

# SLED End Terminal



## Product Manual



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## Preface

For optimum performance, the SLED End Terminal must be designed, deployed and maintained as per this manual. Please thoroughly review and understand this manual before using the SLED End Terminal.

Local requirements may also impose restrictions. Please refer to the local governing body for further information.

If more information is required, please contact Saferoads:

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## Introduction

The SLED End Terminal is a gating, non-redirective end terminal designed to shield the end of Type F Concrete or Steel Temporary Safety Barriers. Impacting vehicles are brought to a controlled stop, minimizing the risk of dangerous secondary impacts. The SLED End Terminal absorbs impact energy and cushions vehicular impacts while significantly reducing the risk to occupants of the impacting vehicle.

SLED End Terminal provides several unique advantages over other end terminals:

- High level of energy absorption
- No anchoring to pavement required
- Short length
- Three different length options for Speed ratings - 50km/h, 70km/h & 100km/h
- Economical to transport and deploy

## Applications

The SLED End Terminal can be used for Temporary installations only in Australia. In order to design the most appropriate SLED End Terminal for a given site, this manual supplies some basic application information about the SLED End Terminal and details its performance when tested to AS/NZS 3845.1:2015 and MASH.

## Limitations

The SLED End Terminal has been tested and passed AS/NZS 3845.1:2015 and MASH test criteria. The SLED End Terminal is capable of decelerating errant vehicles up to 2270 kg at speeds up to 100 km/h and angles of 25 degrees (Test Level 3). To ensure adequate performance in the event of an impact, the SLED End Terminal must be deployed and maintained in accordance with the manufacturer's instructions and local authority guidelines. Impacts that exceed the design capabilities described in this manual (vehicle weight, speed and impact angle) may not result in acceptable crash performance as described in AS/NZS 3845.1:2015 and MASH relative to structural adequacy, occupant risk and vehicle trajectory factors.



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## Testing

SLED End Terminal is a crash worthy barrier system that has been thoroughly tested to AS/NZS 3845.1:2015 and MASH testing procedures. SLED End Terminal has been successfully tested as an end terminal up to 100km/h (TL-3) Note the maximum approved speed in Australia is 80km/h.

Two shorter length SLED options have been crash tested for Speed ratings of 50km/h and 70km/h.

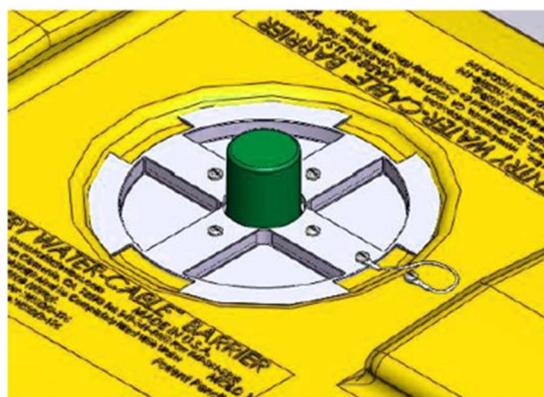
## System Design

A SLED End Terminal installation is comprised of a series of individual water filled sections constructed of high-density polyethylene. Steel cables are moulded into the barrier for tensile strength, plus one non filled section and a steel containment impact sled at the front and a steel transition assembly at the rear.

Each filled section has a water capacity of 834 litres and features a large 200mm diameter fill hole for easy and fast filling. A water level indicator is fitted to the cover of this hole to show whether the section is filled correctly. Each section also has a centrally located moulded in Buttress thread for easy draining.



*Water Level Indicator In Full "DOWN" Position—Wall Is Not Filled To Correct Capacity. It Is Necessary To Add Water.*



*Water Level Indicator In Full "UP" Position—Wall Is Filled To Correct Capacity*

At the end of each section are knuckles which contain vertically concentric holes. These knuckles interlock with the adjacent section and a galvanized steel T pin is installed through them to securely attach sections together. To ensure pins are installed properly there is also a safety keeper pin to be installed at the bottom.

