Defender 70™

MASH TL-2

Temporary Steel Safety Barrier

Free-Standing

Product Design and Installation Manual

Safe Barriers Pte. Ltd.
Reference: D100LDS-M-1804
April 18
# REVISION HISTORY

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<th>Rev No.</th>
<th>Author</th>
<th>Reviewed/Approved</th>
<th>Description</th>
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<td>C. Lee</td>
<td>R. Hood</td>
<td>Draft Issue</td>
<td>30 April 2017</td>
</tr>
<tr>
<td>2</td>
<td>C. Lee</td>
<td>R. Hood</td>
<td>Ver 1.0</td>
<td>28 June 2017</td>
</tr>
<tr>
<td>3</td>
<td>D. Moule</td>
<td>R. Hood</td>
<td>Ver 2.0</td>
<td>14 March 2018</td>
</tr>
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Advice for your Safety

Ensuring all handlers of the product detailed within this installation manual are aware of the potential hazards that could arise while using this product, the guidelines set forth within ASNIZ535 series standards are identified and displayed where appropriate to show the activities potential severity.

Safety Alert Symbol

This symbol is to alert you to potential personal injury hazards. All safety messages that have this image attached shall be followed to ensure injury and death do not occur.

DANGER Symbol

This symbol defines a situation that is hazardous and which, if cannot be avoided, will result in death or serious injury.

WARNING Symbol

This symbol defines a situation that is hazardous and which, if cannot be avoided, could result in death or serious injury.

CAUTION Symbol

This symbol defines a situation that is hazardous and which, if cannot be avoided, may result in minor or moderate injury.

NOTICE Symbol

This symbol defines a situation that could potentially result in non-personal injury. i.e. property damage.
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1. Introduction

1.1. System Overview

The Defender 70™ is a steel safety barrier that is made of hot dip galvanised steel and is intended for use as a temporary barrier system for the protection of workers and motorists within and through a work zone. The barrier is free standing, with tested free standing end terminals.

The secure connection of the Defender 70™ units is made by interlocking the Male and Female end units together with the insertion of a connection pin to secure each unit in place. The cross section of the unit is detailed within Figure 1.1 below and consists of a 680mm width base with an 800mm height which results in a centre of gravity at 379mm ensuring that during an impact, the stability of the barrier will resist any overturn moment during certification tests. Each single unit is 3959mm in length, with an effective barrier length of 3900mm and weighs 320kg, with the addition of the concrete ballast each unit weighs 1,040kg, or 266.67kg per lineal meter.

![Figure 1.1: Defender 70™ Cross Section](image)

The Defender 70™ has undergone the crash tests required by MASH 16 and AS/NZS3845:2015 for safety barriers, as well as both the mandatory and optional tests for transitions from the safety barrier to the end terminal. A more detailed description and crash test results are detailed within Section 2.3. The system can also be installed in one (1) configuration:

- Free Standing system with ABSORB End Terminals at each end
The Defender 70™ requires the addition of Ballast Boxes which are filled with concrete to give the barrier additional mass. The addition of mass to the barrier removes the requirement for anchor pins.

Figure 1.2 below shows the general arrangement of the Defender Barrier™ System before test 2-11.

![Image of Barrier Installation Setup for 2-11 Crash Test]

**Figure 1.2: Barrier Installation Setup for 2-11 Crash Test**

### 1.2. Delineation

Barrier installations, whether they be permanent or temporary, may require delineation to be attached for the duration of the installation. The type/shape/colour of this delineation will vary dependant on the local regulatory requirements. Each governing body has their own requirements for delineator placement and should be consulted prior to installation.

---

**CAUTION**

No modifications are to be made to the skin of the barrier without prior approval from the manufacturer.
1.3. Important Notes

Defender 70™ must be installed in accordance with Austroads Safety Barrier Acceptance conditions in Appendix D of this manual. Proper site design and deployment of the Defender 70™ is essential to assure performance. If you have any questions about the deployment of the Defender 70™ please contact Safe Barriers before deploying the barrier.

