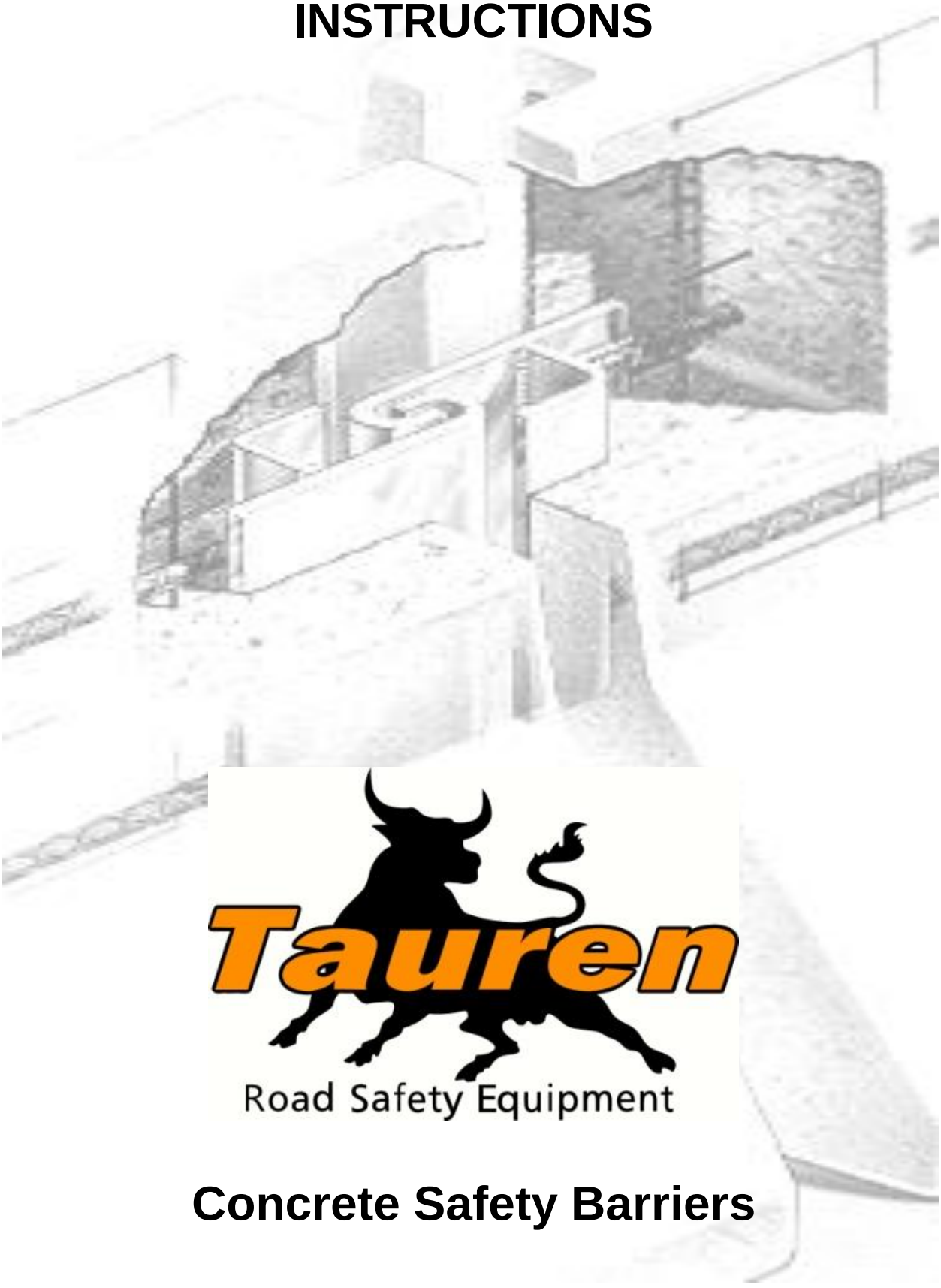
INSTALLATION & MAINTENANCE INSTRUCTIONS



Tauren

Road Safety Equipment

Concrete Safety Barriers

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IMPORTANT NOTES

1. **This manual must be read in conjunction with the Road Authorities guidelines, the site specific risk assessment and the traffic management plan for the worksite.**

2. **JJ Hooks® Safety Barriers are not warranted to prevent any injury or loss due to any accident howsoever caused but may significantly reduce the consequences of such an accident.**

3. **It is the responsibility of the end user to assess the risks associated with the use of (or the failure to use) a safety barrier system tested in accordance with the NCHRP Report 350 test methods, and with the particular site and traffic conditions for which barriers are being considered.**

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1. INTRODUCTION

The purpose of this document is to provide the end user of JJ Hooks® Safety Barrier Systems with installation and maintenance instructions to enable the barriers to be used safely and in accordance with NZTA standards, and with the requirements of the local road authority.