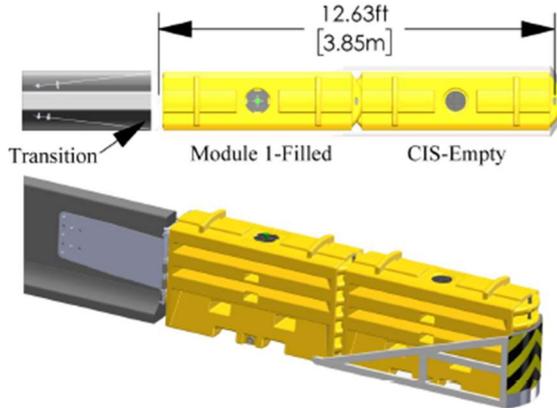
The HDPE plastic is durable and recyclable and will not crack or corrode over time. It will also break up into large pieces on impact, which do not pose a threat to bystanders. Terminal sections are made of yellow plastic. The end nose section is almost identical to the other sections but has large holes to ensure it is not filled with water. Attached to this section is a galvanized steel impact containment sled designed to contain the barriers during an end on impact. The steel sled is tethered to the concrete barrier by the series of steel cables moulded inside the Plastic sections. The steel transition assembly installs between the rear most section and the concrete or steel Longitudinal barriers.



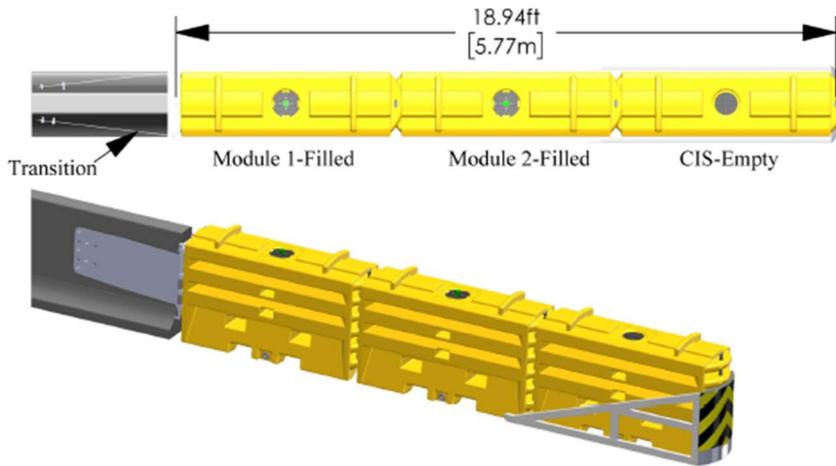
The SLED is available in 3 Lengths for low speed urban areas, Collector Roads and Highways -

### Speed Configuration

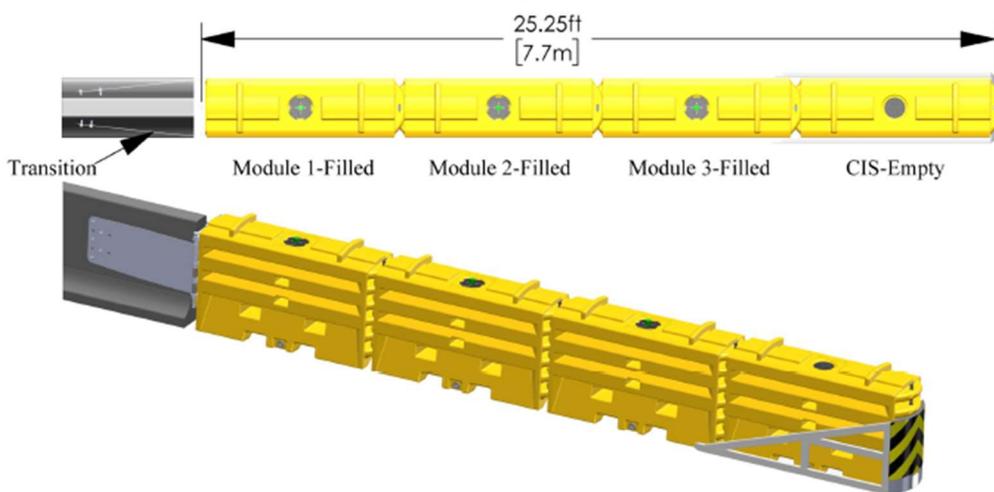
#### TL-1 Configuration up to 50 km/h (31 mph)



