

## **Shield I™ SAFETY BARRIER TL-1**

### **PRODUCT AND INSTALLATION MANUAL Version 1.1 2018**

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National Plastics Group T/A Barrier Systems may make changes to this Product Manual from time to time. Please check our website to ensure You have the current version of this product manual.

## Introduction

The Shield I™ is a temporary water filled barrier system. The system comprises the Shield I™ temporary longitudinal barrier and the Shield I™ terminal end system. The Shield I™ is compliant with the following Performance Specification.

- Manual for Assessing Safety Hardware 2009 (MASH 09) Test Level 1 (TL1).

The Shield I™ is the perfect solution whereby a temporary barrier is required to protect pedestrians and temporary work zones from traffic flow. This water filled temporary barrier is designed to safely contain and redirect errant vehicles travelling up to 50 km and impacting up to an angle of 25 degrees. While effective in redirecting errant vehicles, the medium weight barrier is easy to install and maintain to provide a seamless safety barrier for the protection of site and road work employees from errant vehicles.

The Shield I™ System comprises the Shield I™ temporary longitudinal barrier and the Shield I™ terminal end system.





## Product

The Shield I™ water filled temporary barrier system consists of an approximate 2.2 m (2.0m when installed) long plastic barrier segment with interlocking end sections which has a supporting hole at each end to accommodate a galvanised steel joining pin for connection to the next barrier segment.

The Shield I™ segments are manufactured from UV stabilised modified high density polyethylene (HDP) that provide a non-rigid and flexible vessel designed to accommodate water ballasting. Easy access filling points are provided in the top of each barrier with a drainage point in the base area.

Each segment has three interlocking lugs at one end and two at the opposing end. These lugs are then secured together with a galvanised steel pin to allow a degree of movement when impacted by an errant vehicle.

The front and rear faces of the barrier segments have HDP foam infill panel sections, covered by the same plastics material as the barrier itself. The infill panels are tensioned to each other by way of metal strapping to allow a smooth surface on the side face of the barrier.




The minimum Length of Need (LON) consists of 22 barrier segments filled with approximately 530 L of water with a total Length of Need of 44.0 m. The total nominal length of the barrier system, including terminal ends, is 52.0 m.

Fork lift access is provided for ease of handling. These forklift recesses also allow for water drainage under the barrier to prevent damming.

The Shield I™ system is proprietary product and manufactured with standard colours of Safety Orange length of need and Safety Yellow for the terminal end barrier segments.

## Components

For installation of the Shield I™, the following components are required (This includes the minimum Length of Need and 2 x Leading and Trailing Terminal Ends):

<b>Component</b>	<b>No. of items (per minimum LON)</b>	<b>Image</b>
Shield I™ Orange coloured Longitudinal barrier segment  (note; segment infill and strapping attached prior to purchase)	22	
Shield I™ Yellow coloured Terminal End barrier segment  (note; no segment infill or strapping)	4	
Shield I™ Joining Pin	25	

## Installation tools

For ease of installation, we recommend the use of a forklift. The segments are designed to allow a standard forklift forks to lift and manoeuvre the segment close to their final position. Some manual handling/pushing could be required to align the lugs and insert the joining pin.



## Minimum Length of Need

The minimum “Length of Need” (L.O.N) is the minimum length, excluding leading and trailing terminal ends, that when installed correctly, will enable a safety barrier system to achieve the level performance in accordance with its maximum specification.

Specifically, for the Shield I™, it is the minimum number of individual Shield I™ Longitudinal barrier segments that will safely contain and redirect an errant vehicle, when impacted under conditions equivalent to those specified for a MASH TL1 system.

The minimum L.O.N for the Shield I™ on a two-way road with a posted speed limit of 50 km/h and a clear zone for approaching traffic is 44 m. This comprises of 44 m or 22 x Shield I™ Orange coloured Longitudinal barrier segment. Each filled barrier segments must be filled with 530 L of water.

