Water-Wall™

TL-1 Barrier and

SLED End Treatment
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Introduction

**Water-Wall™ TL-1** is a barrier made up of plastic units that when joined together using a steel pin and filled with water provides positive work zone barrier protection to temporary construction sites and other miscellaneous roadside activities.

When an impacting vehicle contacts the **Water-Wall™ TL-1**, the plastic container ruptures and disperses its ballast water bringing the impact vehicle to a controlled stop or redirecting the impacting vehicle.

If required the **Water-Wall™ TL-1** barrier connects directly to the **SLED End Treatment** which negates the need to shield or flare the ends of the barrier.

**Water-Wall™ TL-1** barrier has been designed and tested to meet the evaluation criteria of NCHRP 350 Test Level 1 (TL-1) for longitudinal barriers.

**Water-Wall™ TL-1** 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 at with a 820kg vehicle at an angle of 20deg and a 2,000kg vehicle at an angle of 25 deg at a speed of 50kph, the impacting vehicle us 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.

**Before installation**

Placement of the **Water-Wall™ TL-1** 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 filling of a unit (using a truck mounted water tanker) should take no more than 1 minute for each 1.854m long unit.

**Water-Wall™ TL-1** 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

Water-Wall™ TL-1 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 Water-Wall™ TL-1 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 50kph and the installation should endeavour to minimise the impact angles to 20 degrees (1 lateral : 2.75 forward). Water-Wall™ TL-1 barrier has a permanent deflection of 2.4m and workers, equipment and materials should be a minimum of 2.4m behind the barrier.

The Water-Wall™ TL-1 barrier can be installed with the SLED 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 SLED 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 as listed below.

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

Water-Wall™ TL-1 Safety Statements

- All installers must be well clear of the water tanker when the units are being filled. Water-Wall™ TL-1 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 35kg 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.

Curbs

As with all road side safety hardware, Water-Wall™ TL-1 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

Water-Wall™ TL-1 barrier can be used in both ‘roadside’ and ‘median’ applications.

End Treatment

The SLED end treatment is a free standing end unit that can be fitted to the Water-Wall™ TL-1 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.
Length of need

The minimum Length of Need (LoN) of Water-Wall™ TL-1 is 3 units (6m). Ensure that when installing the barrier that it is of sufficient length to accommodate this.

The Length of Need (LoN) of the SLED End Treatment when connected to the barrier is the end treatment plus 3 Water-Wall™ TL-1 units. This gives a total system requirement of 6 units plus two end treatment units. Ensure when installing the barrier that it is sufficient length and the placement of the end treatment is as required by this manual.

Foundation requirements

The Water-Wall™ TL-1 is a free standing longitudinal barrier requiring only that the road surface support the fully filled linked sections. It is recommended Water-Wall™ TL-1 be installed on a compacted surface. Appropriate surfaces for installation include concrete, asphalt, dirt and gravel surfaces.
Product Components

The Water-Wall™ TL-1 sections are made of two major components. The plastic water filled shells which include the fill cap and drain plug and the galvanized steel T-pin with the keeper pin.

Overall Dimensions
Width 460 mm
Height 822 mm
Length 1854 mm pin to pin

Weight:
Empty Weight: 35 kg
Filled Weight: 500 kg

Fill Capacity
Volume 465 litres
General Specifications

The Water-Wall™ TL-1 sections are Orange in colour and have an outer shell made from high density polyethylene (HDPE) with a capacity of 465 litres. The polyethylene material is durable and recyclable and will break up in large sections upon impact. It will not crack or corrode when left on the job site or stored for long periods of time.

Each Water-Wall™ TL-1 section contains a large diameter water fill-hole located on the top surface of each section. This large diameter opening allows easy access for water filling using a water tanker truck or large diameter hose. Each Water-Wall™ TL-1 section comes with a twist lock lid to cover.

For draining, each section has a centrally located drain plug and is located at the bottom of each wall section. The drain plug requires 1-1/2 turns to seal the opening preventing any water leaks.
Angle of Rotation

The Water-Wall™ TL-1 is designed to have an angle of rotation of 30° when linked together as seen below. When fully rotated, the linked Water-Wall™ TL-1 sections have an inside radius of 3.5 m.

Deflection Zone

When installing the Water-Wall™ TL-1, a deflection zone must be kept clear on the work zone side to allow for backside deflection into the work zone. When impacted at the design speed of 50 km/hr at an impact angle of 25° with a 2000 kg, impact vehicle the deflection is 2.44m. This is the minimum deflection zone required on the work zone side. Refer to page 11 for the test deflection diagram for a 2000kg vehicle at 50km/h.