WARNING Incorrect installations can lead to outcomes different from the laboratory certification test outcomes.
2. Design and Performance

2.1. Barrier Design

2.1.1. Physical Barrier Design

The standard barrier unit, as detailed within Section 1.2 above, has an effective barrier length of 3900mm with a base width of 680mm and a height of 800mm. The units are connected using male to female connections with an additional connecting pin through the centre of the joint assembly to ensure a secure connection.

The lifting points are located within the slots in the top rail which allow access to the lifting plates. The lifting plate has a dual purpose, firstly, to ensure structural capacity when lifting and manoeuvring the barrier into place and secondly, to increase structural capacity of the system during an impact. All of these components and the general construction of the barrier unit can be found within Appendix A.

2.1.2. Alignment Design

Horizontal Design

The Defender Barrier™ system can be installed to accommodate a minimum horizontal curvature of 230m. This curvature is accommodated by the end plate assembly connection containing up to 1.0 degree of horizontal movement per joint. This movement allows each section to create a bend in the alignment resulting in the ability to curve the barrier along the roadway to accommodate the road environment.

The sliding/pulling of the units to achieve the required radius can potentially damage the barrier and/or roadway. Care must be taken during this process.

Vertical Design

The Defender Barrier™ can accommodate a minimum vertical curve radius of 230m within the roadway. This is due to the short individual sections (3.9m each) and their connections which contain 1.0 degree of vertical allowance at each joint.

Cross Slope Design

The Defender Barrier™ can accommodate a maximum cross slope of 10% or 5 degrees.

2.1.3. Clear Zone, Offset and Deflection Requirements

The clear zone is the horizontal distance behind the barrier that is required to support the unobstructed movement of the barrier during an impact. The rear toe of the barrier should be clear of all obstructions, embankments, kerbing and any other object that will impede the sliding movement of the barrier during an impact. In the case of the Defender 70™ system, this measurement is also equal to the design deflection that has been obtained during the required
crash testing of the product. These crash tests have been conducted with the purpose of obtaining the physical deflections that occur during a design impact.

The incorrect design and placement of the barrier system can result in outcomes different from the laboratory tested outcomes.

2.2. Barrier Installation

There is one (1) configuration (as described earlier) in which the Defender 70™ System can be installed. This configuration requires the use of ABSORB® crash cushion.

2.2.1. The Free Standing System Installation

The inclusion of ballast to the system eliminates the need for the barrier to be anchored. This ballast system requires the insertion of three (3) ballast boxes (see Appendix A) to be inserted into the hollow of the standard barrier unit (see Figure 2.1 below). The ballast boxes are connected with M16 bolts, when the barrier is in use the ballast boxes sit on the ground.

Before loading and shipping, the ballast system connection must be checked to ensure that the bolts are tight. All bolts are supplied with Lock-Tite. Each barrier unit including ballast is 1,040 Kg.

Care to be taken during the un/loading process as the ballast could potentially become loose during shipping.
2.2.2. Installation Termination and Crash Cushions

The Defender 70™ System has been designed to accommodate the following end treatment:

- ABSORB® 350 End Terminal

**Crash Cushions – End Terminal**

Crash cushions can be used for both uni-directional and bi-directional traffic flows. The ABSORB® crash cushion has been designed and crash tested for use with the Defender 70™ system. Figure 2.2 below shows the ABSORB® crash cushion. The connections and transition details can be found within Appendix B. The use of a terminal system will be required on both approach and departure ends of the barrier.
2.3. Barrier Performance

2.3.1. Point of Need

The tested length of Defender 70™ is twenty-seven (27) barrier segments or 105.3m. The tested impact point for Length of Need (Point of Need) is at Barrier 10 or 39.0m from the beginning of the barrier run.