***Please note:** The actual “Length of Need” will differ according to each site and must be assessed during pre-installation site inspection by a qualified person.*

## Terminal Ends

In order to prevent the ends of the Shield I™ L.O.N forming a hazard to errant vehicles, the Shield I™ system must be installed with the Shield I™ temporary barrier terminal end system at the leading and trailing ends of the L.O.N.

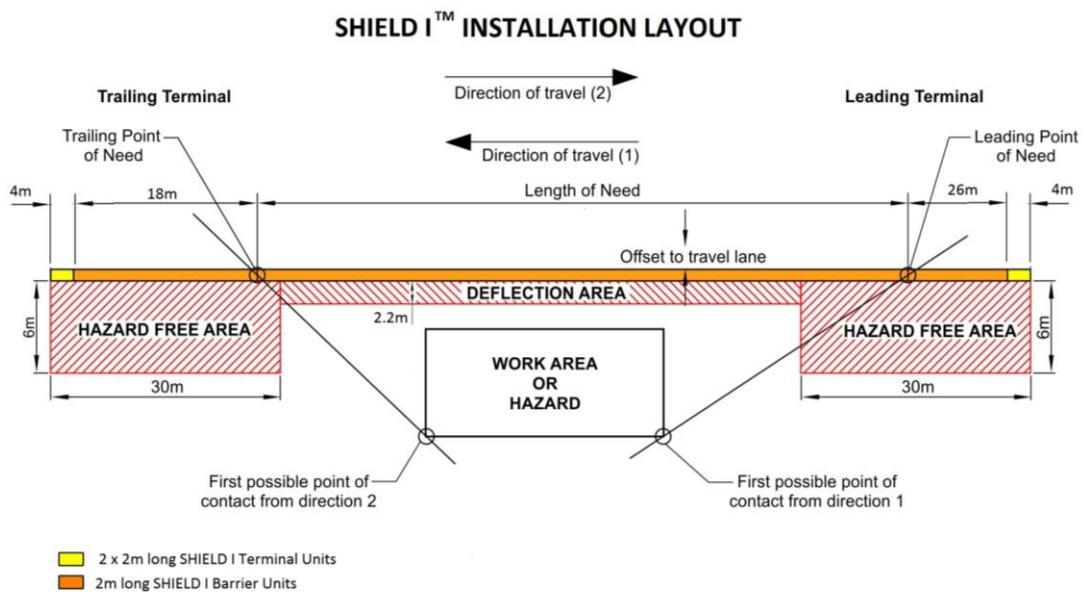
Each Shield I™ temporary barrier terminal end system consists of 4 m or 2 x Shield I™ Yellow coloured Terminal End barrier segments

When connected to either end of the L.O.N, the total minimum length of the barrier system is 52 m.

## Point of Need

The Point of Need is the first and last location along the barriers L.O.N where the installation, when installed correctly, is known to achieve the level of performance in accordance with its maximum specification. Specifically for a longitudinal safety barrier is it is first and last point at which the barrier becomes redirective. When considering a site installation, this is the location where the safety requirement point begins and ends, namely the position where the hazard / work zone should be located with respect to the barrier system.

For further details consult the road controlling authority guidelines for the state or territory where the barriers are to be used.



SHIELD I Layout Diagram

(Not to Scale)

*Diagram 1: Point of Need*

**Please note:** The actual “Point of Need” will differ according to each site and must be assessed during pre-installation site inspection.



## Working Width

The minimum working width for the Shield I™, when impacted at 50 km per hour or less, is 2.19 meters measured from the back of barrier non traffic side or 2.79 meters measured from the front of barrier or traffic side. When installed correctly, this is the worst case, potential lateral movement for the Shield I™ under MASH test level 1 performance conditions.

When considering the installation, this is the minimum clear zone behind the barrier and must be free of any hazards or workzone areas.

