Austroads acceptance documents dated 06-Mar-2018 (Steel Gate)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

BIKER-SHIELD Motorcyclist Protection Device

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*:

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: **Motorcycle Rubrail**

Sub Category: **Other**

Main Material: **Steel**

Gating/Non-Gating: **Not Applicable**

Redirective/Non-Redirective: **Redirective**

Permanent/Temporary: **Permanent**

Ownership:

PASS+CO
Dortmunder Str. 8
57234 Wilnsdorf, Germany
www.passco.de/en/home/

Supplier:

Safe Direction
Unit 2, 5 Simpson Close
Smeaton Grange NSW 2567
Ph. 1300 063 220
www.safedirection.com.au



Introduction:

BIKER-SHIELD Motorcyclist Protection Device is a proprietary steel rub-rail attachment for RAMSHIELD w-beam guardrail designed to reduce the impact severity for motorcycle riders when colliding with a w-beam guardrail. Rider assessment is performed in accordance with EN1317-8.

Test Level:

Information has not been entered.

Recommended End Treatments:

The system does have terminals, which should be installed beyond the tangent point of any curved section of guardrail (i.e., on the straight).

Design:

Refer to:

- Product Manual,
- QTMR Road Planning and Design Manual 2nd Edition Volume 3 Part 6/Section 6.5.1.

System should not be attached to the components of any end treatment.

The surface beneath the system must be smooth and free of snag points, kerbs or obstructions that may interfere with the operation of the product.

Deflection:

Information has not been entered.

Limitations:

Information has not been entered.

References:

- Australian Standard AS/NZS 3845
- QTMR RPDM 2nd Edition Volume 3 Part 6
- SafeDirection letter dated 18-Dec-2018
- Biker-Shield Product and Installation manual, SafeDirection; Ref PM 025/0

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Hiasa Rail Motorcyclist Protection Device

Created: Monday, 29 April 2019

12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Jul 2015

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Motorcycle Rubrail

Sub Category: Other

Main Material: Other

Gating/Non-Gating: Not Applicable

Redirective/Non-Redirective:

Permanent/Temporary: Permanent

Ownership:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au

Supplier:

Australian Construction Products (ACP)
339 Horsley Road, Milperra, NSW 2214
Ph. 1800 724 172
www.acprod.com.au



Introduction:

Hiasa Rail Motorcyclist Protection Device is a proprietary steel rub-rail attachment for public domain w-beam guardrail, intended to reduce the severity of injury to errant motorcyclists, who might otherwise interact with guardrail posts.



Test Level:

Information has not been entered.

Recommended End Treatments:

The system does have terminals, which should be installed beyond the tangent point of any curved section of guardrail (i.e., on the straight).

Hiasa Rail Motorcyclist Protection Device

Page 2 of 2

Design:

Refer to:

- Product Manual,
- QTMR Road Panning and Design Manual 2nd Edition Volume 3 Part 6/Section 6.5.1.

System should not be attached to the components of any end treatment.

The surface beneath the system must be smooth and free of snag points, kerbs or obstructions that may interfere with the operation of the product.

Deflection:

Information has not been entered.

Limitations:

References:

- Australian Standard AS/NZS 3845
- QTMR RPDM 2nd Edition Volume 3 Part 6
- ACP letter dated 29-Jun-2015
- Austroads acceptance document (12-May-2015)
- Hiasa Rail manual (version June 2015)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Ingal MPR (Motorcyclist Protection Rail)

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12:59 PM

Page 1 of 2

Status*: Accepted

Status Commencement Date: Jul 2015

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: **Motorcycle Rubrail**

Sub Category: **Other**

Main Material: **Other**

Gating/Non-Gating: **Not Applicable**

Redirective/Non-Redirective:

Permanent/Temporary: **Permanent**

Ownership:

Ingal Civil Products
57-65 Airs Road, Minto, NSW 2566
Ph: 02 9827 3333
Fax: 02 9827 3300
www.ingalcivil.com.au

Supplier:

Ingal Civil Products
7 Nestor Drive, Meadowbrook QLD 4131
Ph: 3489 9120 Fax: 3489 9130
www.ingalcivil.com.au



Introduction:

Ingal MPR is a proprietary steel rub-rail attachment for both public domain w-beam guardrail and Ezy-Guard SMART, intended to reduce the severity of injury to errant motorcyclists, who might otherwise interact with guardrail posts.