The JJ Hooks® Concrete Safety Barrier from Tauren Barriers Ltd is a precast reinforced concrete barrier incorporating the patented JJ Hooks® connection system. The barriers when placed on site form a continuous chain of positively interlocked safety barriers capable of accommodating varying horizontal and vertical alignments.

The JJ Hooks® Safety Barrier system has been tested to Test Level 3 (TL-3) of the United States National Cooperative Highway Research Program (NCHRP) Report 350.

It is recognised that in many instances where a safety barrier system is being considered, full TL-3 compliance may not be warranted. Examples include worksites where the traffic speeds are significantly less than 100 kph or where the possible angle of a crashing vehicle to the barrier is significantly less than 25°. For this reason the use of JJ Hooks® barriers in configurations other than those replicating the test configuration are not precluded by these instructions provided an appropriate hazard assessment has been performed by the end user.

2. DESIGN

Prior to the installation of any safety barrier system the end user should give consideration to a range of items, including, but not limited to:

- Site conditions, geometry and working width;
- The length of barrier to be installed and the safe termination of the system;
- Site access requirements, including emergency access;
- Any requirements for site screens, delineation, signage, etc.; and
- The results of any Risk Assessments undertaken for the project.

2.1 Site Conditions

JJ Hooks® Barriers must be placed on a flat, stable and compacted surface capable of being trafficked by road vehicles for short periods. The crossfall must not exceed 6%. Unstable surfaces such as deep mud, uncompacted sand or excessively wet surfaces are considered inappropriate. Ideally the surface should be paved and must be free of swales, ditches or other irregularities. The minimum width of stable ground behind the barriers must not be less than the expected deflection of the barrier system.

Barriers must be placed at the same level as the travelled lane and must not be placed in front, behind or on top of kerbing.

2.2 Site Geometry

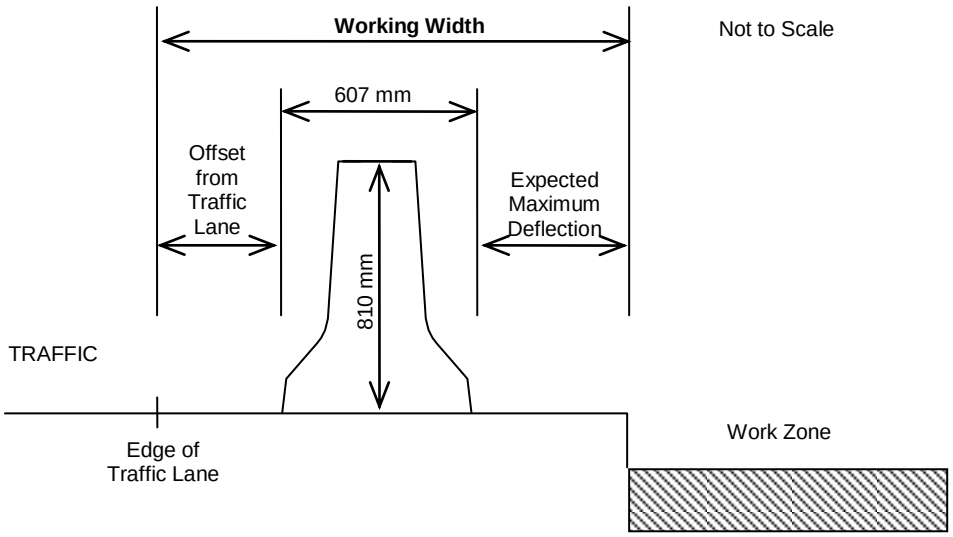
Barriers should (where practicable) be placed parallel to the travelled lane and as far away from the travelled lane as possible.

JJ Hooks® barriers are capable of a horizontal curvature of approx. 30 metres radius (left or right), and a vertical curvature of 30 metres radius in sag and 53 metres on a crest.

Barriers should be placed at the same level as the travelled lane and should not be placed in front, behind or on top of kerbing.

2.3 Working Width

The minimum working width required for the JJ Hooks® Barriers is the total of the width of the base of the barrier (being 606mm) plus the expected maximum deflection and the required offset from the edge of the traffic lane.



2.4 Atmospheric Conditions

JJ Hooks® barriers are suitable for use in all atmospheric conditions normally encountered on New Zealand roads without any reduction in effectiveness.

