

MRWA Energy Absorbing Bollard

Non-redirective crash attenuator

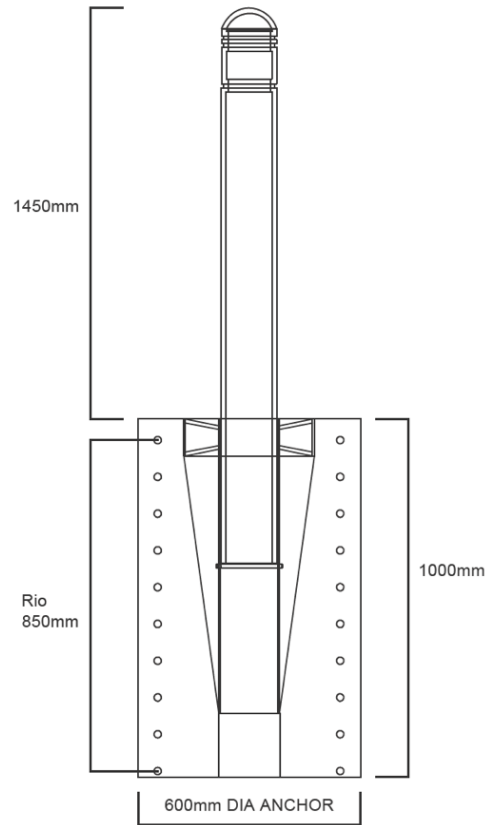






mainroads
WESTERN AUSTRALIA

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Western Australia.*

Energy Absorbing Bollard

- Heavy walled steel bollard
- Installed 1M deep
- 850 mm Reo cage
- Impacted by a passenger vehicle
- Weighing 1,600kg
- at 51.9km/h
- Impact Energy of **166.3kJ**



Footing	700Ø x 1000mm	
Vehicle Stopped	 Hatchback	 Sedan
	 SUV	 Pickup
Crash Tested	1600kg/3500lb vehicle at 60kmh/38mph	

These bollards provide a balance between containment and reduced risk to drivers and occupants.

An internal steel 1000 MPa H-bar is used to provide resistance against impact, coupled with a substantial 800 mm depth solid foundation that is reinforced using a 1 metre depth reo cage.

Surrounding the bollard is a polystyrene casing that crumples upon impact (much like the crumple zones on a vehicle) to absorb the impact force and reduce risk of injury. This damage results in broken footings and debris and the footings must be replaced, but if hit at high speed, they are likely to have saved lives.

Performance

The Energy Absorbing Bollard (EAB) has been designed and tested for installation in places to protect pedestrians from errant vehicles and from damaging buildings and infrastructure.

Performance is critically dependant on correct installation and over time, EABs may require maintenance. It is imperative installation crews are fully familiar with the installation and maintenance instructions.

This manual must be reviewed carefully before any work begins and if necessary, additional information and assistance can be obtained from your supplier

Non-redirective crash attenuator

Classified as a non-re-directive crash attenuator tested under AS/NZS :3845 :1999, Table 5.3.3(3) for a 1600kg vehicle impact at 60km/h the EA Bollard has been designed to safely decelerate and stop an out-of-control vehicle conforming to AS/NZS:3845:1999.

The EAB polystyrene cartridge progressively deforms on impact and absorbs the kinetic energy of the out-of-control vehicle.



Crash tested in accordance with AS/NZS 3845.2 demonstrating crash worthiness for speed zones up to and including 50 km/hr

Outcome: Bollards deflected to a maximum of 60 degrees upon impact demonstrating they were capable of preventing an errant vehicle from entering an area. The impact absorbing cushion crushed and required replacing.

[VIEW VIDEO](#)



The EAB is classed as a discrete crash cushion, tested to AS/NZS 3845:1999 Table 5.3.3 (3). The EAB has a compliance sticker featured prominently to identify the standard to which the EAB complies.

The “impact absorbing” nature of the bollards results in vehicles being brought to a complete stop, protecting people and assets from errant vehicles

Performance

The EAB will perform equally in soil, concrete, asphalt or paved surfaces providing the correct installation procedure is followed.