Water-Wall™ TL-1 Crash Test Data Summary

<table>
<thead>
<tr>
<th>Test Level</th>
<th>NCHRP350 1-11 50km/h</th>
</tr>
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<tbody>
<tr>
<td>Date of Test</td>
<td>2/6/2004</td>
</tr>
<tr>
<td>Vehicle Mass</td>
<td>2096 kg</td>
</tr>
<tr>
<td>Impact Speed</td>
<td>51.4km/h</td>
</tr>
<tr>
<td>Impact Angle</td>
<td>25 deg</td>
</tr>
<tr>
<td>Accident Severity Index</td>
<td>0.26 ASI</td>
</tr>
<tr>
<td>Deflection</td>
<td>2.44m</td>
</tr>
</tbody>
</table>
Test deflection diagram for a 2000kg vehicle at 50km/h

TL-1 TEST SPECIFICATION
IMPACT SPEED: 51.1km/h [31.75 mph]
IMPACT VEHICLE: 2096kg [4621 lbs]
IMPACT ANGLE: 29
DEFLECTION: 2.44m [8 ft]
NCHRP-350 TEST: 1-11
Installation Preparation

Getting started

It is essential that Water-Wall™ TL-1 barrier and the SLED end treatment, are installed correctly. Please read carefully and understand the following instructions before installing Water-Wall™ TL-1.

Note: These instructions relate only to the installation of Water-Wall™ TL-1 barrier and SLED end treatment and are for standard installations only.

Water-Wall™ TL-1 has exactly the same components and barrier setup whether in a 'roadside' or 'median' application. For 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 end treatment are completed for each installation.

Preparation

Before installing Water-Wall™ TL-1 ensure that all components required for the system are on site and have been identified. Before starting installation ensure that one is familiar with the make up of the system. Refer to the Product Components section in the manual for more information.

Ensure that the area where Water-Wall™ TL-1 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 maybe required.

Tools required

There are no tools required to install the Water-Wall™ TL-1 components. The units can be manually lifted and positioned by two personnel and the T-pin used to connect the units is simply dropped into position and secured with the keeper pin.

Each barrier unit requires approx. 465 litres of water and it is recommended that a large truck mounted tanker is sourced for fast barrier construction.

The SLED End Treatment is not filled with water.
Installation Instructions

Standard installation

Step 1 – Site preparation

It is preferred that **Water-Wall™ TL-1** is installed on compacted flat, level ground.

Ensure that sufficient width and traffic control is available before installing **Water-Wall™ TL-1**. Due to the bulky nature if the units, deployment will be from a flat deck truck or similar. Each unit requires 465L of water and it is recommended that a large truck mounted tanker is used.

**Water-Wall™ TL-1** barrier should be installed in a tangent position to the direction of travel.

The TL-1 **Water-Wall** must only be stacked when empty and are not designed to be stacked on each other when filled. It is recommended to stack the empty **Water-Wall™ TL-1** sections no more than three high (shown in Figure 1).

![Figure 1](image1)

To ensure safe unloading of the units, use a fork hoist or similar (shown in Figure 2). Once the units are at ground level then they can be individually moved manually into position.
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.

Note: Lifting the units is a two person job; they weigh 35kg each when empty.

Slide the units into position.

The units must flush fit together so the vertical concentric holes on each unit line up.

Note: None of the units are fixed to the ground in any way.

Step 3 – Connecting the barrier units

One the units are ‘flush fit’ aligned, the vertical connecting pin can be positioned down through the concentric aligned holes.

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

Insert the safety keeper pin into the alignment hole at the bottom of each T-pin. The T-pin and keeper pin must be inserted to finalise the installation on each wall section. The lower end of the T-pin should come in contact with the grade surface to insure that the pin is fully inserted.

Step 4 – Filling the barrier units

When the Water-Wall™ TL-1 has been placed in accordance with the site plan and the sections linked together, the twist lock fill cap for each section should be removed.

Using a truck mounted tanker fill each unit to the top with water. The fill cap is then re-installed while insuring that all tabs are engaged.

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. Refer the Maintenance and Repair section.
SLED End Treatment Installation

If protection is required for the end of the Water-Wall™ TL-1, the SLED End Treatment should be used.

The SLED End Treatment is connected to the Water-Wall™ TL-1 in a tangent position with a Transition unit. The narrow end of the Transition unit is attached to the top knuckle of the end module of the Water-Wall™ TL-1 installation.

The Transition unit is designed to attach to either the “high” or “low” exposed knuckle end of the TL-1 Water-Wall.
Connecting the SLED End Treatment

Insert the T-pin and keeper pin, linking the Transition unit to the Water-Wall™ TL-1.

Move the SLED End Treatment into position at the end of the Water-Wall™ TL-1 installation, aligning the attachment hole of the wide end of the Transition unit with the rear knuckle of the yellow module.

It may be necessary to lift the Transition unit slightly to allow the yellow module knuckle to be positioned properly. Insert the T-pin and keeper pin, linking the yellow module and Transition unit. Verify the SLED End Treatment is aligned with the Water-Wall™ TL-1 sections.

Note: The Yellow SLED module is NOT filled with water.

The SLED End Treatment must not be attached or anchored to the ground, or any other object.

The maximum cross slope or approach slope the End Treatment may be used on is 1 in 10. On slopes greater than this approval is required from the road controlling authority. Delineation may be required by the Road Controlling Authority guidelines. For further details consult MoTSaM, Part 2 or contact CSP Pacific.
Maintenance and Repair

Water-Wall™ TL-1 is a maintenance free system, although it is recommended that inspections are carried out periodically.