2.5 Emergency Access

Emergency access through JJ Hooks® barriers can be achieved by simply lifting the appropriate number of barriers vertically from the line and placing them to one side behind the remaining barriers. If the emergency opening is to be left open, appropriate measures must be taken to treat the exposed ends of the barriers.

2.6 Minimum Length

Minimum total length continuous string shall be 43.2m
12 x 3.6m units or 8 x 6m units as per NZTA requirements.

2.7 Terminating the Safety Barrier

The ends of safety barriers must be appropriately treated to avoid creating additional hazards.

A separate end treatment may not be required if the line of the barriers can be flared so that the exposed end is located outside the clear zone for the particular site. The width of the clear zone shall be as recommended by the local road authority. The flare rate should be not steeper than 10 to 1. Note: CoPTTM may require much shallower flare rates based on situation or conditions, CHECK before deployment.

Each type of end treatment has its own advantages and disadvantages and in some circumstances, new hazards may be created through their use. It is the responsibility of the user to assess the suitability of any end treatment to the site conditions. End treatments recommended by Tauren Barriers are described in Appendix 1.

Users should be aware that on a two lane two way carriageway, the departure end of a barrier system may require end treatment as it may be considered an approach end to the opposing traffic.

Barrier Ends Flared Beyond the Clear Zone

Wherever possible, the ends of the barrier system should be flared to place the blunt end beyond the clear zone. The width of the clear zone should be as recommended by the local road authority. The flare rate should be a minimum of 10:1 or as recommended by the local road authority. Refer to NZTA COPTTM

Proprietary End Treatments

Where it is not possible or practical to remove a blunt end beyond the clear zone, a proprietary end treatment such as the ABSORB 350 by Barrier Systems Inc. (pictured) should be installed. Any proprietary system used should be attached to the JJ Hooks® concrete barriers via an adaptor supplied by the manufacturer of the end treatment.

Proprietary end treatments fall essentially into two categories, gating and non-gating. A gating end treatment allows a vehicle impacting the nose or the side of the unit at an angle near the nose to pass through the device. Where a gating system is used, allowance must be made for a runoff area behind the device for any vehicle passing through the device. A non-gating or redirective device is capable of redirecting an errant vehicle along the line of the concrete barriers.

Gating systems tend to be cheaper to hire or purchase, and cheaper and easier to install. They are often water filled barriers that sit freely on the pavement with the concrete barriers.

Non gating redirective systems are more substantial and are often required to be pinned or bolted to the pavement or a footing. Some systems can be supplied with a precast concrete footing that requires excavation to install.

Any proprietary end treatment system used with the JJ Hooks® Barrier System must be specifically designed or adapted for use with AASHTO “F” shape barriers and must be installed and maintained strictly in accordance with the manufacturer’s instructions.

2.8 Delineation

Consideration should be given to the visibility of the barrier system during all climatic conditions. The provision of any one, or combination, of the following may assist in the delineation of both the barrier system and the travelled path:

- Pavement markings including but not limited to edge/fog line markings and painted lateral shift arrows;
- Raised Reflective Pavement Markers
- Corner cube reflectors; and
- Signage.

Tauren Barriers are able to supply, upon request, temporary reflective chevron markers which can be attached to the JJ Hooks® Barriers. The selection and spacing of the delineation should be in accordance with the Road Authority's guidelines, the site specific risk assessment and the traffic management plan for the worksite. Refer to COPTTM for specific requirements.

3. INSTALLATION

3.1 Resources Required

The following are the minimum resources required for the safe installation of JJ Hooks® barriers:

- 2 x 2.5 Tonne Swiftlift lifting clutches or equivalent for the 3.6m units
  or
  2 x 5.0 Tonne Swiftlift lifting clutches or equivalent for the 6.0m units;
- 1 x chain sling – ideally a 2 leg Grade 80, 10 mm chain sling;
- Tag/Control line (at discretion of dogman giving consideration to site layout, lifting procedure, etc.);
- 1 x Crane, Crane Truck, Hiab or plant with a certified lifting point capable of safely lifting the barrier at the required offset (standard 3.6 m barrier is 2.5 tonne, standard 6.0 m barrier is 4.3 tonne), capable of a vertical lift of 1 metre and with a clearance from hook to ground of at least 3.8 metres;
- Certified crane or plant operator;
- Dogman or crane chaser equipped with safety boots, gloves and any other PPE required at the particular site;
- Traffic control as appropriate to the site and as required by the local road authority.

3.2 Lifting Procedure

3.2.1. Pre Lift Inspection

Prior to lifting a JJ Hooks® Barrier the following items must be inspected:

- Lifting anchors for wear, corrosion, deformation or cracking.