The material used for the top surface of the energy absorbing cartridge must be comparable strength or softer than the 25mm thick non-bonded pavers.

Stronger or thicker materials (like 32MPa concrete more than 25mm thick) might adversely affect the crash characteristics of the EAB performance in impact conditions.



25 mm non-bonded pavers
(or equivalent)

Fill with polyurethane foam

Soil

NB: The material used for the top surface of the energy absorbing cartridge must be comparable strength or softer than the 25mm thick non-bonded pavers.

Tools required

- High water pressure jet / vacuum truck
- Auger or digging tools
- Spirit level
- String line
- Road marking paint
- 1/2 Besser block or high-density foam block
- 32 MPa concrete
- Crowbar
- Shovel
- Broom



Before any attempt is made to begin the installation of an EAB, it is important to read and fully understand the installation instructions.

This will ensure correct installation and minimise possible errors which can compromise the performance of the EAB.

Before soil excavation begins, it is critical to locate all underground services. A plan / plans of the underground services can be obtained from Dial Before You Dig.

Using the plans and an experienced locator, all underground services (gas pipes, phone cables and water pipes) must be clearly marked on the surface of the road / footpath where the work will be undertaken.

Water jets and vacuum trucks are the preferred method for excavation. An auger could cause extensive damage to the underground services if not detected before works start.

While underground infrastructure plans supplied from Dial Before you Dig provide the best available public information, the risk of unidentified services not marked on the plans remains a reality, so extra care must be taken when excavating.



Recommendations

The EAB should be positioned to provide the maximum protection for pedestrians.

The EAB can be used as

- a single EAB to protect an area and should be positioned at least 500mm away from the area boundary.
- A line of EABs should be arranged as shown below with the spacing between the EABs to be the safest arrangement for the area at risk.
- Risk assessment must be conducted to ensure the optimum outcome.

To shield a concrete road barrier, steel road barriers or a rigid object, ensure the EAB is placed no further than 500mm from the object.

This will significantly increase the probability the out-of-control vehicle will hit an EAB and not the hazardous object.

When installing a line of EABs for a temporary work zone, consideration should be given for the ability of an out-of-control vehicle to enter the protected area. It is recommended a risk assessment be conducted, to determine the appropriate distance required in a line of EABs.

Make me removable

The EAB can be fitted with a lifting ring and if removed a cover plate must be placed over the hole in the cartridge as protection for the public and the cartridge



Replacing the damaged footing

In the event of impact, it is important to visually examine the damage at the earliest opportunity. Damaged paintwork is usually a sign the EAB has been impacted.

If a steel bollard is involved in an accident and does not have visible deformation (not bent) despite paint damage, the bollard may be able to be used again after it is cleaned and repainted.

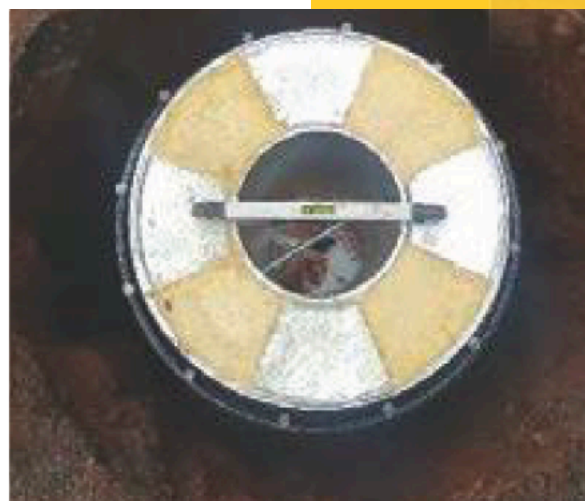
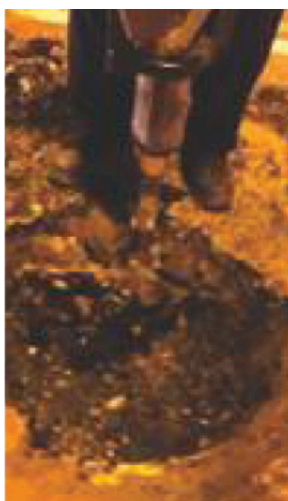
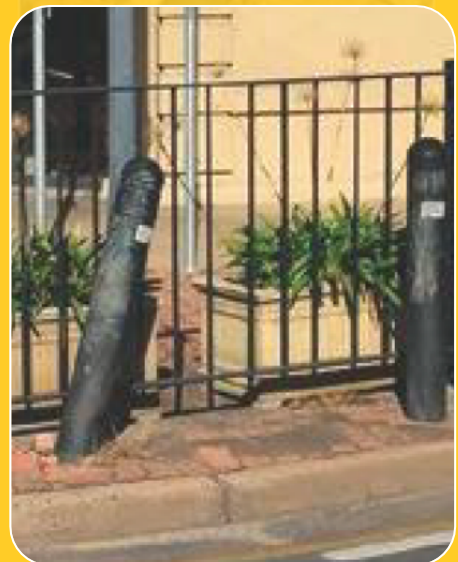
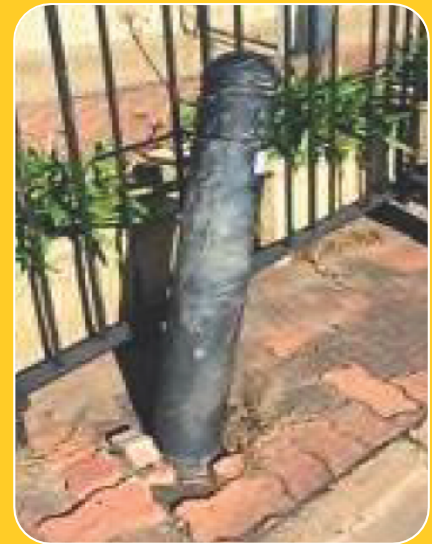
If any visible deformation of the steel bollard is detected, then a new steel bollard must be installed.







STEP 1: Examine damage to the foundation below the surface cartridge. Any significant damage to the cartridge will result in the bollard not being straight.





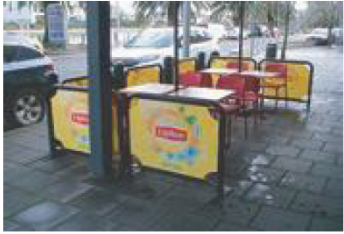
STEP 2: The bollard needs to be removed

STEP 3: The concrete footing needs to be broken using a jack hammer and crowbar.

STEP 4: A new cartridge and Reo cage need to be installed and filled with 32MPa concrete to repair the damaged footing.



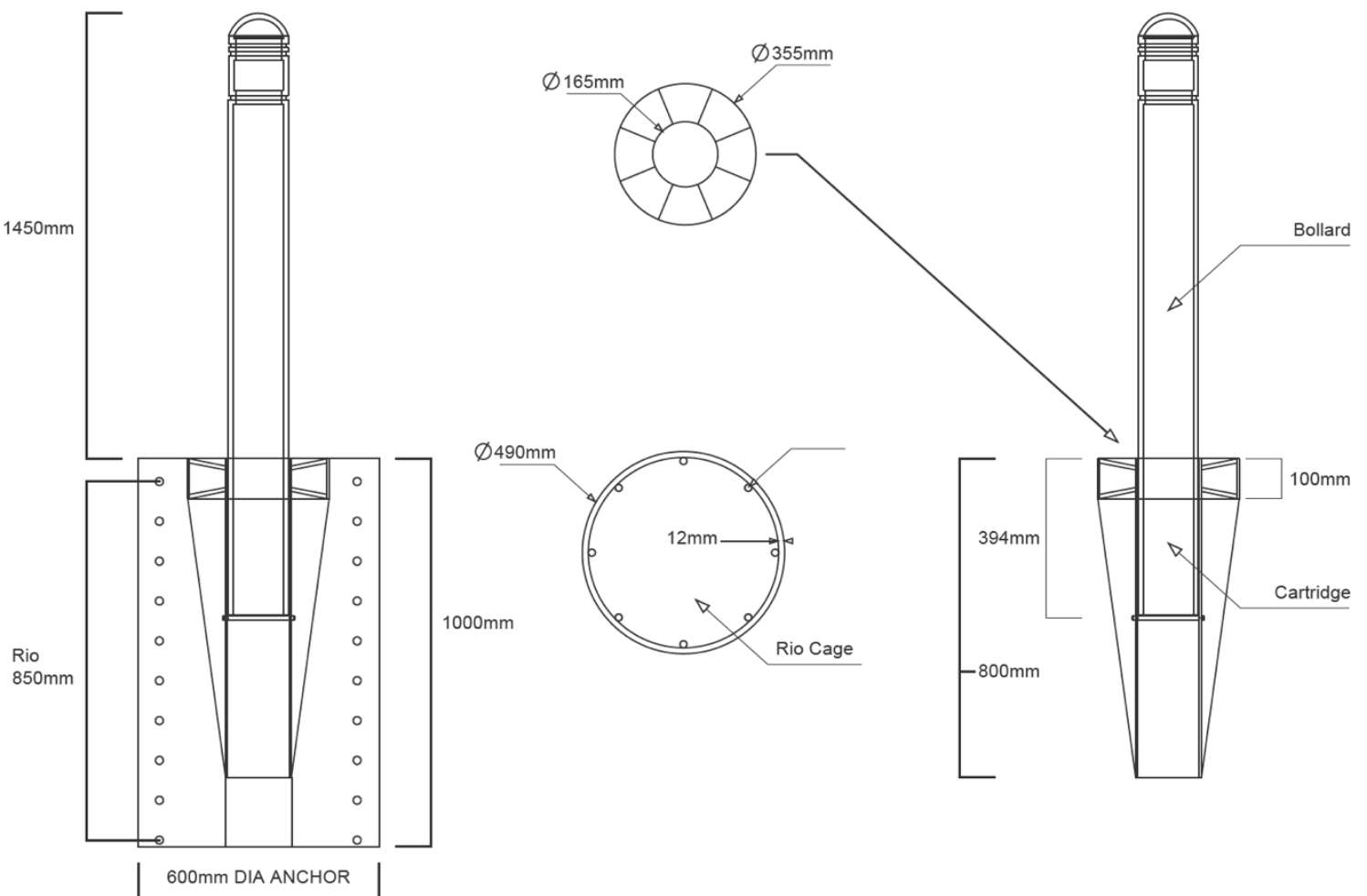
ITEM	ACTIVITY	ACCEPTANCE CRITERIA	PICTURE
1	Preparation	<p>Before soil excavation begins, locate all underground services. The underground services plans can be obtained from Dial Before You Dig. An experienced locator will identify all underground services (gas pipes, phone cables, water pipes, etc) from the plan and clearly mark these on the surface of the road or footpath. Water jets and vacuum trucks are preferred for excavation, rather than an auger which could cause extensive damage to obscured underground services. Correct PPE must be worn at all times during the installation. Refer to SWMS.</p>	 <p>DIAL BEFORE YOU DIG www.1100.com.au</p> <p>The Essential First Step.</p>
2	Site preparation	<p>Mark out where the hole centres are to be dug or excavated. Follow the site design.</p> <p>NOTE: It is recommended spacing be 600mm from the curbing, this may vary slightly depending on the job requirements.</p>	
3	Site preparation	<p>If installing a line of bollards, use a string line to check the bollards are in a straight line.</p> <p>NOTE: Ensure the ITP has been checked for the correct locator to avoid hitting any services.</p>	
4	Dig holes Use water jet vacuum truck or auger	<p>Excavate a 1000mm deep x 600mm diameter wide hole.</p> <p>NOTE: If using machinery refer to the SWMS for the safe operating procedure.</p> <p>NOTE: Water jet and vacuum truck are the preferred method for excavation, rather than an auger which could cause extensive damage to the obscured underground services.</p>	
5	Concrete holes	<p>Place the HD foam block or 1/2 a Besser brick in the centre of the hole and place the Roadside energy absorbing cartridge on top of the foam or brick.</p> <p>NOTE: The smaller end of the cartridge must be at the bottom of the hole to ensure correct bollard performance.</p>	
6	Position cartridge	<p>Insert the cylinder of the reo cage around the cartridge. Ensure the cage is at equal distance around the cartridge. Pour concrete into the space surrounding the cartridge to approximately 300mm.</p> <p>NOTE: Concrete should be 32Mpa strength concrete at a 70mm slump mix.</p>	

ITEM	ACTIVITY	ACCEPTANCE CRITERIA	PICTURE
7	Position cartridge	<p>Use a spirit level to ensure the cartridge is correctly positioned.</p> <p>NOTE: Using a 150mm x 1450mm light-weight galvanised pipe placed into the cartridge to check the bollards will be vertical will be helpful.</p>	
8	Pour concrete	<p>Fill the remainder of the hole with a minimum 32MPa strength concrete.</p> <p>NOTE: If the cartridge is to be covered with concrete or asphalt, the covering depth must not exceed a depth of 30mm. The cartridge may be covered with non bonded pavers to a depth of 50mm.</p>	
9	Place bollard	<p>Install the bollard once the concrete is dry by placing the Roadside EAB in the centre of the cartridge and lowering approximately 400mm on to the cross-bar.</p> <p>The material used for the top surface over the energy absorbing cartridge must be comparable strength or softer than the 25mm thick non bonded pavers. Much stronger and thicker materials (like 32MPa concrete more than 25mm thick) may affect the crash characteristics of the EAB performance when impacted.</p>	
10	Replace pavement	<p>Finish by screeding the concrete surface and if applicable replace pavers around the installed bollard.</p>	
11	Finish	<p>Clean and sweep up any excess dirt or debris from the site.</p>	

NB: Installers must complete the EAB registration form and email to hello@zerocivil.com