#### TL-2 Configuration up to 70 km/h (43 mph)



#### TL-3 Configuration up to 100 km/h (62 mph)



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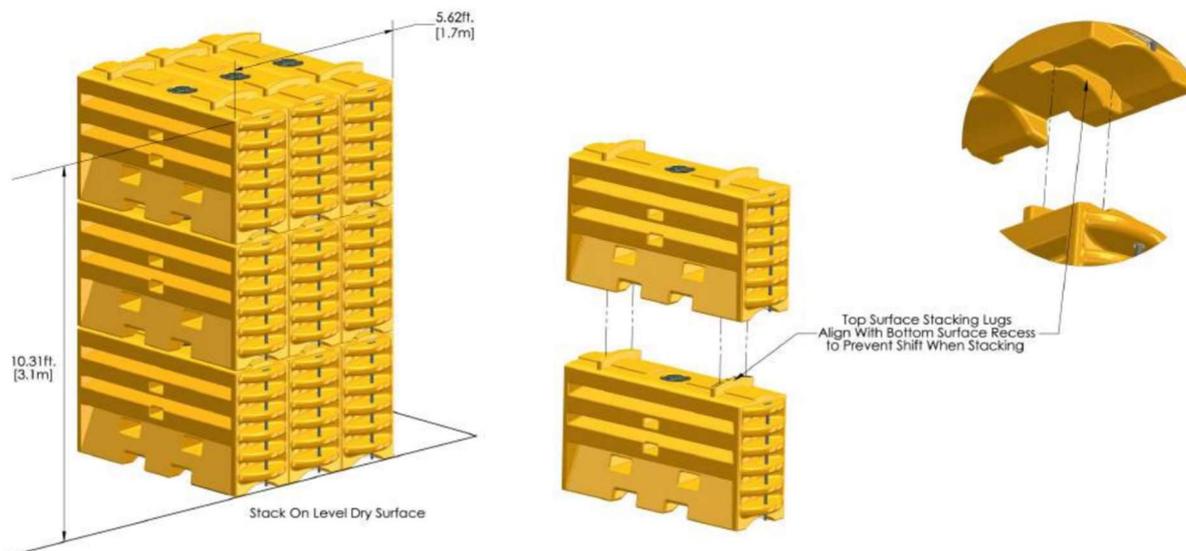
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See below for SLED specifications -

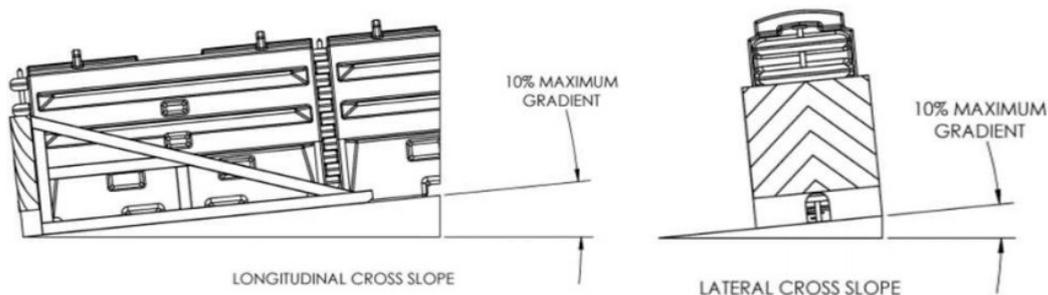
Installed Length	TL-3, 100km/h – 7.92m TL-2, 70km/h – 6.0m TL-1, 50km/h – 4.07m
System Height	1084mm
Segment Width	690mm
Weight per Module Empty	73kg
Weight per Module Full	907kg
Water per Module	834 Litres

All SLED End Terminal sections are yellow and contain internal moulded in steel cables. Any other colour, or product without internal moulded in cables, will not qualify as a SLED End Terminal product.

Sections should not be lifted from the moulded in cables. Sections can be moved either empty or full using a forklift. For bulk transport and storage sections should be emptied. sections may be stacked up to 3 high and are held in place by lugs and recesses on the top and bottom of each section. Sections should only be stacked empty and straps should also be used to secure sections together.