  The lifting anchors are located in the top surface of each barrier, ¼ of the length of the barrier in from each end.

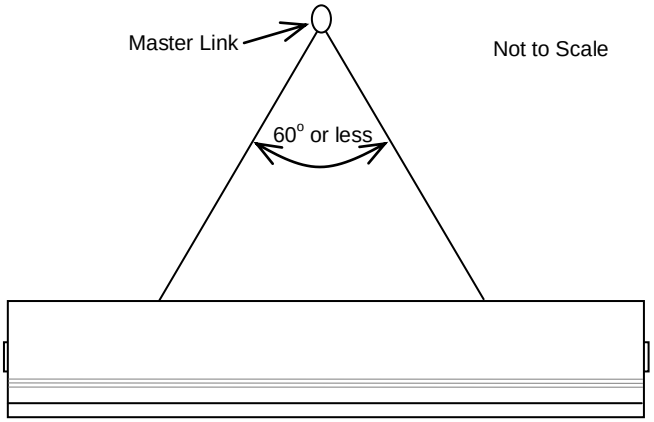
  Do not lift barriers using the swift lifts if wear or corrosion exceeds 10%, or if the swift lift is deformed or cracked.

- The JJ Hooks® Barrier for structural damage, signs of impact or cracking (excluding shrinkage cracks).
  Exercise due care when lifting barriers which show evidence of structural damage.

Note: JJ Hooks® Barriers contain reinforcing mesh providing a fully reinforced concrete product. Shrinkage cracking is normal and will not reduce the serviceability of the barrier or increase the risks associated with lifting the barrier.

3.2.2. Sling Angle

The lifting anchors used in all Tauren Barrier JJ Hooks® barriers have been designed for a maximum sling angle of 60°.



The easiest way to ensure that the sling angle is not exceeded is to make sure that each leg of the chain sling is longer than the distance between the lifting anchors. Alternatively you can measure from the top of the barrier to the underside of the Master Link prior to lifting the barrier. The minimum heights should be 1600mm for a 3.6m barriers and 2.6m for the 6.0m barriers.

3.2.3. Lifting

It is essential that:

- The lifting clutches, chains, etc. are attached by suitably trained and experienced operators and/or personnel.
- Only one barrier is lifted at a time.
- The tabs of the lifting clutches are aligned with the chain sling.
- The lifting point of the crane is positioned over the centre of the barrier prior to commencing the lift.
- Barriers are lifted evenly and remain horizontal.
- Barriers are lifted and positioned as smoothly as possible to avoid barrier damage and impact loading the lifting apparatus and crane.
- If the connection snags, stop the lift and either remove the debris causing the snag or adjust the chain sling.

Tag/control lines should be used whenever the dogman determines that the risks associated with rotation of the barriers outweigh those introduced by the use of a line.

3.3 Installation Sequence

Working in the direction of the traffic, commence the installation of the barriers at the approach end of the system and work through to the departure end.

Barriers should be installed sequentially to ensure that the correct installation spacing is achieved. If a gap is required within a run of barriers the barriers should be installed through and past the gap and then removed to create the gap. This will ensure that the barriers adjacent to the gap are appropriately spaced if the gap needs to be closed during the project.

End treatments on the approach side of barriers should be installed after the first barrier(s) have been placed.

Barriers should be removed in the reverse order.

3.4 Installation Procedure

- Ensure that appropriate temporary traffic management is in place for the barrier installation process. This may include, temporary road or lane closures, speed restrictions, etc.
- Set/mark out the barrier alignment;
- Attach lifting clutches to the lifting anchors cast in the top of the barriers;
- Attach a suitable chain sling to the lifting clutches and position the crane or lifting plant so that the hook or lifting point is directly above the centre of the barrier;
- Lift the first barrier into position;
- **Work from the non-trafficked side of the barrier(s) wherever possible, taking into account of entrapment hazards;**
- Lift each subsequent barrier into position - each barrier must be lifted high enough so that the bottom of the engaging hook is above the top of the hook on the preceding barrier (approx 320 mm above the ground). The chaser or dogman should first guide the engaging hook into the adjacent rebate and then move to the other end of the barrier to ensure the desired alignment is achieved.
- Barriers should be placed at their maximum separation to replicate test conditions;
- Visually inspect each installation ensuring there are no objects or ground conditions that cause the barrier joins to be uneven or twisted.

3.5 Maintenance

Under normal operating conditions JJ Hooks® barriers require no maintenance other than regular inspections for damage, removal of any litter or debris built up around the barriers and occasional cleaning if the visibility of the barriers is affected.

