



ZERO CIVIL

ZERO WASTE FOUNDATIONS

INNOVATION 01 OF 05

01

TAPER

Supplied in two halves. Can be truncated for 150 mm installation. Re-usable

SELF-DRILLING SCREWS.

Enable fast attachment of Taper to post without the need for pre-drilling.



350 MM GROUND SOCKET

Can be truncated to 150 mm or use an additional socket to extend to 650 mm depth

CAP

Used to seal socket during installation or when items are removed. No trip factors. Can be driven over.

SPECIFICATIONS 2026

UNIT INCLUDES.....	2
DEPTH FOOTING.....	4
TOOLS.....	5
ADVANCED POLYMERS.....	6
PERFECT ALIGNMENT.....	9
IMPACT TESTED.....	10
TEST FINDINGS:.....	10
IMPACT RESISTANT.....	12
FRANGIBILITY.....	13
RESULT OF IMPACT.....	15
NO DIGGING OR HEAVY LABOUR.....	16
UPGRADES OR CHANGES.....	17
ANY SIZE OR WEIGHT ITEM CAN BE SECURED.....	18
FOOTING DEPTH.....	19
INSTALLING BOLLARDS ON ZERO WASTE FOUNDATIONS.....	21
OUTCOME OF IMPACT.....	23
MRWA SPECIFICATION SIGNAGE 601 EXTRACT.....	24
DOH&S WORKSAFE AWARD.....	26
SUCCESSFULLY ADDRESSING THE MAJOR CAUSES OF WORKPLACE INJURY.....	26
INNOVATOR OF THE YEAR.....	27
WORKING PROCEDURES.....	29
DRAWINGS.....	30



INCLUDES
Department of
Transport



1. Ground socket 350 mm
2. Self-locking Taper
3. Cap
4. Self-drilling screws

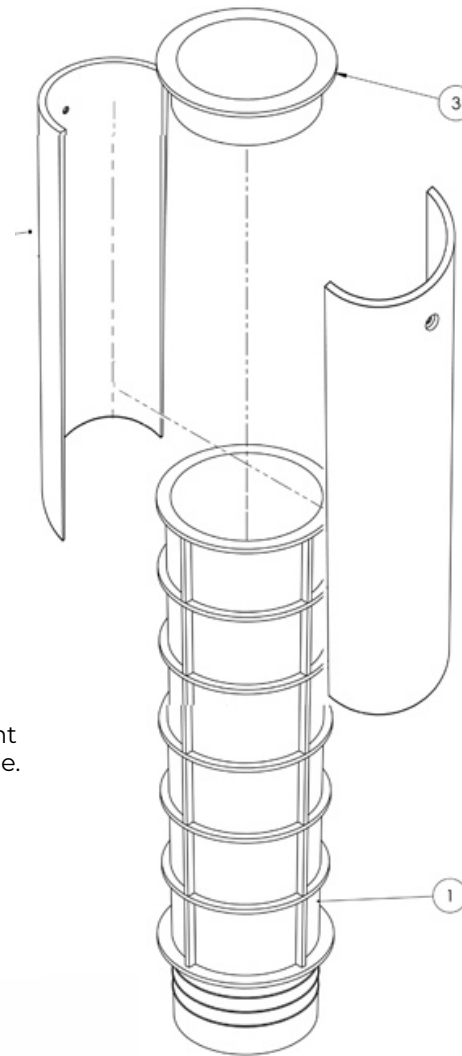
Self-drilling galvanised screws are supplied to attach taper to item and when item is dropped into the ground socket – it “automatically” locks in using friction

MRWA APPROVED

ZERO WASTE Foundations and CHS posts have been MRWA Approved for all regions
Refer to P.16

Self-locking Taper enables items to be safely secured using only friction – ensuring items remain perfectly aligned and secure and can only be removed using the tools provided.

Socket and Taper are both made from an Advanced Polymer compound resistant to impact and highly durable.



Cap supplied with every unit- used when installing socket and when items are removed.