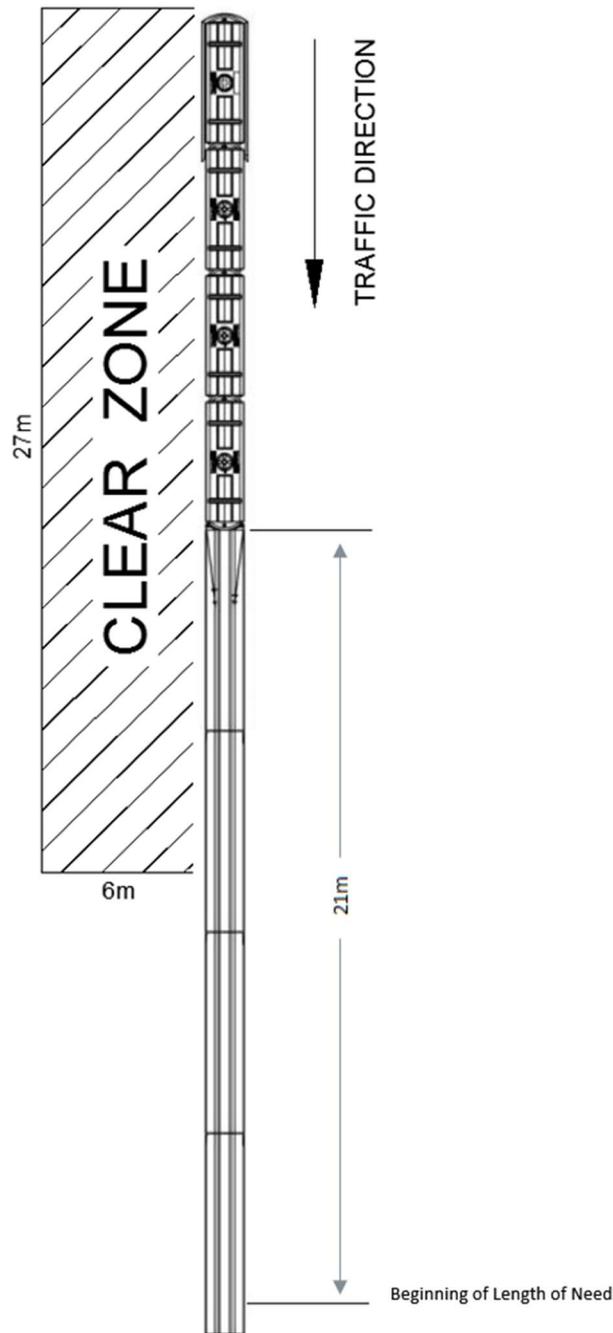
The SLED End Terminal is designed to be used in applications where the cross-fall will be less than 10 degrees (1.75m drop for every 10m of run).



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# Deployment Length of Need



The beginning of length of need of an unpinned concrete barrier is 21m from the beginning of the first portable concrete barrier as shown in the illustration.

Please refer to the HV2 Manual for Beginning Length of Need when Deployed with HV2 Barriers.

## Installation

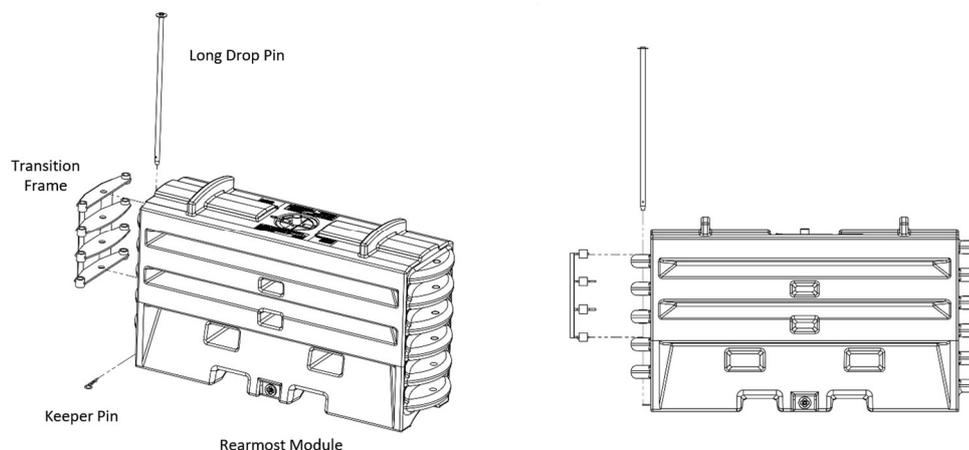
Since the SLED End Terminal is free standing and does not require anchoring the foundation is only required to hold the weight of the barriers. Acceptable foundations include concrete, asphalt, Sprayed sealed pavements and Unsealed Compacted Formation. Foundations should be free of rough surfaces such as pot holes, loose soil, rocks etc. especially under the barriers and within the deflection zone. Kerbs should not be in front of, or within the deflection zone of the barrier system.

Begin preparing for the installation by thoroughly reviewing the specified terminal location, layout and orientation as per the approved traffic management plan. A visual inspection should be carried out to confirm the suitability of all segments. Should visible damage be evident in any segments, they should be sent for inspection and repair prior to use.

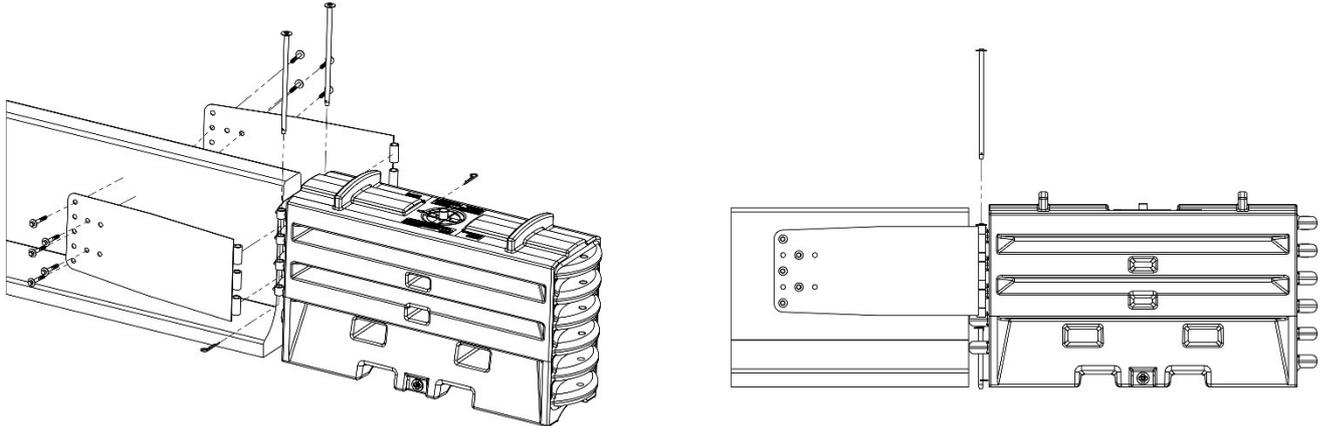
**Caution:** Refer the minimum installed lengths as illustrated in this manual to ensure compliance to AS/NZS 3845.1:2015 and MASH.

For a typical installation, the recommended tools and equipment are:

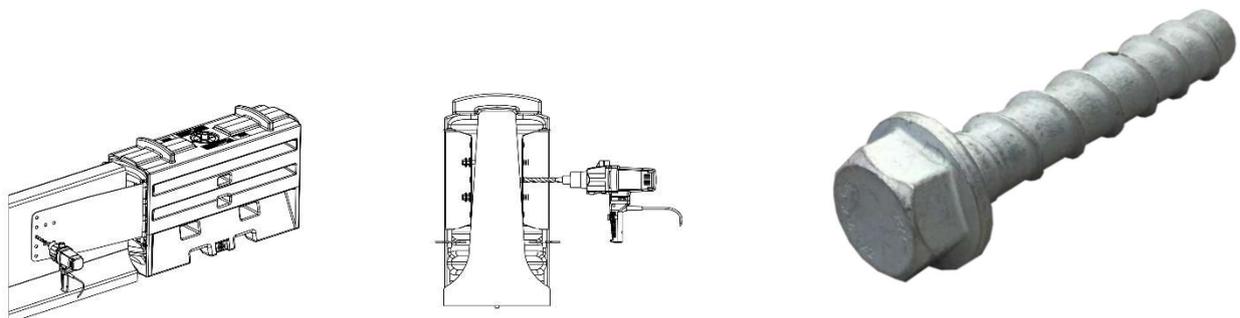
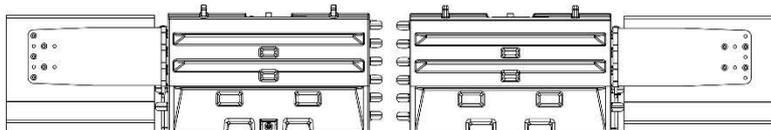
- SLED End Terminal Installation Manual.
  - Traffic control plan and approval.
  - Traffic control equipment (as required)
  - Fluted concrete drill bit 20mm diameter, 200mm minimum length
  - Rotational hammer drill
  - Torque wrench
  - Impact wrench
  - Sockets ¾" – 2"
  - Ratchet and extensions
  - Shifter
  - Hammer
  - Pry bars
1. Begin deployment at the concrete barrier. Work from the non-traffic side of the installation whenever possible. Unload segments from the transport vehicle using safe lifting and movement procedures.
  2. Install the transition frame on the rearmost section of the terminal so that the Transition plates sit at the upper section of the Barrier. Align centre holes of the transition frame and the knuckles of the module.



3. Insert the long drop pin through the centre holes of the transition frame and the module knuckles until the long drop pin is fully bottomed out.
4. Secure the long drop pin by inserting the keeper pin (R-clip) through the small hole near the bottom of the long drop pin.
5. Align the module and frame with the barrier leaving approximately 100mm between the module knuckles and the face of the barrier.
6. Align the transition panel hinges with the transition frame hinges.
7. Install the two short drop pins, one on the left and one on the right, from the top until the pins have fully bottomed out. Secure the short drop pins by inserting the keeper pins (R-clips) through the small hole near the bottom of each short drop pin. The hinges should now freely rotate.



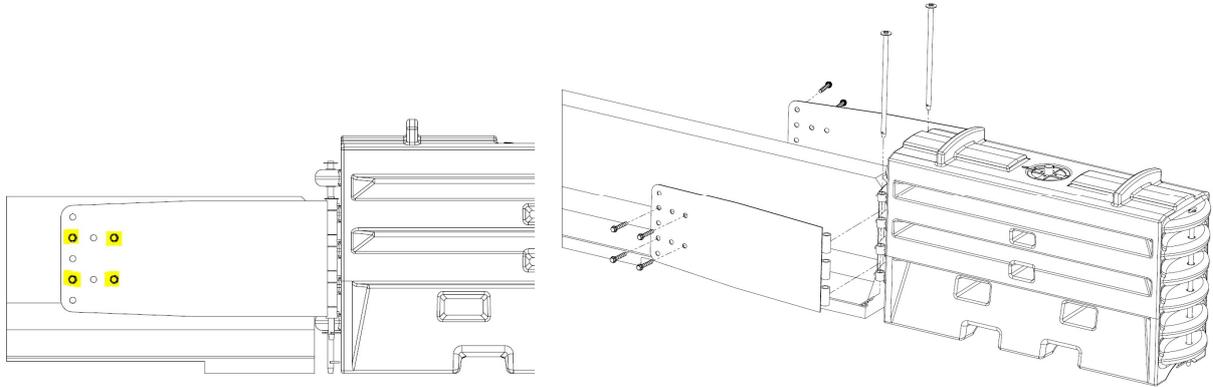
8. Rotate the transition panels till they contact the barrier. Panels may not sit flush on barrier.
9. Locate the anchoring holes that are to be drilled into the barrier wall. A minimum of 8 anchor bolts are required, 4 each side. Once holes are located use a rotary hammer drill with the appropriate drill bit to drill into the barrier the total length of the anchor bolt. Clear holes of debris.
10. Place an anchor bolt in each hole. 20mm x 120mm Hex head Screw Bolts are recommended for easy removal. Note that 3/4" x 4.5" Screw Bolts are supplied with new SLED kits from the USA, please ensure the correct drill bit size is used for installation.



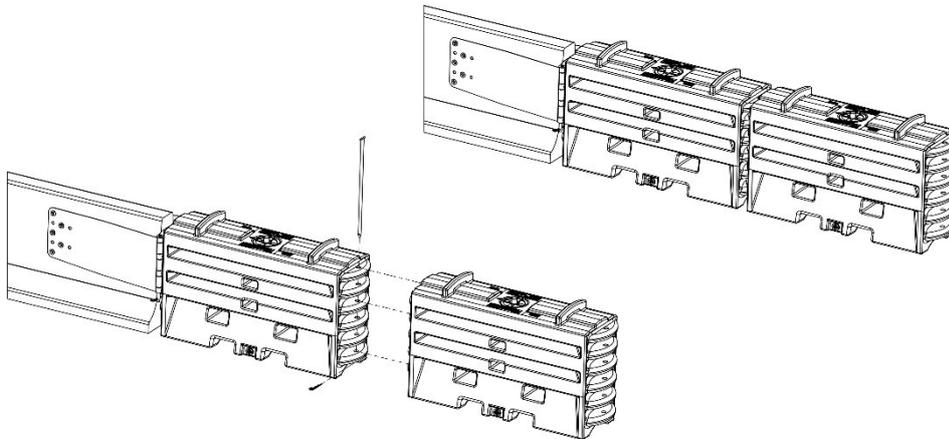
11. Use the torque wrench and torque the Screw Bolts as per manufacturers recommendations. Once all bolts are properly torqued remove the clamp.

**12. Recommended Assembly for DB80 Barrier**

The 5 Knuckle end of the SLED is to face the DB80 Barrier, connect the top plate of Transition Frame to the Second top knuckle. Use the 4 bolt holes in the Transition plate as shown below