In all Defender 70™ installations the inclusion of the ABSORB® 350 crash cushion requires a 6m x 22.5m clear zone behind the ABSORB® crash cushion.
2.3.2. Length of Need Deflection

The following table outlines the clear zone requirements for the Defender 70™.

Table 2.1: Design Deflection Table

<table>
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<tr>
<th>MASH16 Deflection Table</th>
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<tr>
<td></td>
<td>70kph</td>
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<td></td>
<td>25°</td>
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<tr>
<td></td>
<td>1.20m</td>
</tr>
</tbody>
</table>

The above deflection value is the tested deflection on the Length of Need of the Defender 70™.

2.4. Pavement Conditions and Anchorage Requirements

2.4.1. Pavement Conditions

The Defender 70™ System has been tested while sitting atop a standard asphalt surface. There are no anchors required for the Defender 70™ System.
2.4.2. **Anchorage**

The Defender 70™ System does not require anchorage.
3. Installation Procedure

3.1 Planning

When planning the job it is essential that the following points are established and agreed with the contractor:

- The start, finish and alignment of the Defender 70™
- Any curvature of the Defender 70™ in both the horizontal and vertical planes
- There is sufficient clearance from overhead cables to allow lifting
- There is adequate working room and safety zone during installation

3.2 Lifting and Loading

Each barrier unit contains two (2) lifting plates, 1350mm apart. These lifting plates are equally spaced along the barrier length to ensure adequate weight distribution during the lift and can be found where the open slots are along the top of the barrier, as shown in Figure 3.1 (right). Alternatively, when using a forklift to transport the barrier, the forklift prongs can be used within the drainage slots to lift the barrier and manoeuvre into place.

![Figure 3.1: Top Rail Slot with Lifting Plate](image-url)
Figure 3.2 below shows a fully loaded truck with the maximum number of layers available for transport. Generally, a standard transportation vehicle (19m flat-bed semi-trailer) will be able to accommodate three (3) layers consisting of three (3) units per layer. This typical stack can be mounted on a standard truck three (3) times resulting in a maximum of 27 units per delivery. These 27 units will enable up to a 105.3m length of run per delivery vehicle.

This loading configuration will result in a width of approximately 2.04m with 800mm height per layer. The overall height of the loaded vehicle will vary depending upon the trailer height. In addition to the barrier, and in accordance with Australian transportation requirements, layers of steal cannot be transported without non-metal separation. In this case, the usage of 100mm x 100mm timber dunnage is recommended, however the use of other non-metal separation material is acceptable.

3.3 Loading – Unloading Sequence

The loading of each layer consists of identifying the deployment start point. Deployment from leading terminal (this is the standard). The Defender 70™ units are loaded with the MALE end to the rear of the truck and the FEMALE end toward the front of the truck.

1. Base layer of 9 units is loaded
2. Timber dunnage is installed
3. 2\textsuperscript{nd} layer of 9 units is loaded
4. Timber dunnage is installed
5. **3rd** layer of 9 units is loaded

The unloading of the truck is done from the rear and done by unloading the full layer, then moving to the 2nd layer, and finally the bottom layer.

**WARNING**

When un/loading ensure site safety rules are adhered. Special consideration should be given to the proximity of overhead cables, slings/chains can lift the weight and have been serviced.

The site engineer shall be contacted prior to loading to ensure the correct arrangement is used when loading the delivery vehicle. The direction of approach to the site will also affect the loading arrangement. Generally, for an installation the barriers will be placed while driving with the flow of the traffic, the barrier shall be loaded such that the female end will be towards the front of the truck. This will allow the installation to continue without the need to rotate any of the units during installation. If the reverse direction of approach is occurring, the loading of the units will require to be orientated with the male joints towards the cab of the truck.

### 3.4 Site Activities

#### 3.4.1 Unloading Sequence

Before the unloading can occur, a check to ensure the delivery vehicle is resting on solid, level ground is required. This will ensure the barrier units will remain stable when the harnesses are released.

**WARNING**

Please ensure delivery vehicle is level and secure before releasing the harnesses used for transport. Unstable barriers are a falling risk.