Two holes in Taper- (one is spare) as Taper should be removed and re-used

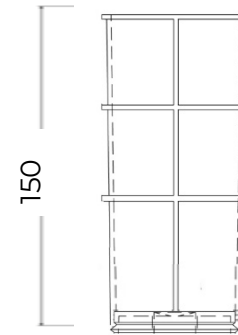
Ground Socket is 350 mm depth and can be reduced to 150 mm or extended to 650 mm Depth (see over for details)

DEPTH FOOTING

The socket provides a protective shield in the concrete footing, so the footing must be made large enough to ensure it is not dislodged when an item is impacted

It is the size of the concrete footing that determines what size item you can safely secure. Refer to local guidelines allowing for local wind and soil conditions, size or weight of item, possible impact force to ensure concrete footing is not dislodged when impacted

You can reduce depth to 150 for solid concrete pavements and traffic islands and increased depth to 650 mm or more for verge installations signs and bollards.

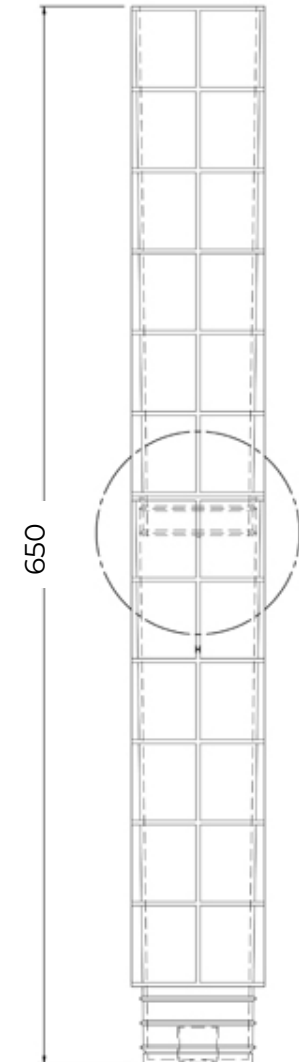


150 MM DEPTH

To reduce depth, you truncate base and reinsert into truncated socket (must be exactly 150 mm depth). Refer to directions

650 MM DEPTH

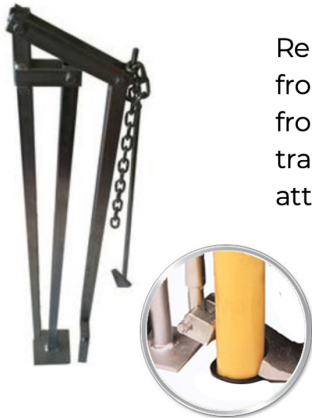
To extend depth you truncate one socket using a simple hand saw (or drop saw if doing large numbers) and insert into another. Sockets have vertical ribs to ensure tight fit. Refer to directions for details



TOOLS



Installation tool used to correctly align socket, enables installation of ground socket from standing position



Removal tool used to lever items from ground socket, operated from standing position, facing traffic, (sheared post removal attachment included)



Scan for more info

ADVANCED POLYMERS

Unlike old fashioned and cheap plastics that over time became brittle, the ZERO WASTE Foundations are made from what is referred to as "Smart Plastic" that self-repairs

Chosen for four important qualities:

1. It is the plastic most resistant to impact.
2. With excellent memory properties which enable it to absorb impact force, distort and return to its original shape without damage.
3. Because of its structure, isotactic polypropylene has the highest crystallinity, resulting in good mechanical properties such as stiffness and tensile strength.
4. It is considered the world's most environmentally friendly plastic
5. Rigid enough to hold the post accurately, but tough enough to deform slightly under impact instead of cracking or transferring all force into the concrete.
6. A **PP block copolymer** is polypropylene modified with ethylene-propylene making it tougher and less brittle than standard PP homopolymer.

Metal devices not only are not flexible or able to absorb impact force (protecting surrounding paving) Metal devices rust, corrode and need replacing after a limited lifespan.

Main Roads WA specifies PVC casings to secure signposts- but PVC becomes brittle primarily due to prolonged exposure to sunlight and extreme temperatures, These environmental factors degrade the material's structural integrity over time, causing a significant loss of impact resistance so that it shatters or cracks easily

THE SOLUTION

Because of its ability to deflect impact, dissipate kinetic force, and remain lightweight, advanced polypropylene is frequently used in demanding engineering applications such as high-impact zones such as car bumpers making it ideal for this application.

CORROSION RESISTANT

The expected lifespan of a steel post, or fixing device is around 10 years, but poor-quality steel can rust out in less than 6 months.

In the past five or so years we have seen massive influx of cheap Asian posts (with by far the majority of suppliers now supplying imported steel as shown below - this post lasted less than 3 months before rusting out at the base)

If corrosion effects are considered in the design phase and the right decisions made prior to construction, structures can be built to last and protected for far longer.