***Please note:** Any hazards within this zone such as kerbs, channels or slopes may limit the lateral movement of the barrier during an impact with an errant vehicle and prevent the Shield I™ barrier from functioning properly.*

## Loading Barriers

Barriers can be loaded with crane truck or forklift.



## Install Considerations and Variables

Each site application using the Shield I™ barriers will be unique and will require a site assessment by suitably qualified personal prior to installation. This is needed to establish curves, slopes – cross and length, curbing, crests, sags, and other conditions specific to the individual site conditions and requirements. A pre installation site inspection and assessment should also account for the surface type and condition and review features such as soft ground, rock, wetness and other possible adverse site factors.

Prior to installation please check the following:

1. There are sufficient barrier segments for minimum Length-of-Need
2. The Point of Need is clearly established
3. Maximum Flare and Flare rates may be achieved
4. The site has a suitable Installation Surface (see below)
5. The Slopes and Curves of the installation do not exceed the maximum specifications (see below)
6. Minimum Working Width Clear Zone must be achieved
7. Terminal End Clear zone as per diagram 1.
8. Potential clashes with utilities and drainage are avoided,
9. Potential run off of water into existing water systems avoided

The data supplied below is provided as a guide for standard installation conditions. For installation configurations or surfaces outside those considered standard, please contact National Plastics Group. These include but are not limited to, surfaces with significantly different coefficients of friction or installation configuration.

### **INSTALLATION SURFACE**

Asphalt or surfaces with friction properties equal to or less than that of asphalt, such as concrete deck or compacted gravel surfaces.

### **CURVES or RADIUS**

8 degrees per join or 28.6M curvature.

### **CROSS SLOPES**

5 % (max)

### **LONGITUDINAL SLOPES**

5 % (max)

### **CURBING/CHANNELS/UPSTAND**

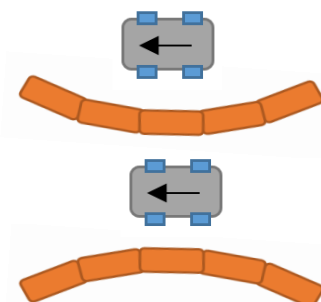
Positioned at least 2.19 m (Working Width) from back face of barrier

### **SAG VERTICAL CURVE**

1V:20H (max)

### **CREST VERTICAL CURVE**

1V:20H (max)





## Flare and Flare Rates

The “Flare” is the change in the offset of the barrier system to move it further from the travelled way or closer to the travelled way.

The “Flare Rate” is the ratio of the longitudinal distance to the traverse offset by which a barrier system flares away from or towards the edge of the travelled way.

The Shield I™ safety barrier system underwent a range of impact tests at 50 kph and the relevant rates for this speed as determined under MASH 09 Test Level 1 are shown below:

<b>Speed in kph</b>	<b>Offside distance to shy line</b>	<b>Nearside distance to shy line</b>	<b>Barrier system inside shy line</b>	<b>Barrier system beyond shy line</b>
<b>50</b>	<b>1.5 metres</b>	<b>1.0 metres</b>	<b>1:15</b>	<b>1:10</b>

Flare rates should not differentiate between permanent and temporary installations, however, for short term installations (a few weeks) or where the traffic volumes are very small, a flare rate of as high as 1:5 may be adopted.

Flares at the appropriate flare rates may be used instead of a terminal, provided the flare extends beyond the clear zone.

## Interfacing or Transition to/or from Rigid Barriers

Requirements relating to the interfacing or transition from rigid barriers to non-rigid are typically stated within the local state road agency guidelines and can vary from state to state. The Shield I™ Safety Barrier System is designed to safely contain and redirect errant vehicles away from roadside hazards, pedestrians or road workers.

Where required to transition from a rigid to a non-rigid barrier, we recommend a minimum of 13 Shield I™ Safety Barrier segments to the point of need (PON) or transition.

The Interfacing is the length of a road safety barrier system used to connect systems with different operating characteristics. Typically used to connect a non-rigid (eg. water filled temporary barrier) to a rigid road safety barrier system (eg. bridge safety barrier). Under the test results AS/NZS 3845:2015, the Shield I™ system was determined to have a length of need of 44 metres or 22 barriers, with a working width of 2.19 metres and 4 metres or 2 barrier segments at each terminal end.

Provided that this minimum length of need is installed with the centre point (i.e. 13 metres or 6 barriers) in line with the end of the connecting system with a minimum gap of 2.19 metres between the 2 systems, the Shield I™ can be installed as an interfacing system – see diagram below:

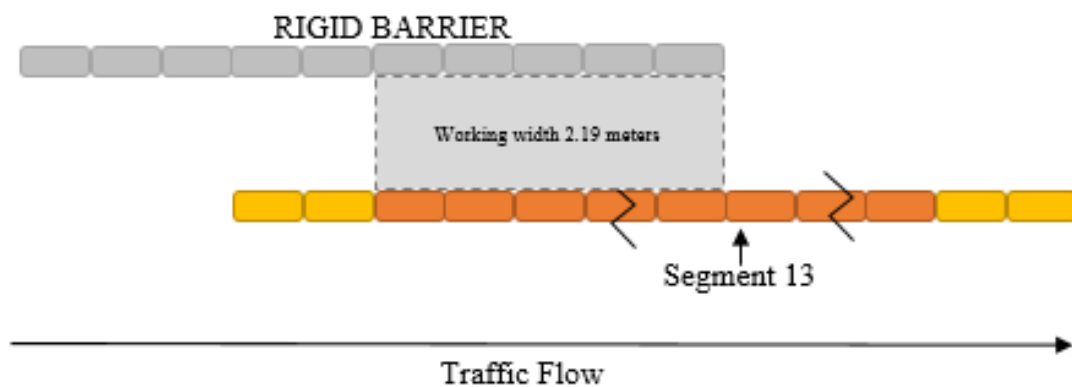


Diagram 2: Interfacing or transition



## Specifications

The National Plastics Shield I™ water filled temporary barrier system has been designed as a MASH09 Test Level 1 water filled temporary barrier.

### **Plastic Segment**

The barrier system consists of an approximate 2.2 m (2.0 m when installed) long hollow UV stabilised modified rotomoulded high density polyethylene (HDP) plastic barrier segments, with interlocking end sections which has a supporting hole at each end to accommodate a joining pin for connection to the next barrier segment.

Length	
- Individual length	2200 mm
- Installed length	2000 mm
Width	600 mm
Height	920 mm
Wall thickness	8.0 mm
Weight	
- Empty	72 kg

The barrier is formed in accordance with AS/NZS 3845:2015-1 or equivalent Standard, with a thickness mass of 10900 g/m<sup>2</sup>.

All Shield I™ Safety Barriers are manufactured using the highest quality virgin materials, and carry a full manufactures warranty against faulty materials and workmanship.

### **Joining Pin**

The Shield I™ joining pins connecting the barrier modules were manufactured from 60.3 mm diameter (outer) x 940 mm long galvanised steel. Each pin was fitted with a welded flat metal top cap. The Shield I™ is manufactured from steel in accordance with AS/NZS 1163 or equivalent Standard.

Length	940 mm
Diameter (outer)	60.3 mm
Thickness	4.5 mm
Weight	4.2 kgs



### **Segment Infill**

The front and rear faces of the Shield I™ barrier segments have hard foam infill panel sections, covered by the same plastics material as the barrier itself. The infill panels are tensioned to each other by way of metal strapping.

The Shield I™ infill is manufactured from Rigid Low Density Polyurethane Foam (AUE276) in accordance with AS/NZS or equivalent Standard. Foam test density is 42.1 kg/m<sup>3</sup>.