All slings, chains, tag lines and machinery will need to be checked to ensure they are maintained and in acceptable working condition.

The unloading sequence is the reverse of the loading sequence detailed within section 3.3 above.

#### 3.4.2 Connection of the Units

When connecting the units on site, care must be taken to ensure each section is placed level on the ground with each footing section having contact with the surface. In most cases, the installation process will begin with the upstream (approach) end of the barrier being installed first. Once the first unit is placed, each consecutive unit can be lowered onto the joint of the previously placed unit to create a secure connection at the male/female joints. Once the run has been installed, a second pass can be conducted to engage the connecting pins at the joints, marking the correct connections being done.
During the connection of units, ensure spotters are in place and the use of tag lines is incorporated to reduce the chance of workers being pinned/pinched by the lowering barrier.

Figure 3.4 below has been shown in three (3) parts:

Part 1: Shows the difference between the Male (bottom) and Female (top) joints.

Part 2: Shows a typical lifting / connection process using a sling arrangement.

Part 3: Shows the internal connection (before the pin is inserted) of the Male and Female joints.

Figure 0.2: Sequence of Unit Connection
3.5 Post Construction and Maintenance

3.5.1 Post Installation Inspections

Once the installation of the system has been conducted, a post installation inspection shall be done to ensure the product has been installed correctly and is fit for purpose in the required location. The inspection shall consist of checking the following items:

- Horizontal and vertical alignment of the barrier is correct;
- All foot sections have suitable contact with the surface;
- The point of need for the system is in the required location;
- Barrier ends have been terminated with the accepted treatment;
- Each joint has been connected correctly and the connection pin has been fitted in EVERY joint;
- Delineation has been included as/where required;
- Each barrier section has ballast secured within the unit;

3.5.2 System Maintenance

Due to the product construction, the main reason for barrier maintenance would be due to an impact. If an impact were to occur, a system inspection should be undertaken to ensure the barrier is of sound structural capacity to continue use. The following is a list of observations that would warrant the replacement of a section of barrier:

- Toe / foot sections bent
- Unit skin torn or ripped
- Lifting plate visible through the barrier skin
- Barrier end joints dislodged or bent

To undertake the replacement of a section of barrier, the downstream unit from the one being replace will need to be removed first and the system pulled to the side. Once the downstream unit is disengaged, the damaged unit, and all other damaged units upstream can be removed and replaced.

Once the barrier has been repaired with the new units, an inspection should be conducted on the full run to ensure the system is adequate for the purpose of the installation. The inspection list detailed in Section 3.5.1 above should be used as a guide.

3.5.3 End of Useful Life

All Defender 70™ barriers are made of recyclable mild steel. We recommend sending to your local steel recycler at the end of useful life.
Appendix B  End Terminal

Legend:

1. INSTALL SAFETY HANGER ADAPTER & PIN FIRST.
2. INSTALL SAFETY HANGER ADAPTER & PIN FIRST.
3. INSTALL SAFETY HANGER ADAPTER & PIN FIRST.
4. INSTALL SAFETY HANGER ADAPTER & PIN FIRST.
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26. INSTALL SAFETY HANGER ADAPTER & PIN FIRST.
27. INSTALL SAFETY HANGER ADAPTER & PIN FIRST.
28. INSTALL SAFETY HANGER ADAPTER & PIN FIRST.
## Appendix C  Crash Test Summary

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Appendix D  Installation Checklist

Defender™ Installation Checklist

Contractor   Job Location   Barrier Type   Barrier Length   Barrier Pin Spacing   Terminals   Terminal Install   TAUI Installed according to manufacturer’s instructions   Absorb 350 is water filled and transition installed

Job ID   D100 Low Deflection   D100 High Containment   Other (with approval attached)   Max 48.15 m   Max 9.15 m   TAUI   Departure Terminal   Approach Terminal   Both Ends

NOTES:

Date   Name   Signature