By securing steel infrastructure using ZERO WASTE Foundations an asset lifespan can be extended, and maintenance time and costs can be reduced.

SOLUTION

The ZERO WASTE ground socket forms a protective shield between the metal post or item of infrastructure and the concrete, reducing the risk of rust and corrosion.

The self-locking taper (secured to the item using galvanised screws) encircles the post protecting the post from the corrosive nature of concrete

Using only friction to secure items overcomes the problem of metal pins or padlocks that can rust and corrode creating dangerous litigation risks, unstable items or making it impossible to remove items when required

Items become corrosion resistant

Items of infrastructure secured on ZERO WASTE Foundations are protected from corrosion and are removable from the concrete foundation, making them removable, re-usable, re-locatable and 100% recyclable

RELIABLE LOCKING DEVICE

Conventional securing devices rely on pins, padlocks, screws, bolts or other mechanical fasteners to hold items in place. These components can break, seize, rust, corrode become loose, or become difficult to remove over time, leaving assets misaligned, jammed in position, or requiring complete replacement.

Rigid metal locking systems are also poorly suited to vulnerable roadside infrastructure. When impacted, they have limited ability to absorb and recover from force. Instead, they will distort, or transfer impact loads into the footing, corrode over time, and create an ongoing cycle of damage, repair and replacement.



ZERO WASTE Foundations solve this problem with a friction-locking system that requires no pins, padlocks or exposed mechanical locking parts. The post is secured by a tapered friction fit inside the ground socket, creating a strong, stable connection without complicated hardware.

A key advantage of this design is that impact does not force the post loose. Instead, impact can drive the tapered post connection further into the socket, increasing engagement rather than weakening the fixing.

Because the system locks through full-length friction rather than point fasteners, installed items remain secure, straight and correctly aligned over time. Posts cannot easily spin, loosen or shift out of position, reducing maintenance and helping roadside assets stay neat, safe and serviceable year after year.

PERFECT ALIGNMENT

It is very easy to spot a ZERO WASTE development as all items are perfectly aligned. Using only friction to secure items ensures they are perfectly aligned, remaining firmly secured in the footing year after year, impact after impact.

Metal bolts, metal pins or padlocks can become loose, making items unstable. If concrete anchors become loose, the concrete anchors cannot be reinserted into the same footing- the footing must be replaced.



IMPACT TESTED

Both Impact Tested and “pull Tested” to demonstrate locking capacity of the self-locking Taper principle using the Advanced Polypropylene compound.

TEST Findings:

Locking Capacity Tests: Conducted by Unirig Pty Ltd.

If secured according to directions, over 200 kg of upward force is required to remove items secured using the Smart Auto Lock Taper. (ZWF)

Durability Tests: Conducted by Unirig Pty Ltd.

The Smart Auto Lock Taper is highly resistant to damage. Even if the top half of the socket was sheared away the taper would continue to hold effectively.

Impact Tests: Automotive Safety Engineering Pty Ltd.

Impact from a vehicle will not adversely affect the Smart Auto Lock Taper. The post will bend at the surface of the concrete footing (or paving) and the foundations will remain undisturbed following multiple impacts.

Refer to Document “Testing and Approvals” for further details



CORROSION RESISTANT

The expected lifespan of a steel post, or fixing device is around 10 years, but poor-quality steel can rust out in less than 6 months.

In the past five or so years we have seen massive influx of cheap Asian posts (with by far the majority of suppliers now supplying imported steel as shown below - this post lasted less than 3 months before rusting out at the base)

If corrosion effects are considered in the design phase and the right decisions made prior to construction, structures can be built to last and protected for far longer.

By securing steel infrastructure using ZERO WASTE Foundations an asset lifespan can be extended, and maintenance time and costs can be reduced.

SOLUTION

The ZERO WASTE ground socket forms a protective shield between the metal post or item of infrastructure and the concrete, reducing the risk of rust and corrosion.

The self-locking taper (secured to the item using galvanised screws) encircles the post protecting the post from the corrosive nature of concrete

Using only friction to secure items overcomes the problem of metal pins or padlocks that can rust and corrode creating dangerous litigation risks, unstable items or making it impossible to remove items when required

Items become corrosion resistant

Items of infrastructure secured on ZERO WASTE Foundations are protected from corrosion and are removable from the concrete foundation, making them removable, re-usable, re-locatable and 100% recyclable

IMPACT RESISTANT

As neither metal nor concrete are impact resistant, installing items directly in concrete provides no future benefit. Metal devices provide a short-term benefit, although create major long-term problem as every device will need to be replaced.

Problem 1: Metal is prone to rust and corrosion and when items are installed directly in concrete, the concrete creates a corrosive force reducing the lifespan of the item and creating litigation risks

Problem 2: Metal is not malleable so when impacted the impact force can distort the metal damaging the device and the surrounding concrete and paving

Solution: Instead of using metal we utilised an impact resistant and self-healing plastic to create a protective shield between the item and the foundations that will endure for generations.

Problem 3: Metal devices require a pin, padlock, or ground anchor which can come loose or be damaged upon impact. Items can then become projectiles or be removed by vandals (more often than not 3 or 4 pins are required to hold an item)

Solution: Using only friction overcomes the problem of locking mechanisms that often fail creating dangerous litigation risks, unstable items or making it impossible to remove items when required. ZERO WASTE Foundations continue working effectively impact after impact, year after year.



FRANGIBILITY

ZERO WASTE Foundations are a protective shield and can be used to secure any strength of 60OD CHS post from 2.3 light walled to solid 60 mm steel bar. They do not affect the frangibility of an item.

To minimise risks associated with errant vehicles, for heavier or larger posts, a special shock absorbing mechanism is employed to limit impact force and the consequent vehicle deceleration. However, for the smaller posts, the practical approach used is to ensure the posts are frangible.

> The measure of post frangibility is based the post's bending strength.

> 60 OD Grade 350 CHS Steel post with a wall thickness of 3.2 or less, having a bending strength below 3.34 kNm are considered frangible, for all speeds.

> ZERO WASTE Traffic Bollards made using 60 OD Grade 350 CHS with a wall thickness of 2.9 are recommended by MRWA for use on highways with a speed of 100km or greater

LOW SPEED IMPACT

When a vehicle impacts a post at relatively low speed (Diag.1), the post will initially deflect elastically and if there is sufficient momentum and energy in the errant vehicle, the post's bending strength will be exceeded, leading to plastic deformation concentrated near the top of footing as the post bends over.

The maximum impact force can be estimated from the following: **$F_I \times \text{Height of Impact} = M_s$**

(M_s = Nominal section moment capacity of post = $3.34/0.9 = 3.71\text{kN.m}$ for 75x50x2.5RHS Gr350. Note the 'design strength' has been divided by the capacity reduction factor 0.9 to obtain the 'nominal strength').

Assume Height of Impact = 0.5m. $F_I = 3.34/0.9/0.5 = 7.42$ kN, approx. = **750kg force.**

High Speed Impact

When a vehicle impacts a post at a high speed (Diag.2), the response of the post is somewhat different to the low-speed impact.

For example, the inertia of the post above the point of impact is likely to cause an extra zone of plastic bending (or hinge) to form close to the point of impact, as show on the right.

This extra hinge in fact relieves the impact forces compared to a post remaining relatively straight but quickly gaining rotational or angular velocity concentrated at the footing top.)

> For the same post section size and height of impact, the corresponding force to cause this bending will be twice the previous value, i.e.: $F2 = 2 F1 = 1,500\text{kg force}$ (as an inflection point will be at a height of 0.25m). IE: The post will bend more easily, reducing risk of injury to drivers.

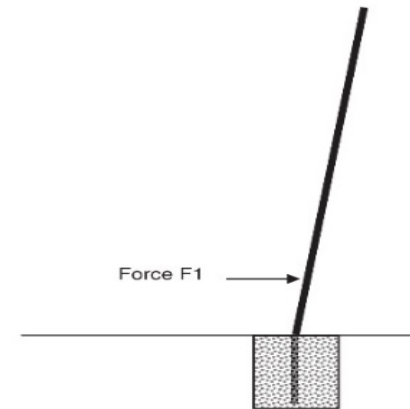


DIAGRAM. 1.

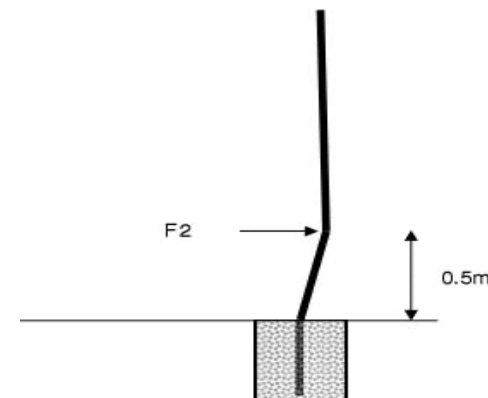


DIAGRAM. 2

RESULT OF IMPACT

Items remain firmly seated in the footing following impact and can only be removed using the tools provided- this overcomes the problem of items becoming loose or projectiles.

LOW SPEED

Low speed impact such as a carpark will result in bending of the post at ground level.

MEDIUM SPEED (60 KM ZONES)

At medium speed the post bends at ground level but the bending is more severe. Posts from 2.3 to 3.6 have been tested and the footing remains undisturbed following multiple impacts

HIGH SPEED (110 KM ZONES)

At high speed the post bends at ground level and can be flattened. Posts from 2.3 to 2.9 have been tested and the footing remains undisturbed following multiple impacts

Results are the same in concrete, asphalt or paving.



NO DIGGING OR HEAVY LABOUR

On new works this effect is immediate. For existing developments, it will take some time to become fully sustainable but within as little as 2-3 years around 80% of the workload could be simple swap outs.

- No digging or heavy labour (The Number one cause of injury for roadworkers)
- Time working in dangerous traffic reduced from 30 mins to 30 seconds (The Number one cause of serious injury)
- No risk if hitting dangerous underground obstacles (A growing concern, being both costly and possibly life threatening).
- No working with concrete dust (a growing concern, possibly very costly to Road Authorities)

With no change, these risk will continue to grow costing road authorities billions.

Find out how >>

In WA road-related workers' compensation claims were \$63.1 million in 2022/23

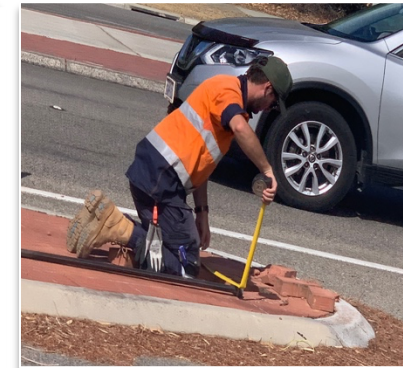
Workcover WA

\$4.6 billion is lost annually due to utility strikes.

BYDA

Traffic Management costs are soaring TMP's must be submitted, with approvals taking up to 10-20 working days

ABC



UPGRADES OR CHANGES

When you want to upgrade your bollards, change speeds or upgrade street furniture, it becomes simple. No need for dangerous temporary signage.

No delays in replacing worn out assets – keeping our roads and cities clean and infrastructure in good working condition becomes low cost and efficient

No need to dig up existing foundations- simply remove items using the ergonomic tools and insert new items- you can remove bollards, insert bins or tables or seating.

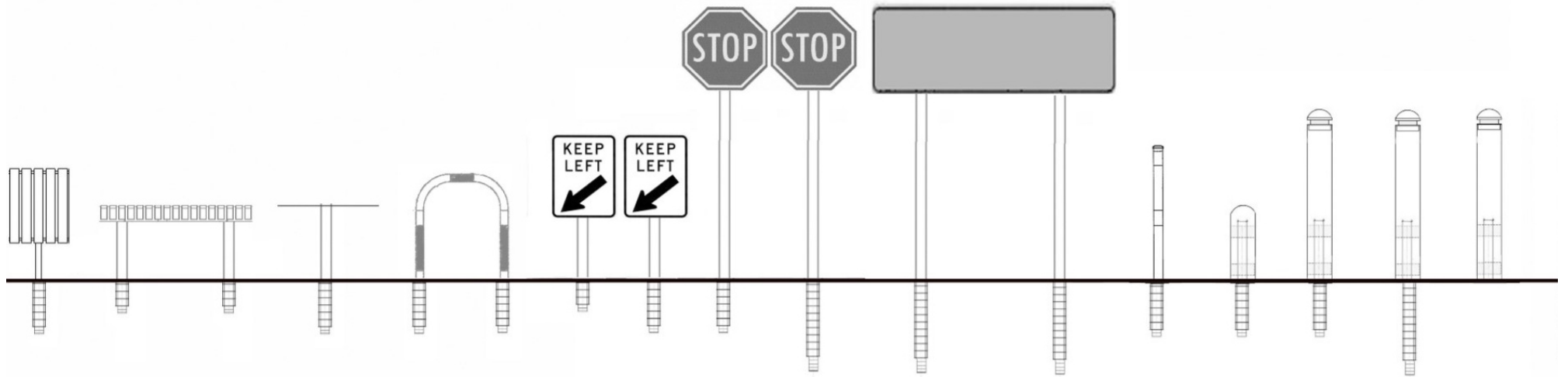
Old items can be reused or sold. Nothing needs to go to landfill.



ANY SIZE OR WEIGHT ITEM CAN BE SECURED

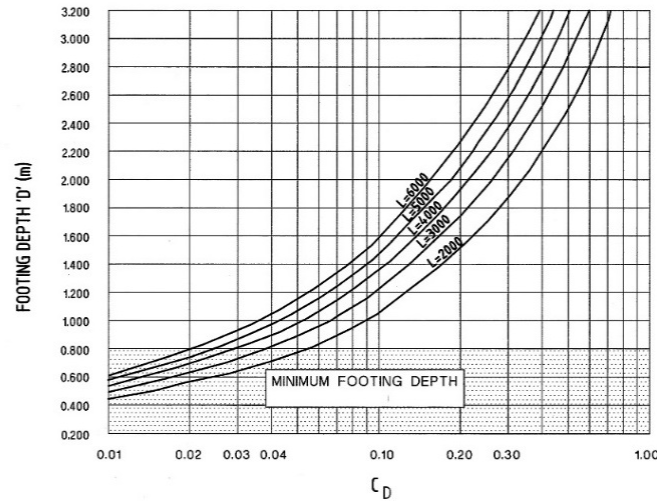
Because items are secured using friction there is no limit to the size or weight of item that can be secured using the same 60 mm footing.

This makes items interchangeable, making better use of infrastructure and space.



ANY SIZE OR WEIGHT ITEM CAN BE SECURED USING THE ZERO WASTE FOUNDATIONS (60 MM)

FOOTING DEPTH



$$C_D = \frac{F}{1.5Pbn}$$

- F = FORCE ACTING ON SIGN (kN), REFER TO DRG 0330-1680 & 1681
- P = SOIL PRESSURE INDEX (kPa)
- b = FOOTING DIAMETER (m)
- n = NUMBER OF POSTS
- L = MOMENT LEVER ARM(m), REFER TO DRG 0330-1679

RIITI ENGF FOIIATION TARI F

NOTES:

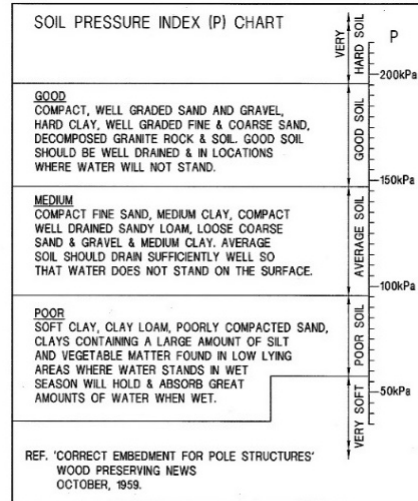
1. REFER TO USER GUIDE FOR EXAMPLE.
2. RUTLEDGE EQUATION

$$D = 1.18C_D + \sqrt{(1.18C_D)^2 + 2.63LC_D}$$

FOR D < 3m

SOURCE: "FOOTING DESIGN FOR WIND RESISTANT HIGHWAY SIGNBOARDS"; IVEY & HAWKINS, TEXAS TRANSPORTATION RESEARCHER (APRIL 1966).

3. DEPTH SCALE ON CHART INCLUDES 300mm FOR POSSIBLE DISTURBANCE TO SOIL AROUND POSTS.



POST SIZE	SUGGESTED FOOTING DIAMETER b (m)	ED
60.3 CHS 2.3	0.4	0.4
2.9	0.4	0.4
3.6	0.4	0.4
5.0	0.4	0.4
60.0	0.5	0.5

'ED' = MINIMUM EMBEDMENT DEPTH OF POST IN FOOTING (m)

Protective shield

The ZERO WASTE ground sockets create a protective shield between the item and the concrete foundations protecting the concrete from damage and making the item removable

Quality concrete can last 100 years

Good quality concrete can last 100 years, but rapid set can be damaged upon impact. If you want the foundations to not break up when items are impacted, or surrounding pavement to be damaged, you must use good quality concrete (MP30 or greater)

Ensure foundation is not dislodged

The concrete footing needs to be large enough to ensure it will not be dislodged if item is impacted- we have provided a guideline but as soil conditions differ from region to region- please refer to local guidelines.

NB: If base is dislodged it does not need to be disposed of. It can be re-aligned, and a little extra concrete added to stabilise the footing

The size footing must be adjusted to suit the size and weight of the item, wall thickness of the item and possible impact force. It is also affected by the existing foundations, whether they are soil or sand or existing concrete.

We cannot specify what every region will require- please refer to local guidelines.

AS A GUIDE FOR POST STRENGTH:

Diameter	Wall	Depth	Length	Finish
60 mm	2.3	150 – 650 mm	Supplied to length specified	Can be powder Coated
60 mm	2.9	150-650 mm	Supplied to length specified	Can be powder Coated
60 mm	3.6	650 mm	Supplied to length specified	Can be powder Coated

INSTALLING BOLLARDS ON ZERO WASTE FOUNDATIONS

Large diameter steel, stainless steel and Advanced Polymer Bollards can be installed on the same 60 mm ground socket using the Bollard Impact Recovery System.

The Impact Recovery System preserves the foundations and makes Bollards

- More resistant to impact
- Deflect a maximum of 20 degrees
- Self-recover from low speed impact
- Removable and re-usable following severe impact

*Surface Mount Option also available.

02

OUR SECOND INNOVATION



BOLLARDS RECOVER FROM IMPACT

When secured using the Impact Recovery System, bollards absorb low-speed vehicle impact (deflecting up to twenty degrees before the resistance core prevents further forward movement) and slowly, safely self-recover (no reduced capacity to recover following multiple impacts)

BOLLARDS REUSABLE

Bollards are removable (using ergonomic tools), and reusable, following even severe impact

FOOTINGS REUSABLE

The Impact Recovery System protects the surrounding pavements and footings from damage when bollards are impacted or need replacing.



IMPACT TESTED

ZERO WASTE Foundations are independently tested. Impact Recovery Bollards impact tested and supported by more than two decades of field performance. Visit website to view videos and client testimonials

INDUSTRY SUPPORT

Multi award winning, chosen by leading WA transport, road, utility and local government authorities — including Department of Transport, Main Roads WA, Western Power, City of Perth, City of Fremantle and City of Wanneroo

SAVE THOUSANDS

You save thousands over the life of a development not only by making bollards and surrounding foundations reusable but - greatly improving the safety and efficiency of bollard maintenance

OUTCOME OF IMPACT

Bollard Type	Speed	What happens upon impact
Surface Mount - Standard 140 Steel	≈ 4 km/h	Bolts bend or pull out, and slab damage is likely. These bollards are not protective they are regarded as aesthetic only.
Surface Mount - Standard 165 Steel	≈ 4 km/h	Bolts bend or pull out, and slab damage is likely. These bollards are not protective they are regarded as aesthetic only.
In-ground - Standard 140 Steel	≈ 7 km/h	Survives a very slow nudge. A light car hit can crack the footing. These bollards are not protective they are regarded as aesthetic only.
In-ground - Standard 140 Steel Concrete Filled	≈ 8 km/h	Stiffer but more brittle. Energy drives into the footing and moisture can be trapped causing rust. These bollards are not protective they are regarded as aesthetic only.
In-ground - Standard 165 Steel	≈ 7 km/h	Very limited improvement over 140 mm. As there is nowhere for the impact force to go, a car hit (especially with so many SUVs and 4WD on the road) still tends to damage the footing and can cause cars to become projectiles.
In-ground - Standard 165 Steel - Concrete Filled	≈ 8 km/h	Stiffer but with little real-world gain. Loads transfer into the footing and footing is dislodged with added risk of bollard rusting out at base and simply folding upon impact.
Impact Recovery - Surface Mount with Steel, Stainless steel or Advanced Polymer Bollard casing	≈ 13 km/h	Bollard deflects and self-recovers under low-speed impact and side glances. Upon higher-speed impact, the resistance core can bend and require replacement. Surrounding footing is not damaged.
Impact Recovery - In-ground 350 with Steel, Stainless steel or Advanced Polymer Bollard casing	≈ 16 km/h	Improved stability over surface mount. Bollard deflects and self-recovers under low-speed impact and side glances. Upon higher-speed impact, the resistance core can bend and require replacement. Surrounding footing is not damaged.
Impact Recovery - In-ground 650 with Steel, Stainless steel or Advanced Polymer Bollard casing	≈ 19 km/h	Greater embedment improves resistance to more serious low-speed impacts. Bollard deflects and self-recovers under low-speed impact and side glances. Upon higher-speed impact, the resistance core can bend and require replacement. Surrounding footing is not damaged.
Impact Recovery - In-ground 650 (Extra Heavy Duty) with Steel, Stainless steel or Advanced Polymer Bollard casing	≈ 21 km/h	Highest-duty option for severe low-speed impacts/ impacts from utility vehicles or trucks. Bollard deflects and self-recovers under low-speed impact and side glances. Upon higher-speed impact, the resistance core can bend and require replacement. Surrounding footing is not damaged.