Test Level:

Information has not been entered.

Recommended End Treatments:

The system does have terminals, which should be installed beyond the tangent point of any curved section of guardrail (i.e., on the straight).

Ingal MPR (Motorcyclist Protection Rail)

Page 2 of 2

Design:

Refer to:

- Product Manual,
- QTMR Road Panning and Design Manual 2nd Edition
Volume 3 Part 6/Section 6.5.1.

System should not be attached to the components of any end treatment.

The surface beneath the system must be smooth and free of snag points, kerbs or obstructions that may interfere with the operation of the product.

Deflection:

Information has not been entered.

Limitations:

References:

- AS/NZS 3845
- QTMR RPDm 2nd Edition Volume 3 Part 6
- Ingal letter dated 17-Jun-2015
- Ingal letter dated 18-Jan-2016
- Austroads acceptance document (8-Jan-2016)
- Ingal MPR manual (release 12/15)

Department of Transport and Main Roads

Road Safety Barrier Systems and End Treatments: Product Information Sheet

This information sheet shall be, where relevant, read in conjunction with the manufacturer's latest manual.

Raptor

THIS IS NOT A ROAD SAFETY BARRIER

Created: Monday, 29 April 2019

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Page 1 of 2

Status*: Accepted

Status Commencement Date: Not Set

Status Expiry Date*: Not Set

* TMR reserves the right to alter the Status and Status Expiry Date at any time. Always refer to latest version of TMR's Road Safety Barrier Systems and End Treatments document.

Category: Other

Sub Category: Other

Main Material: Other

Gating/Non-Gating:

Not Applicable

Redirective/Non-Redirective:

Non-Redirective

Permanent/Temporary:

Permanent

Ownership:

Valmont Highway Distribution
lbrown@valmonthighway.com

Supplier:

Valmont Highway Distribution
57-65 Airds Road, Minto, NSW 2566
Ph: 02 9814 1711
www.valmonthighway.com
Contact: Leigh Brown
Email: lbrown@valmonthighway.com



Introduction:

The RAPTOR is a proprietary plastic single point protector that may be used to shield high-risk utility poles or other single point hazards (e.g., trees) where conventional barrier systems may be impractical.

Variants:

Two variants exist:

- 2.46m x 1.15m x 1.05m (L x W x H) 300mm void
- 2.76m x 1.15m x 1.05m (L x W x H) 600mm void



Test Level:

Not Applicable.

Recommended End Treatments:

Not Applicable.

Design:**Installation:**

The supplier produces a Product Manual and an Installation Manual. Installers shall be cognizant of the contents of these manuals.

This device was deemed to be successfully tested using a small car (820kg) at 80 km/h outside of standardised testing arrangements. This device is accepted for use in the following application situation:

- urban environment, maximum design speed (or speed environment) 70 km/h, exposed single-point hazards with crash history where conventional barrier system is impractical or not warranted.

Subject to the above and subject to risk assessment this device may be appropriate for use in the following situations:

- Medians
- Gore areas
- Pedestrian use areas
- Cycle use areas

Deflection:

Not applicable.

Limitations:

This device cannot be used on crossfalls steeper than 10%.

This device should not be installed lower than 100mm below the road level.

This device is intended for use on closed systems, i.e., not for use on I-section or channel columns. The supplier should be consulted for site-specific advice when there is doubt about the shape of the hazard being shielded.

Soil at the post and ground anchor sites shall be compacted to not less than 95% relative compaction.

References: