ArmorZone™
TL-2 Barrier and End Treatment

Product and Installation Manual
Table of contents

Introduction 3
System Overview 3
Before Installation 3
Limitations and Warnings 4
Safety Statements 4
System Design and Design Considerations 5
Parts Identification 7
Bill of Materials 7
Installation Preparation 8
Installation instructions 9
Installation Examples 12
Connecting the End Treatment Unit 12
Barrier Installation Checklist 14
End Treatment Installation Checklist 15
Maintenance and Repair 16
Frequently Asked Questions 17

APPENDIX – Technical Drawings

ArmorZone™ Barrier 19
ArmorZone™ End Treatment 20
Safety Zone with End Treatment 21
Safety Zone without End Treatment 22
NZTA Letter of Acceptance 23
Introduction

ArmorZone™ is a TL-2 barrier made up of plastic units that when joined together using a double pin and filled with water provides positive work zone barrier protection to temporary construction sites and other miscellaneous roadside activities.

If required the ArmorZone™ TL-2 barrier connects directly to the ArmorZone™ TL-2 end treatment which negates the need to shield or flare the ends of the barrier.

ArmorZone™ barrier has been designed and tested to meet the evaluation criteria of NCHRP 350 Test Level 2 (TL-2) for longitudinal barriers.

ArmorZone™ TL-2 barrier is designed and constructed to provide acceptable structural adequacy, minimal occupant risk and safe trajectory as set forth in NCHRP 350 for longitudinal barriers.

When impacted with 820kg or 2,000kg vehicles at speeds of 70kph and angles up to 25 degrees (1 lateral : 2.14 forward), the impacting vehicle is stopped, re-directed or contained in a safe manner.

When correctly installed the system is capable of stopping, containing or re-directing an errant vehicle in a safe manner under NCHRP 350 impact conditions.

The unique ArmorZone™ polyethylene composition, profile design and double pin allow the barrier to be installed straight or down to a minimum radius of 28m if required

Before Installation

Placement of ArmorZone™ shall be in accordance with the design as provided for the temporary work zone. Installation shall be in accordance with the installation instructions supplied for this product.

Depending on the circumstances at the site, installation including the filling of a unit (using a truck mounted water tanker) should take no more than 1 minute for each 2.0m unit.

ArmorZone™ is a highly engineered safety device made up of a relatively small number of parts. Before starting installation ensure that one is familiar with the make up of the system.
Limitations and Warnings

ArmorZone™ TL-2 barrier has been rigorously tested and evaluated per the evaluation criteria in the NCHRP 350 guidelines for a longitudinal barrier. The impact conditions recommended in NCHRP 350 are intended to address typical in-service collisions.

When properly installed and maintained ArmorZone™ TL-2 barrier allows an impacting vehicle to be stopped, contained or re-directed in a safe and predictable manner under the NCHRP 350 impact conditions. Vehicle impacts that vary from the NCHRP 350 impact conditions described for longitudinal barriers may result in significantly different results than those experienced in testing. Vehicle impact characteristics different than, or in excess of, those encountered in NCHRP 350 testing (weight, speed and angle) may result in system performance that does not meet the NCHRP 350 evaluation criteria.

The adjacent road operating speed must be limited to 70kph and the installation should endeavour to minimise the impact angles to 25 degrees (1 lateral : 2.14 forward).

ArmorZone™ TL-2 barrier has a permanent deflection of 2.1m and workers, equipment and materials should be a minimum of 2.1m behind the barrier.

The ArmorZone™ barrier can be installed with the ArmorZone™ end treatment. If this treatment is not used the end of the barrier must be shielded or flared as per the layout drawings in the appendix of this manual. These technical drawings show the Safety Zones with and without the ArmorZone™ end treatment. If further assistance is required please contact CSP Pacific.

Safety Statements

General Safety

• All required traffic safety precautions should be complied with. All workers should wear required safety clothing. (high visibility vests, steel capped footwear, gloves etc)

• Only authorised trained personnel should operate any machinery. Where overhead machinery is used, care must be taken to avoid any overhead hazards.

• Gloves should be worn at all times.

ArmorZone™ Safety Statements

• All installers must be well clear of the water tanker when the units are being filled.

• ArmorZone™ is a stand alone barrier and does not require at any stage during installation that the surrounding soil be dug or drilled in anyway.

• The empty units weigh 50kg each and should be unloaded by two personnel. Do not attempt to lift a unit which contains water.

• Final positioning of the empty units and placement of the steel connectors should be done by one person so as to remove the risk of hands and fingers being caught between the components.
System Design and Design Considerations

Slopes

A maximum approach and cross slope of 1:10 is preferable. On slopes greater than this, approval is required from the road controlling authority.

Curb

As with all road side safety hardware, ArmorZone™ barrier has been designed and tested so the centre of gravity of the impacting vehicle is a constant height in relation to the system. For this reason, it is preferred that curb or channels not be in front of the barrier as it will alter the height of the vehicle at impact. Curb behind the barrier will affect the performance of the system through limiting deflection. If there is no option but to install in front, behind or on a curb, approval is required from the road controlling authority.

Undulating ground conditions

Site specific grading may be necessary to ensure that there are no “humps” or “hollows” that may significantly alter the impacting vehicles stability or substantially alter the barrier height in relation to the ground.
Median and roadside applications

ArmorZone™ barrier can be used in both ‘roadside’ and ‘median’ applications.

End treatment

ArmorZone™ end treatment is a free standing ‘special’ end unit that can be fitted to the ArmorZone™ barrier in a tangent position if an end treatment is required. If an end treatment is not used it will be required to flare the barrier as shown in the technical drawings in the appendix of this manual.

Minimum Installation Length and Length of Need (LoN)

The total minimum system length requirement is 50m comprising of 2 ArmorZone™ End Treatments and 23 units (46m).

The Length of Need (LoN) of ArmorZone™ complete with End Treatments is 8 units (16m).

Ensure that when installing the barrier that it is sufficient length and the placement of the end treatment is as required by this manual.

Soil conditions

ArmorZone™ is installed above ground so soil conditions on site are not applicable. However it is recommended ArmorZone™ systems be installed on a compacted surface.

Deflection

<table>
<thead>
<tr>
<th>Test 2-11</th>
<th>2,000kg pickup truck, 25 degree angle at 70kph (NCHRP 350 TL-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic deflection</td>
<td>Permanent deflection</td>
</tr>
<tr>
<td>2.10m</td>
<td>2.10m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test 2-10</th>
<th>820kg car, 20 degree angle at 70kph (NCHRP 350 TL-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.05m</td>
<td>1.05m</td>
</tr>
</tbody>
</table>

Note: Results are from actual crash testing and the test article length was 50m.

Results from Test 2-11 are the published TL-2 Deflection.
Parts Identification – Standard Barrier

Standard unit  
(stabilised PE)

Double Pin  
(hot dipped galvanised)

Bill of Materials
For every 2.0m (linear) of temporary barrier the following components are required:

• 2.0m ArmorZone™ Standard Unit - 1 required
• Double Pin - 1 required
• Water - 520L required

Parts Identification – End Terminal

End Treatment Unit  
(stabilised PE)

Double Pin  
(hot dipped galvanised)

Bill of Materials
To protect one end of an ArmorZone™ barrier the following components are required:

• 2.0m ArmorZone™ End Treatment Unit - 1 required
• Double Pin - 1 required

Note: No water is required.
Installation Preparation

Getting started

It is essential that ArmorZone™ TL-2 barrier, and end treatment, are installed correctly. Please carefully read and understand the following instructions before installing ArmorZone™.

**Note:** These instructions relate only to the installation of ArmorZone™ barrier and end treatment and are for standard installations only.

ArmorZone™ is designed so that it has exactly the same components and barrier setup whether in a ‘roadside’ or ‘median’ application. For all installations, commence placement of the units at one end and connect the units together until the correct barrier length and position is achieved. Please ensure that the checklists for both the barrier and the end treatment are completed for each installation.