The overall dimensions of the finished infill are:

Thickness	550 mm
Density	42.1 kg/m <sup>3</sup>
Foam Weight	9kg

### **Segment Strapping**

The segment strapping serves the purpose of attaching the infill to the exterior of the segment and is covered with the same HDP material. The strapping is manufactured from 19mm high tensile steel/stainless steel in accordance with AS/NZS 2400-13 or equivalent Standard. Minimum thickness is to be 0.5 mm.

The overall dimensions of the finished strapping are:

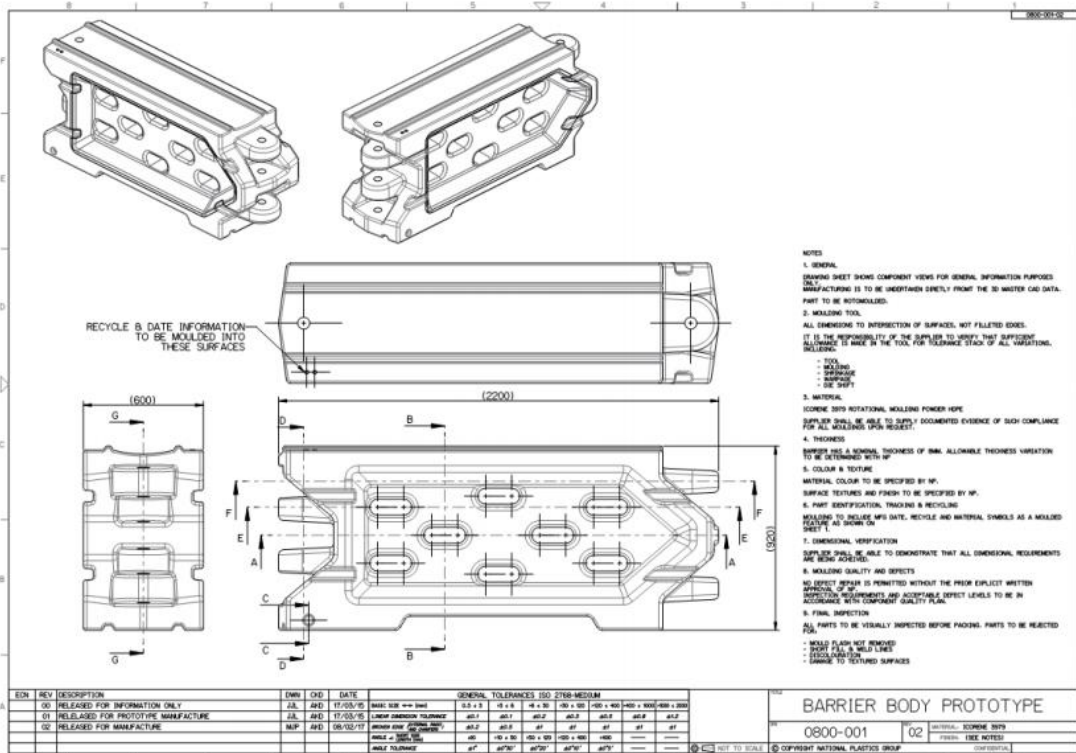
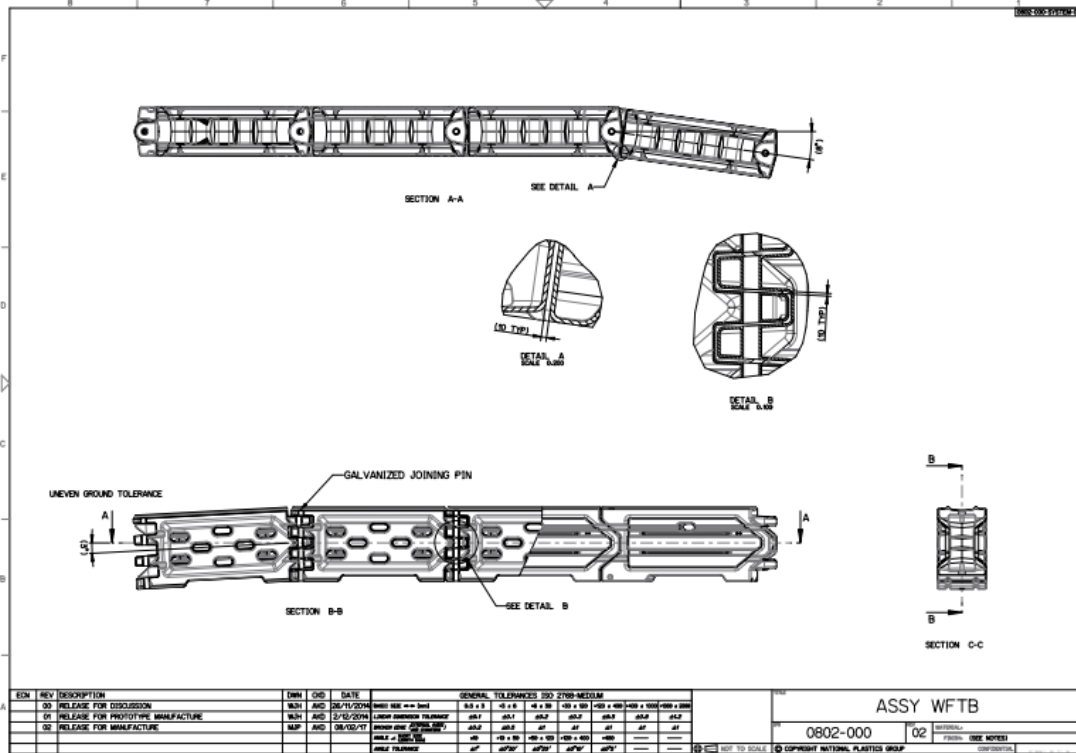
Length	19 mm
Thickness	0.5 mm

### **Segment Plug**

The plugs are made from HDP with a rubber gasket ring. They are 50 mm in diameter with one plug per segment.

<b>Total Barrier Weight</b>	<b>81kg</b>
<b>Water Capacity</b>	<b>530Lt</b>
<b>Total Weight when filled</b>	<b>611kg</b>

## Drawings



## Safety Information

All personnel installing and maintaining the Shield I™ water filled barrier system must wear appropriate safety clothing and accessories as stated by the relevant local employment and safety standards. This includes, but not limited to:

- High visibility vests or jacket
- Hard hat or sun hat
- Protective footwear eg. steel cap shoes or boots
- Gloves

## Installation Instructions

Prior to the installation of any water filled temporary barrier, a site inspection must be conducted by a qualified Shield I™ Barrier System installer, taking into account the proposed location, length of need and working width required of the barrier system. Once approved, the steps required to install the Shield I™ Barrier System include:

Step 1. Mark the required location either using a string line or spray paint.

Step 2. Starting upstream of the Point of Need, place the first Shield I™ temporary safety terminal end in the required position with the two interlocking lugs facing upstream (facing oncoming traffic).



Step 3. Slide the second Shield I™ temporary barrier terminal end into position interlocking the two lugs with the first segments opposing three lugs.

- Step 4. Insert the Joining Pin between the first and second terminal end accordingly.



- Step 5. Once the terminal end is completed, continue the same process (step 3 and 4) with the longitudinal barrier then the downstream terminal end.

- Step 6. Check the positioning of the barrier and all lugs are interconnected with joining pins inserted accordingly.

- Step 7. Pour 530 L of water into each longitudinal segment (orange colour) accordingly working downstream from the first longitudinal segment. The barrier system must be ballasted with water and should be filled through the top access hole to the top. In freezing temperatures, an anti-freeze solution may be added to the water ballast to avoid icing.

***Please note:*** The correct installation and ballasting procedures stated above must be followed, to allow the system to properly fulfil its function.

- On completion of the installation, a confirmation inspection should be carried out to ensure that the pins are correctly in position and barriers are filled with water.



- The plastic cap attached to each barrier should be snapped into position into the water access hole.
- Following water ballasting check the drainage bung, which are positioned at the bottom of each barrier, for water leaks and tighten if required.

## Dismantling or Removing the System

Following completion of the site works or need the Shield I™ safety barrier system can be easily dismantled as follows:

- Step 1. Commence by removing the downstream terminal end removing the connected joining pin then sliding out the terminal end barrier segment to allow the lugs to dislodge. Place the terminal end barrier segments and joining pins on the truck accordingly.
- Step 2. Once the downstream terminal ends has been removed, remove the plug positioned at the bottom of upstream longitudinal barrier segment to drain the water. Complete drainage of one barrier takes approximately 3.5 minutes.
- Step 3. When the upstream longitudinal barrier segment has been emptied, remove the joining pin and slide out the barrier segment dislodging the lugs. Place the longitudinal barrier segment and joining pin on the truck accordingly.
- Step 4. Continue step 3 working upstream (towards oncoming traffic) until all temporary barriers segments have been removed.



## Maintenance and Repair

Regular inspection and maintenance procedures of the Shield I™ system are required to ensure the continuing safety of the system, road users and pedestrians:

- The correct water content can be confirmed by visual inspection. Lift cap on the top of each barrier to check water is at the top. If the water level is not at the top, determine the reason and either replenish the water or replace the damaged segment.
- Damaged barrier segments should be removed immediately by remove the plug, positioned at the bottom of the barrier segment, to drain the water. Remove the joining pin downstream then upstream. Slide the damaged barrier segment out and slide the new barrier segment into position. Re-insert the Joining Pins both upstream and downstream then fill the new barrier segment with 530 L of water.
- A visual inspection should be conducted to confirm the correct placement, usage of the system and that each joining pin is in position.
- General cleaning of the barrier system can be carried out when required with water and commercial detergents with high pressure hoses.

***Please note:*** The above process can also be followed to gain emergency access to the protected site.



## Limitations and Warnings

A full site inspection, audit and risk analysis is required, taking into account site conditions and complexities prior to the planning and installation of a Shield I™ safety barrier system.

### *Speed*

The National Plastics Shield I™ water filled temporary barrier system is capable of preventing the penetration, vaulting, under-riding or overriding of impacting errant vehicles under MASH09 Test Level 1 evaluation criteria. Impact in excess of 50 km per hour or site conditions inferior to that included in the test programme, may result in vehicle penetration, vaulting or overriding the barrier system.

### *Installation surface*

There are no in-ground components of the National Plastics Shield I™ water filled temporary barrier system or terminal end. The performance of the system is defined by the friction between the system and the ground surface. Different deflections are likely with the system when installed on surfaces with different coefficients of friction when compared to the test surface.

### *Flood damage, obstruction of floodwater, collection of debris.*

The large clearance area in the footings of the National Plastics Shield I™ water filled temporary barrier allows water and small to medium debris to flow easily beneath the segments. A visual inspection is recommended in flood prone areas. Any significant debris can simply be removed by emptying the water from desired section, removing the barrier from affected area and creating easy access for debris removal.

### *Environment (Toxicity, environmental harm, disposal)*

The National Plastics Shield I™ water filled temporary barrier system does not present any immediate environment harm with no environmental contaminates emitted in a cured state. The water contained within the barrier should be natural with no chemicals or other additives, however care must be taken in the disposal of water following barrier operation to ensure minimal run off into existing water systems. Disposal of barrier segment at the end of life should be within local guidelines and in accordance with National Plastics Shield I™ water filled temporary barrier Product Manual.