Where the barriers are placed for extended periods in locations where they are exposed to sea water, sea air or in areas where salt is used to control snow, the steel hooks should be regularly cleaned and inspected for signs of corrosion. Hooks showing signs of corrosion (other than surface discoloration) must be reported to Tauren Barriers so that the barriers can be assessed and replaced as necessary.

3.6 Incident Reporting

Incidents that result in significant damage to individual barriers or to the barrier system as a whole, **must be made safe,** and reported to Tauren Barriers for investigation.

4. COMPLIANCE ISSUES

4.1 Crash Test

The JJ Hooks® barrier system has been tested to the requirements of the NCHRP Report 350 Test Level 3 (TL-3) test 3-11. In the test, a 2050 kg vehicle travelling at 101 kph was crashed into a straight line of JJ Hooks® barriers at an angle of 25° to the line of the barriers. The barriers deflected laterally 1.3 metres. The tested barrier system consisted of 16 interlocked barriers which were struck at barrier 7 (numbered 1 to 16, approach to departure). The tested barriers were free standing on a concrete pavement and were not attached to the pavement in any way. The barrier system contained and redirected the vehicle, the vehicle did not penetrate, under-ride, nor override the installation.

4.2 New Zealand Standards

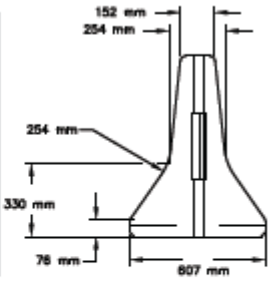
The JJ Hooks® barrier system meets NZTA Specified requirements that JJ Hooks having tested and passed the NCHRP350 Crash test requirements.

4.3 Estimated Deflections

In order to assist users in making an informed assessment of the hazards associated with the deflections of JJ Hooks® barrier systems, the estimated deflection is 1.2m from rear edge of barrier (100 km/hr, 2050kg vehicle, 25 degree angle)

APPENDIX 1. ROAD AUTHORITY APPROVALS

J-J HOOKS® CONCRETE BARRIER SYSTEM



SUMMARY	
SUPPLIER:	Tauren Barriers Ltd. (www.taurenbarriers.co.nz)
TEST LEVEL / CONDITIONS:	TL3. NCHRP-350 TL-3 (March 1999), MASH TL-3 (bolt down version only).
PRODUCT MANUAL	click for product manual download *current as at 24 Dec 2013. Tauren Barriers. Contact supplier for up-to-date manual
FOR USE WITH	TL-3 F-shape barrier profile only (not new jersey shape). Compliant end treatment and /or suitable barrier flare in accordance with CoPTTM

The J-J Hooks® concrete barrier joint system has FHWA approval and has been used in New Zealand as connection system for temporary concrete barrier units for temporary traffic management barrier systems for over 17 years.

This barrier system, like most temporary systems, relies on ribbon strength (connection of continuous strings of barriers) to generate absorption and redirection capability. The J-J Hook connections between barriers are key to this ribbon strength and they must be in good condition and robustly linked. Full contact with the road surface is also key as the friction of the barrier on the road is important for the function of the system.

This system does not require pinning or anchoring to the road surface.

TECHNICAL INFORMATION	
DIMENSIONS	3.6m length unit OR 6m length unit. 606mm width (base), 810mm height NOTE: 3.6m and 6m units can be used together interchangeably without any restrictions
WEIGHT	2400kg (3.6m unit), 4300kg (6m unit)
MINIMUM LENGTH	43.2m minimum total length continuous string (12 x 3.6m units or 8 x 6m units)
MINIMUM RADIUS	3.6m units - 30m horizontal radius, 30m vertical radius (sag curve), 53m vertical radius (crest curve)
GRADE OR PLACEMENT RESTRICTIONS	Not to be placed on 6% or more crossfall. Not to be placed on unstable (mud, un-compacted sand) ground or a surface where the full underside surface of the barrier is not in contact with the road surface). Barrier rotation - 7 degrees lateral per section, 4 degrees vertical per section.
DEFLECTION	1.2m from rear edge of barrier (100km/hr, 2050kg vehicle, 25° angle)
FLARE RATE	10V:1H maximum (for the system). NOTE: CoPTTM may require much shallower flare rates based on conditions or location
OTHER RESTRICTIONS / CONSIDERATIONS	▸ Not to be placed on, directly in front, or directly behind a kerb (if in front - deflection zone must be present behind. Behind kerb - minimum 3m rearward offset). ▸ Ensure safe and correct lifting and manoeuvring of barriers is undertaken. Barrier size and weight means heavy machinery/plant is required. Ensure product manual and expert advice is sought for installation/removal. ▸ Can be fitted with sight screens (on the non-traffic side). Refer to product manual.