Preparation

Before installing ArmorZone™, ensure that all components required for the system are on site and have been identified. ArmorZone™ is a highly engineered safety device made up of a relatively small number of parts. Before starting installation ensure that one is familiar with the make up of the system. Refer to the Parts identification and Bill of materials section in this manual for more information.

Ensure that the area where ArmorZone™ is to be installed is flat enough (i.e. a maximum slope of 1:10) and compacted so that the ground conditions will not significantly alter the height of the vehicle in relation to the height of the barrier.

Minor site grading may be required

Tools required

There are no tools required to install the components of ArmorZone™. The units can be manually lifted and positioned by two personnel and the double pin used to connect the units is simply dropped into position.

Each standard barrier unit requires approx 520L of water and it is recommended that a large truck mounted tanker is sourced for fast barrier construction. The diameter of the ‘fill hole’ is 125mm.
Installation Instructions

Standard installation

Step 1 - Site preparation

It is preferred that ArmorZone™ barrier is installed on compacted flat, level ground.

Ensure that sufficient width and traffic control is available before installing ArmorZone™. Due to the bulky nature of the units, deployment will be from a flat deck truck or similar. Each unit requires 520L of water and it is recommended that a large truck mounted tanker is used.

ArmorZone™ barrier should be installed in a tangent position to the direction of travel.

ArmorZone™ units are dispatched in bundles of up to 13. (shown in Figure 1)

To ensure safe unloading of the units, use a fork hoist or similar to lower each row to ground level. From there each unit can be manually moved into position. (shown in Figure 2)

Note: If the drainage bung is on the workzone side of the barrier when assembled, it will allow for safe access when decommissioning the barrier.
Step 2 - Placement of the barrier units

Unload the units and set out in a row along the intended barrier position. Make sure the configuration of the ends will fit together where they join. (shown in Figure 3)

Lifting the units is a two person job; they weigh 50kg each when empty.

**Slide the units into position.** (shown in Figure 4)

The units must fit flush together so that the vertical holes on each unit line up. (Shown in figure 5 & 6).

**Note:** None of the units are fixed to the ground in any way.
Step 3 - Connecting the barrier units

Once the units are ‘flush fit’ aligned, the double pin can be positioned down the 2 vertical alignment holes. (shown in Figure 7 & 8)

The double pin sits in the vertical holes under its own weight only and is not connected to the barrier units in any other way.

Note: If slight curvature of the barrier is required, position as required at this point.

Step 4 - Filling the barrier units

Lifting the flap on the top of the unit will allow access to the 125mm diameter water ‘fill hole’. (Shown in figure 9).

Using a truck mounted tanker fill each unit to the top with water. (Shown in figure 10).

Check that there are no leaks before filling the next unit. If there is a leak the unit must be replaced. It may be possible to fix at a later stage depending on the damage.
Installation Examples

**Straight installation**

**Curved installation**

Step 5 - Connecting the End Treatment Unit

If protection is required for the end of the barrier, the ArmorZone™ end treatment can be connected to the barrier in a tangent position.

Position the end treatment unit so that the lugs line up with the end barrier unit. Slide the unit into position so that the vertical holes line up. (shown in Figure 11 & 12)

Once the units are ‘flush fit’ aligned, the double pin can be positioned down the 2 vertical alignment holes. (shown in Figure 13 & 14)

**Note:** The end treatment end unit is not and can not be filled with water.

The double pin sits in the vertical holes under its own weight only and is not connected to the barrier units in any other way.
Note: The end treatment unit is **NOT** fixed to the ground in any way and must **NOT** have the double pin inserted at the exposed end of the unit.

**Step 6 - Delineation**

Depending on location, delineation may be required as per the Road Controlling Authority Guidelines.

For further details consult MoTSaM, Part 2: Section 5 or contact CSP Pacific.