The water level should be checked periodically to insure that each section is properly filled. The Water-Wall™ TL-1 is not fully effective unless each section is filled.

Severely damaged sections should be removed and replaced. Small leaking sections can be repaired as described below.

When patching leaks (holes or cracks) the Water-Wall™ TL-1 plastic must be dry, free of dirt, and grease. In addition, any paint or added finish beyond the factory plastic surface should be removed.

Plastic welding is the most common method for repairing damaged sections. A small butane torch is used for applying heat to the plastic rod. The rod should be melted to the patch and the wall surface in order to create a bonding patch. Temperature for bonding the plastic is 260-290°C. The torch head should be held 65 to 130 mm away from the weld surface. Care should be taken when applying heat to plastic to insure that the melting occurs only as desired. The appropriate respiratory and safety equipment should be worn and the work done in a well ventilated area.

NOTE: Repairing a crack or hole does not return the plastic to its original strength, although most repairs are sufficient to insure a water tight section. Monitoring of the repair should be done for a short period after filling to insure that the repair has been done properly. If leaks cannot be completely sealed, the section should be replaced.

The T-pins may be difficult to remove after an impact. A fork lift will facilitate wall realignment if necessary, without removing the T-pins or to relieve the force on the T-pins for removal.
Water Freezing Prevention

In freezing weather conditions, allowing the water in the Water-Wall™ TL-1 to freeze to a solid mass of ice will affect the performance of the barrier. If the temperature at the installation site is expected to be at or below the freezing point of water, it is recommended that an additive be used to prevent the water in the units from freezing.

The following additives can be used to stop the water freezing. For percentages required, cost and environmental impact and reduced temperature, consultant with a third party is required.

Sodium Chloride, Calcium Chloride, Ethylene/Propylene Glycol, Liquid CMA and Potassium Acetate. Check with the road controlling authority on the additive suitability.

Redeployment to Another Site

If redeployment of the Water-Wall™ TL-1 to another near-by site is required, draining of the sections may not be required to re-locate.

The units can only be moved while full of water if the correct equipment is available, as they weigh 500kg. A forklift and appropriate transport vehicles are to be used that have the correct capacity to take the full units. If the Water-Wall™ TL-1 is going to be stored for a period of time or if the correct equipment is not available, the sections should be drained by removing the drain plug with the drain plug removal tool which connects to a standard ratchet and extension, see figure below.
Appendix – Technical Drawings

Water-Wall™ TL-1 Repair Procedure

1. **WATER WALL REPAIR PROCEDURE:**
   - STOP DRILL THE HOLE OF THE CRACK TO PREVENT THE CRACK FROM GROWING.
   - USING A PANEL FROM THE PATCH KIT TRIM IT SO THAT THE EDGES OF THE DAMAGED AREA.
   - PLASTIC "WELD" COMPLETELY AROUND THE CRACK IN A PLASTIC WELDING TOOLS OR A PROpane OR BUTANE TORCH. USE A SMALL PIECE OF HOPE AS FILLER MATERIAL FOR THE WELD.
   - TEST FOR LEAKS.
   - USE PATCH PANEL FROM PN 450010.00 OR 450310.00.

2. **WATER WALL PATCH REPAIR:**
   - CUT A SMALL PIECE OF THE DAMAGED AREA.
   - ATTACH THE PATCH PANEL TO THE DAMAGED AREA USING WELDING MATERIAL.
   - TEST FOR LEAKS.
Water-Wall™ TL-1 Patch Repair

1. Water-Wall™ Patch Repair

2. Plastic Weld completely around edge of patch.
Water-Wall™ TL-1 Safety Zone with SLED End Treatment

Equipment and workers should not be in the safety zone, clear zone or within the 2.4m deflection distance of the barrier.
Water-Wall™ TL-1 Safety Zone without End Treatment
Water-Wall™ TL-1 Lane Closure Layout

The installation configuration shown is for illustrative purposes only and local regulations and road authorities must give final configuration approval.
SHOULDER CLOSURE

THE INSTALLATION CONFIGURATION SHOWN IS AN EXAMPLE. ALWAYS REFER TO LOCAL REGULATIONS AND ROAD AUTHORITY FOR FINAL CONFIGURATION APPROVAL.

† SLED END TREATMENT

‡ 15° MAXIMUM WATER-WALL ANGLE ROTATION
Water-Wall™ TL-1 Lane Closure Layout

The installation configuration shown is an example and should be reviewed and altered to suit the specific layout of each site. The final installation configuration and layout should be referred to the Engineer or Architect for final configuration approval.
Water-Wall™ TL-1 Double Lane Closure Layout with SLED End Treatment

The installation configuration shown is an example. Always refer to local regulations and road authority for final configuration approval.

† SLED END TREATMENT
Water-Wall™ TL-1 Lane Shift Layout with SLED End Treatment

THE INSTALLATION CONFIGURATION SHOWN IS AN EXAMPLE. ALWAYS REFER TO LOCAL REGULATIONS AND ROAD AUTHORITY FOR FINAL CONFIGURATION APPROVAL.

† SLED END TREATMENT