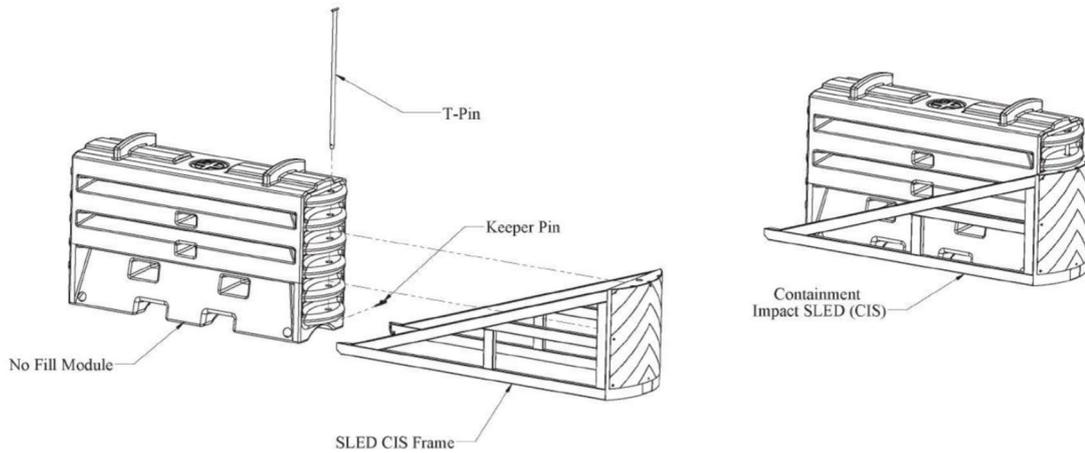


13. Position the next yellow water fillable module so the knuckles and connecting bolts are aligned. Be sure to mate a 6-knuckle end to a 5-knuckle end. Insert the T-Pin from the top until the T-Pin contacts the ground. Secure the connection between modules by inserting the keeper pin (R-Clip) through the small hole near the bottom of the T-Pin.

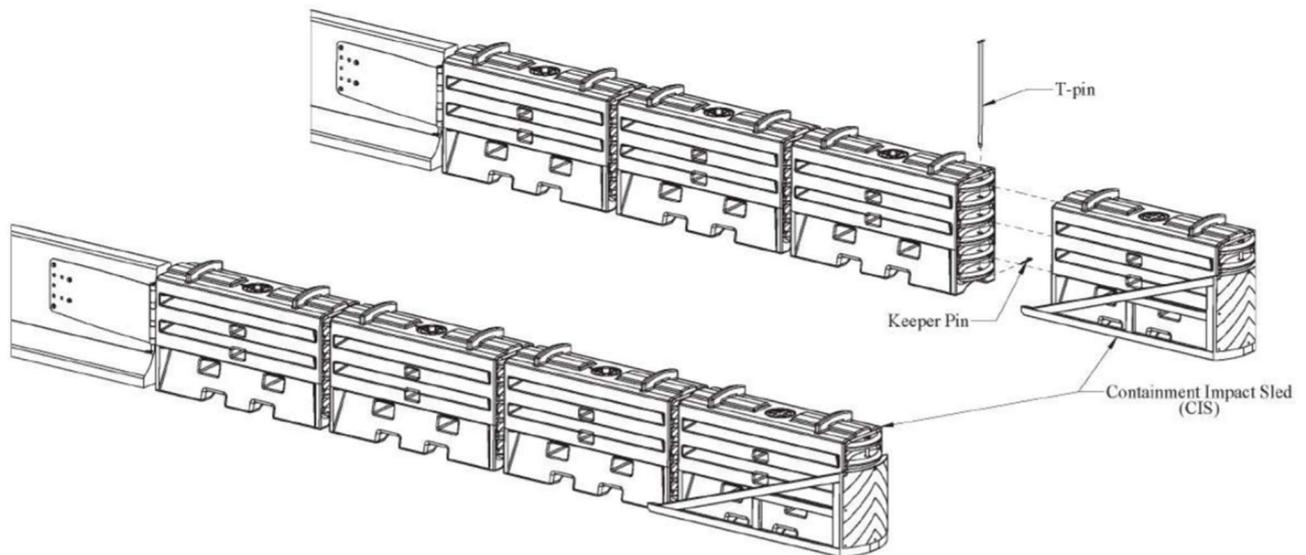


14. Repeat step 12 with the third module. Note that for the 70km/h SLED only 2 water fillable modules are used and only one for the 50km/h system.

15. The containment impact sled (CIS) comes preassembled with a yellow no fill module, T-Pin, keeper pin and SLED frame. Position the CIS so the knuckles and holes on the no fill module align with the previously installed module. If the CIS and previous module have the same number of knuckles the no fill module will need to be rotated within the CIS frame by removing the keeper and T-Pins, rotating the no fill module, and reinstalling both pins.