### *Effects of fire on system performance.*

The National Plastics Shield I™ water filled temporary barrier system is manufactured from rotomoulded UV stabilised modified high density polyethylene (HDP) with a nominal 8.0 mm wall thickness and using a 940 mm long galvanised steel joining pin. All components are not combustible during fire and have limited potential for fire damage.

A physically inspection should be completed on each barrier segments after a fire to ascertain if any damage has occurred and confirm the required water is contained within each segment. Failure to do may impede the barriers performance on impact from an errant vehicle.

## **Contact Details**

For additional information on the use of the Shield I™ safety barrier, please contact us on **1800 677 003** (within Australia).

The Shield I™ barrier is proudly manufactured in Australia by:

**National Plastics Group  
5 Christensen Road  
Stapylton QLD 4207**

Please ensure that this manual is reviewed prior to the deployment of the barrier system, and ensure proper performance of the system, installation, care and maintenance programmes, and the enclosed should be followed.



## **APPENDIX A: Term Definitions**

### **Crash**

An event or series of events resulting from a vehicle colliding with another person or object, likely to cause property damage, serious injury or death to the vehicle occupants or to persons struck.

### **Crash testing**

Conducting a series of full scale impact tests on a road safety barrier system in accordance with recommended guidelines, e.g. MASH is appropriate.

### **Dynamic deflection**

The largest transverse deflection of a road safety barrier system recorded during an actual crash or during a full scale impact test.

### **End treatment**

The collective term for devices and features at the leading and trailing ends of the road safety barrier systems, which are selected on the basis of traffic speed and composition, the type of road barrier system and the particular site constraints.

### **Flare**

Change in the offset of a road safety barrier to move it further away from the travelled way.

### **Flare rate**

Ratio of the longitudinal distance to the transverse offset by which a road safety barrier system flares away from, or towards, the edge of the travelled way. It can be expressed as a percentage.

### **Gating terminals**

Terminals that are designed to break away, pivot or hinge and allow the vehicle to pass through when impacted at an angle to the end, or at a point upstream of the beginning of the length of the associated road safety barrier system.

### **Interface**

The length of road safety barrier systems used to connect systems with different operating characteristics. It is commonly used to a rigid road safety barrier system such as a bridge safety barrier.

### **Length of need (LON)**

The length of road safety barrier system, excluding leading or trailing terminals, needed to prevent errant vehicles colliding with a roadside hazard.

### **Longitudinal road safety barrier system**

A road safety barrier system whose primary function is to prevent penetration and to safely redirect an errant vehicle away from a nearside or offside hazard.



### **Manufacturer**

The team that manufactures all the components of a recognised road safety barrier system, and supplies it to a site for erection.

### **Non gating terminals**

Terminals that are designed to redirect a vehicle and absorb part of the energy of an impacting vehicle at any point along the terminal without allowing it to pass behind the road safety barrier system.

### **Non rigid road safety barrier system**

A road safety barrier system where elements are designed to move substantially in a crash, and where energy is absorbed by movement of the road safety barrier system and deformation of the vehicle.

### **Proprietary system**

A road safety barrier system that is the subject of patent or other intellectual property rights within Australia and New Zealand.

### **Rigid road safety barrier system**

A road safety barrier system where there is no dynamic deflection. The deformation is contained in the impacting vehicle.

### **Risk analysis**

The systematic use of available information to determine how often specified events may occur and the magnitude of their likely consequences.

### **Risk management**

The systematic application of management policies, procedures and practises to the tasks of identifying, analysing, assessing, treating and monitoring risk.

### **Shy line**

The distance from the edge of the travelled way beyond which a roadside object will not be perceived as an immediate hazard by the typical driver, to the extent that they will not change their vehicle's placement or speed.

### **Terminal end (see also End Treatment)**

The collective term for devices and features at the leading and trailing ends of the road safety barrier systems, which are selected on the basis of traffic speed and composition, the type of road barrier system and the particular site constraints