EAB installation weights and dimensions

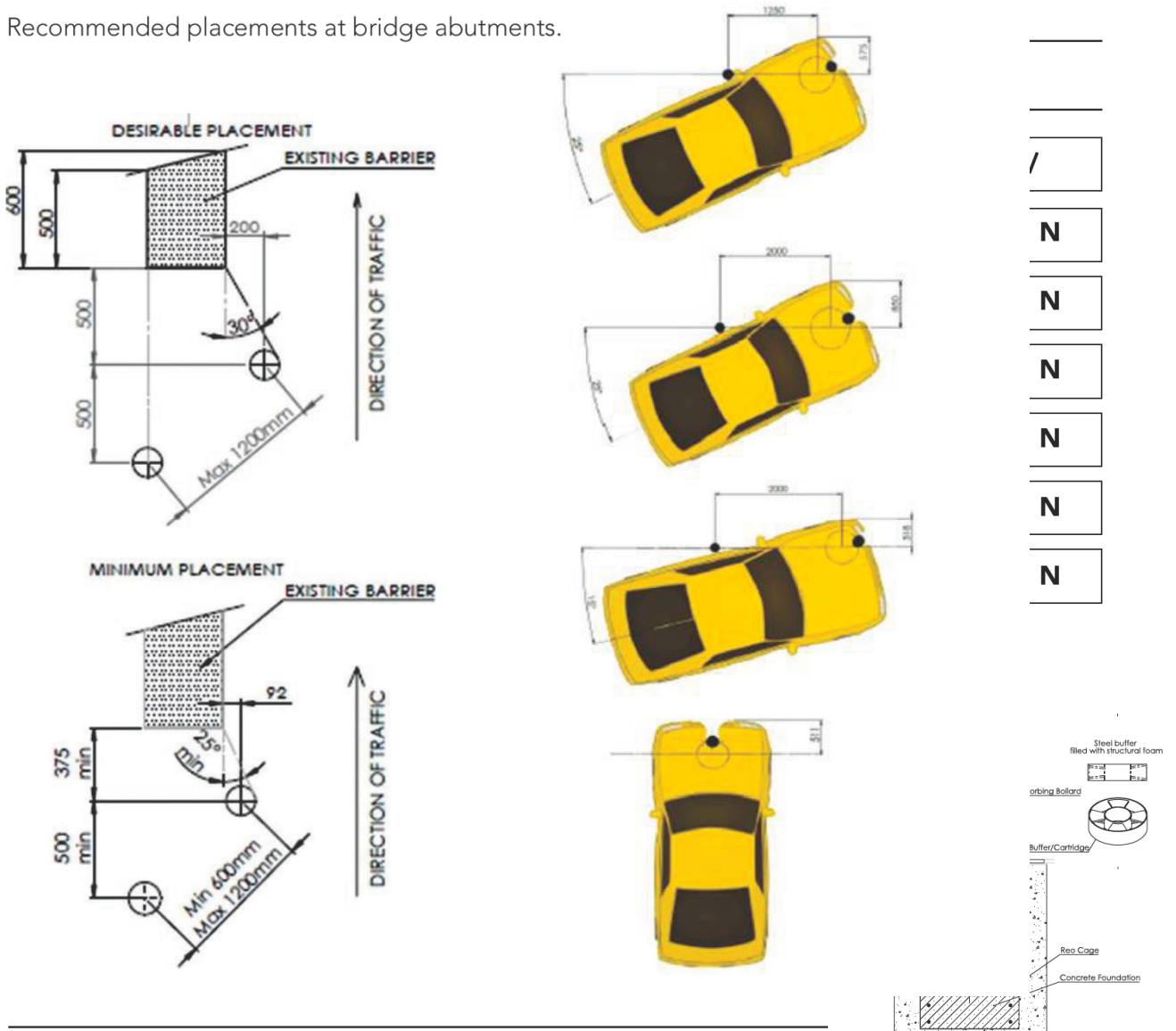
	Bollard, cartridge, reo cage	Bollard only	Cartridge only	Reo Cage only
Diameter	450mm	150mm	355.6mm	450mm
Length	1850mm	1450mm	800mm	800mm
Weight	120.3kg	67.5kg	28.5kg	24.5kg



When EABs are installed in a row, consideration must be given to the location and a clear zone prepared around the site. A site safety and risk assessment should be conducted to identify all possible impact directions before a recommendation is confirmed for the installation spacing. The different scenarios are provided below as a general guide only.

to hello@zerocivil.com

Recommended placements at bridge abutments.



Compliance Form

NOTE: Correct installation of the EAB is imperative to ensure performance under impact conditions. All installers of the EAB, MUST adhere to the following installation requirements and confirm installation documentation in writing the installation documentation has been strictly adhered to.

Name of company installing the EAB: _____

Installation site: _____

Installation date:

/	/
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1. "Dial Before You Dig" contacted and plans have been sourced.

Y	/	N
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2. Service location checks carried out. Proof required.

Y	/	N
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3. Correct reo cage installed 450mm x 800mm x 12N spiral.

Y	/	N
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4. Concrete used is 32MPa grade @ 70mm slump.

Y	/	N
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5. Concrete over the top of cartridge is not more than 25mm thick.

Y	/	N
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6. Surface around EAB reinstated to customer's specifications.

Y	/	N
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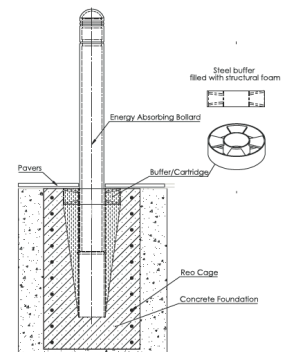
Installer's signature: _____

Print name: _____

Mobile number: _____

Email: _____

Additional comments about the installation:



Please sign and email copy to hello@zerocivil.com