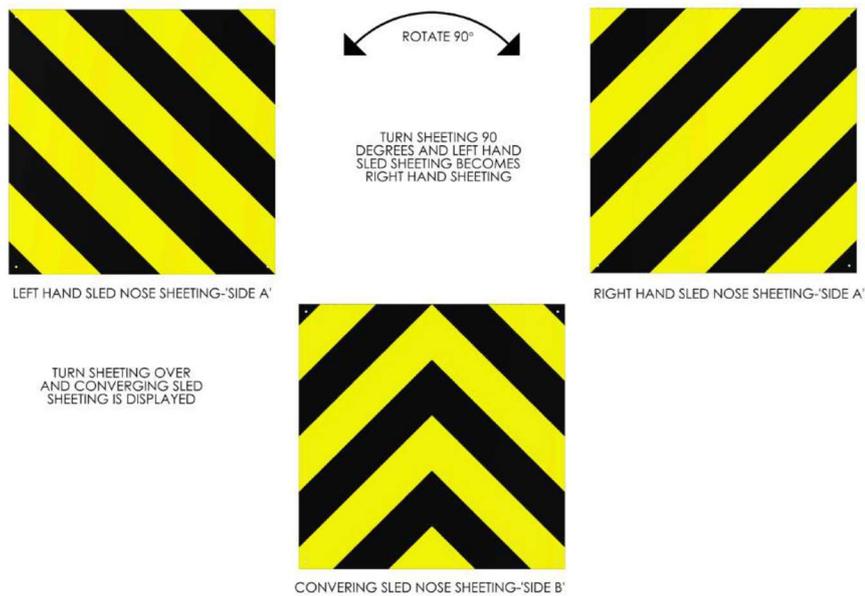


16. Install the T-pin from the top. Secure the connection between the modules but inserting the keeper pin (R-Clip) through the small hole near the bottom of the T-Pin. Note the CIS frame will slide under the front most water filled module by approximately 100mm.



17. Before filling double check all connections and the alignment of the transition, the water filled modules and the containment impact sled.

18. Make sure that the buttress thread drain plugs are installed and secure in each water filled module. Remove the water level indicator cap and fill each of the water filled modules with water. Ensure suitable antifreeze solution is used if required. Replace the water level indicator cap. The module is full when the water level indicator is fully extended. Fill all modules except the no fill module in the impact containment sled. The no fill module has 6 open drain holes to ensure it does not hold water.
19. The SLED Nose Sheet can be removed and realigned for either left or right Verge or Median Use.



## Retrieval

1. Remove the drain plugs from each module and allow water to drain.
2. Remove the keeper pins and T-Pins from containment impact sled and using appropriate techniques remove the containment impact sled.
3. Remove the keeper pins and T-Pins from the remaining modules and remove the modules.
4. Remove the bolts, keeper pins and T-Pins from the transition panels and remove the panels.
5. Remove the keeper pin and T-Pin from the transition frame. Remove the transition frame and module.

## Maintenance and Repair

While installed there should be periodic checking of the water level. There is no other scheduled maintenance. In a major impact any severely damaged sections should be removed and replaced. Mild damage may be able to be repaired.

A plastic repair kit is available from Saferoads with a patch and welding rod made of the same material as the SLED End Terminal. Patching holes or cracks should be done on clean dry surfaces with any paint or added finish removed. A small butane or propane torch is used to apply heat to the plastic rod. The rod should be melted to the patch and the barrier to bond them together. The torch temperature should be between 250-290°C and the head should be held between 6-13mm from the weld surface. Care should be taken to ensure only desired plastic is melted.

Repairing cracks and holes does not return the plastic to its original strength. Only minor repairs to ensure water tightness should be attempted and repairs should be monitored for a short period after the repair to ensure their quality.

## Antifreeze

In colder climates it is desirable that the water not freeze. In this case an appropriate anti-freeze should be used. Local restrictions and environmental impact should be considered when selecting an appropriate anti-freeze and care must be taken when draining barriers.



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## Safe Work Method Statement

Activity	Hazard Identified	Controls Required	Risk Before Controls	Person Responsible	Residual Risk	Sign Off
Lifting SLED Segments	Lifting equipment failure	Ensure machinery and operators are appropriately certified. Ensure all equipment is in good, working and tagged condition.	M		L	
	Contact with overhead services	Ensure there are no hazards above the area. If unsure arrange a spotter.	H		L	
	Contact with people or property	Ensure hazards are cleared from area, and do not use lifting equipment in adverse weather.	M		L	
Placing SLED Segments	Crushing under or between segments	Where possible personnel should be away from area. If personnel are required body parts should be clear when lowering and joining barrier segments. Appropriate PPE should also be worn.	M		L	
	Arriving or departing worksite	Abide by worksite speed limits and transport routes. Ensure nearby personnel are wearing high-vis clothing.	L		L	
Attending worksite	Environmental hazards	Personnel should wear appropriate clothing and footwear for environmental conditions.	L		L	
	Excess noise	Where required personnel should wear appropriate hearing protection.	M		L	
	Falling items or debris	Where required personnel should wear appropriate protective gear such as helmets, boots and eye protection.	M		L	