**Installation Examples**
# ArmorZone™ TL-2 Barrier Installation Checklist

| The units are positioned on **level** ground, i.e. maximum across and approach slope of 1:10 |  |
| The set-out of the barrier is as **per the design instructions** and/or the layout drawings in the appendix of the Product and Installation manual |  |
| Adjacent road operating speed is limited to a maximum of 70kph |  |
| Vehicle impact angle, with the barrier, is limited to 25 degrees (1 lateral : 2.14 forward) |  |
| Workers or equipment are not located in the COPT™ safety or clear zone |  |
| Minimum length of need of 14m (7 units) is provided. This excludes the end treatment |  |
| ArmorZone end treatment or a flared installation is installed as per the layout drawings in the appendix of the Product and Installation manual |  |
| The lugs of each unit have a ‘**flush fit**’ with each other and the double pin is positioned **through both vertical holes** in the lugs of each unit |  |
| The lid and bung are **attached to each unit correctly** so as to ensure the units will remain full of water as intended |  |
| Each unit is **filled to the top** with water. (approx 520L) Check for leaks daily |  |
| The barrier is **not** fixed to the ground or any other device in any way |  |
| **Attach delineation as required by the road controlling authority with an adhesive such as “No More Nails”** |  |

## Notes:

- **Location:**
- **Installed by:**
  - **Date:**
- **Inspected by:**
  - **Date:**

More information on **ArmorZone™ TL-2 Barrier** call 0800 655 200 or email **cspcustomerservices@csppacific.co.nz**

**CSP PACIFIC**
306 Neilson St, Onehunga,
PO Box 12 949, Penrose,
Auckland 1642, New Zealand
www.csppacific.co.nz

**Leading road side and barrier systems supplier**
## ArmorZone™ End Treatment Installation Checklist

<table>
<thead>
<tr>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>The end treatment unit is positioned on <strong>level</strong> ground, i.e. maximum across and approach slope of 1:10</td>
<td></td>
</tr>
<tr>
<td>The set-out of the system is as per the design instructions and/or the layout drawings in the appendix of the Product and Installation manual</td>
<td></td>
</tr>
<tr>
<td>The <strong>end treatment unit is connected</strong> to the ArmorZone™ barrier using the double pin <strong>through both vertical holes</strong> in the lugs of each unit</td>
<td></td>
</tr>
<tr>
<td>Adjacent road operating speed is limited to a maximum of 70kph</td>
<td></td>
</tr>
<tr>
<td>Barrier impact angle of the end treatment is limited to 15 degrees (1 lateral : 3.7 forward)</td>
<td></td>
</tr>
<tr>
<td>Minimum length of need for the end treatment is 8 units (16m) exclusive of the Barrier length of need</td>
<td></td>
</tr>
<tr>
<td>The lugs of each unit have a <em>‘flush fit’</em> with each other</td>
<td></td>
</tr>
<tr>
<td>The <strong>end treatment unit is not</strong> and cannot be filled with water</td>
<td></td>
</tr>
<tr>
<td>Do not install a double pin at the upstream end of the <strong>end treatment unit</strong></td>
<td></td>
</tr>
<tr>
<td>The <strong>end treatment unit is not</strong> fixed to the ground or any other device in any way</td>
<td></td>
</tr>
<tr>
<td>Attach delineation as required by the road controlling authority such as “No More Nails”</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:

### Location:

<table>
<thead>
<tr>
<th>Installed by:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspected by:</td>
<td>Date:</td>
</tr>
</tbody>
</table>

More information on ArmorZone™ End Treatment call 0800 655 200 or email cspcustomerservices@csppacific.co.nz
Maintenance and Repair

Maintenance

ArmorZone™ is a maintenance free system, although it is recommended that inspections are carried out periodically.

In extreme conditions it may be possible for evaporation to take place and it is important that the barrier units remain filled to the correct level.

It is important that the end treatment unit is in the correct position, undamaged and not filled with debris.

Repair

After a typical impact

Recommended tools:

- Flat deck truck
- A truck mounted water tanker
- A crow bar or similar

Replacement parts required for a severe impact:

- ArmorZone™ Standard and / or End Treatment Units
- Double Pins
- 520L of water for each standard unit

Key steps:

- Separate the damaged components by removing the double pins
- Drain any units that are partially damaged
- Assess which components are damaged and replace with new parts accordingly
- Connect replacement units to the undamaged section of the barrier and align as required
- Fit the replacement double pins between each unit
- Fill all the units with water to the required level
- Connect the end treatment unit to the barrier
- Attach delineation as required

For further information consult the ArmorZone™ Installation Instructions section in this manual.
After fire damage

ArmorZone™ is made of polyethylene and joined together using double pins. It is possible that under extreme conditions, like large fires, that the components of the system can be damaged. If this is the case replace the components as described above and as outlined in the ArmorZone™ Installation Instructions section in the product manual.

Frequently asked questions

1) What type of equipment is required to install ArmorZone™?
   Each unit weighs 50kg (empty) so can be unloaded, positioned and stacked by hand by two personnel. Units are connected together by simply fitting the double pin by hand. To fill the units it is recommended that a truck mounted water tanker is used. (520L required per unit)

2) Does your company provide spare parts? What is the lead-time for supply?
   It is important to fix a damaged barrier as soon as possible because it most probably won’t perform as required when damaged. Replacement components are available from CSP Pacific and can be available between one and three working days.

3) On average, how long does it take to install an ArmorZone™ Barrier?
   Depending on the application and circumstances at the site, installation and assembly of the system should take a two person crew approx. one hour to install a 120m section.

4) What about vandalism, can ArmorZone™ be easily damaged?
   The units are constructed using strong polyethylene and would not easily be damaged. The construction is similar to ‘other’ water filled barriers and this is not considered an issue. See separate Assessment of Materials report for details on vandalism.

5) How easily can ArmorZone™ be restored after impact?
   The system is made up of very few components and is modular so easily repaired. A flat deck truck, crow bar and water tanker will be required to reinstate.

6) What maintenance is required? What is the expected performance life?
   ArmorZone™ is a maintenance free system. For barriers installed for long periods of time or in extreme conditions, cyclic checks may be required. The standard barrier units must remain filled to the required level and the end treatment unit needs to be in the correct position, undamaged and not filled with debris. See separate Assessment of Materials report for details on performance life.

7) What is the Deflection of ArmorZone™ Barrier?
   Maximum deflection recorded during actual NCHRP 350 crash testing at TL-2 was 2.1m.

8) In a leading position, can the end of the barrier be protected?
   A TL-2 ArmorZone™ end treatment can be connected to the barrier. (NCHRP 350)

9) What is ArmorZone™ Barrier connected to?
   ArmorZone™ barrier is a free standing system and is not anchored in anyway.
10) Is the performance of ArmorZone™ jeopardised when the water is frozen?
Performance of the barrier may not be as intended if the water freezes. If conditions are below zero degrees additives can be used to stop the water freezing.

Refer to the road controlling authority for acceptable additives.

11) Can ArmorZone™ units be moved when full?
It is possible and extreme care must be taken, a full unit weighs 570kg. Each unit is equipped with fork hoist holes through the barrier and must be used with the appropriate machinery and safety equipment.
### Appendix - Technical drawings

**ArmorZone™ Barrier - Plan, Elevation, Isometric & Pin**

#### Technical Drawings

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastic Shell</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Bung</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Lid</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Lid Plate</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Lid Cover</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Lid Washer</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Standard Pin</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Full Indicator (optional)</td>
<td>1</td>
</tr>
</tbody>
</table>

---

The information herein is proprietary to Armorflex International Ltd and shall not be disclosed, duplicated or used otherwise without the express written approval of Armorflex International Ltd.

© 2010 Armorflex International Ltd

**Standard Tolerance:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Date</th>
<th>Int.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20/12/2010</td>
<td>DJ</td>
</tr>
</tbody>
</table>

**Drawing Number:**

<table>
<thead>
<tr>
<th>Sheet</th>
<th>Drawing Number</th>
<th>Rev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-1</td>
<td>P-AZ-A1</td>
<td></td>
</tr>
</tbody>
</table>

**SCALE:** 1:20
ArmorZone™ Safety Zone - With End Treatment

Note:
Deflection downstream of Barrier Length of Need (B.L.O.N.) as per "Design Considerations" section of this Manual.

COSPIM Safety Zone for 70 kph

Equipment and workers should not be in the COSPIM Safety Zone. Clear Zone or within the 2.1m deflection distance of the barrier.

ArmorZone TL-2 with End Treatment

Direction of Traffic

30m

22.5m

9m

End Treatment Unit

14m (7 units)
ArmorZone™ Safety Zone - Without End Treatment

Note: Deflection downstream of Barrier Length of Need (B.L.O.N.) as per Design Considerations section of this Manual.

C.o.P™ Safety Zone for 70kph

Equipment and workers should not be in the C.o.P™ Safety Zone. Clearzone or within the 2.1m deflection distance of the barrier.
Interim Acceptance for Safety Barrier Product

Product:  ArmorZone™ TL2 Plastic Barrier System

Safety Barrier - Temporary

Expiry Date:  30 June 2020

The ArmorZone™ TL2 temporary barrier system, previously known as Armorflex P2 TL2 plastic barrier system, has been tested in accordance with NCHRP Report 350 and was accepted as compliant with the required evaluation criteria for Test Level 2 (TL2). Pending further updates to the NZ Transport Agency’s M23 Specification for Road Safety Barrier Systems, the ArmorZone™ TL2 temporary barrier system is granted interim acceptance by the NZ Transport Agency for use on the state highway network, with the following conditions:

Product Identification

![ArmorZone™ TL2 End Treatment](image1)

![ArmorZone™ TL2 Barrier](image2)

Conditions of Use

The ArmorZone™ TL2 temporary barrier system must be installed and maintained in accordance with the product installation/maintenance manual and relevant NZ Transport Agency specifications. NZ Transport Agency specifications and standards shall prevail where there is discrepancy between the product manual(s) and the NZ Transport Agency specifications and standards.

Installers must ensure that they are familiar with relevant conditions, requirements and limitations of the system, particularly with regard to the appropriate length of need, minimum installation length and test deflection. Vehicle impacts that vary from the NCHRP Report 350 impact conditions may result in significantly different results than those experienced in testing.
The ArmorZone™ TL2 temporary barrier system has been evaluated in accordance with the Test Level 2 criteria presented in NCHRP Report 350 under the following test conditions:

- 820kg small car impacting at an angle of 20º and a nominal speed of 70kph;
- 2,000kg pick-up truck impacting at an angle of 25º and a nominal speed of 70kph.

All units MUST be connected with the appropriate steel connecting pin and filled with water when in use.

The ArmorZone™ TL2 End Treatment forms an integral part of this system and MUST be installed and maintained in accordance with the product installation/maintenance manual and relevant NZ Transport Agency specifications and CoPTTM.

Should the end treatment component of this system NOT be fitted, or the system not correctly filled with water ballast, the barrier system will be considered non-conformant with this acceptance.

A copy of this Interim Acceptance memorandum must be appended to the Installation Manual.

Expiry of Acceptance

This acceptance expires on 30 June 2020 and replaces any previous acceptance.

New installations of the ArmorZone™ TL2 temporary barrier system must not be deployed on the state highway network after the expiry date of acceptance unless a further period of acceptance is granted or the product has been formally included in the NZ Transport Agency M23 Specification for Road Safety Barrier Systems, in which case the M23 specification would replace this interim acceptance.

Should the NZ Transport Agency discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed differs significantly from that which was crash tested, it reserves the right, at any time, to modify or revoke its acceptance of the ArmorZone™ TL-2 temporary barrier system.

Authorised by the National Traffic & Safety Manager