MRWA SPECIFICATION SIGNAGE 601 EXTRACT

MRWA has approved the use of ZERO WASTE Foundations and CHS posts in all regions. Sign support dimensions shall be in accordance with Drawing Nos [8720-0657](#), 0330-1686, 0330-1687 and 0330-1688 and the post schedules shown on the sign drawings.

Taper lock base (ZERO WASTE Foundations) added for circular signpost in Clauses 601.43.04, 601.43.07 & 601.26.3(b). Refer to manufacturer's drawings for details

AREA	SIGN SIZE	
	A & B	C & D
METROPOLITAN PERTH AND BUILT-UP AREAS	76x38x2.0 RHS or 60.3 CHS 2.3	75x50x2.5 RHS 60.3 CHS 2.9
RURAL AREAS SUBJECT TO TROPICAL CYCLONES (REGIONS C&D - DWG. 9430-506)	75x50x2.5 RHS 60.3 CHS 2.9	75x50x2.5 RHS 60.3 CHS 2.9
RURAL AREAS NOT SUBJECT TO TROPICAL CYCLONES (REGIONS A&B - DWG. 9430-506)	76x38x2.0 RHS or 60.3 CHS 2.3	75x50x2.5 RHS 60.3 CHS 2.9

SINGLE TRAFFIC SIGN POSTS

1. For signs facing oncoming traffic, 60.3 mm CHS 2.3 mm posts are to be used in conjunction with a fixing bracket that provides a flat surface of approximate 75 mm x 20 mm around the bolt fixing area to secure the sign to the post. The fixing bracket shall also restrain the sign from rotating around the post.
2. The CHS posts may be also used in situations where the use of a removable post system can have a significant cost benefit in replacing the damaged sign post by reusing the existing footing. Approved systems are given in Annexure 601G.
3. Approved single sign posts for use as alternative are given in Annexure 601G.

ANNEXURE 601G: MAIN ROADS APPROVED ALTERNATIVE SIGN POSTS AND POST FIXING DEVICES

3 Smart Taper (post fixing device) – Smart Urban Pty Ltd

<https://smarturban.com.au/>



SCAN TO VIEW
MRWA SPEC 601

601.43.07 ALTERNATIVE SIGN POST FIXING DEVICES

1. For signs to be installed where a concrete surface cannot readily be removed to excavate the post hole, an approved galvanised post mounting bracket may be bolted to the surface. Main Roads approved mounting brackets are listed at Annexure 601E.

The taper-lock method for fixing the sign post may be used as an alternative by core drilling the surface (or removing the pavers to install the socket in the case of a paved area). The method of installation shall be as recommended by the manufacturer.

Any fixings associated with mounting of removable posts and flexi-posts shall be in accordance with Drawing No. 9548-0106 or the recommendation of manufacturers for approved products given in Annexure 601G.

A square or circular hole as shown on Drawing No. 9548-0106 or manufacturer's drawing for flexible and removable posts, shall be excavated to accommodate the sign post, footing and any attachments.

Flexible and removable signs posts shall be installed in accordance with the Drawing No. 9548-0106 or manufacturer's recommendation for approved products given in Annexure 601G.

If an approved self-locking taper is used for installing the sign post, the footing, sleeves and bases for the installation of the sign post shall be in accordance with the manufacturer's recommendation.

DOH&S WORKSAFE AWARD

Dept of Occupational Health and Safety awarded ZERO WASTE Foundations the WorkSafe Award for:

"Outstanding achievement in the workplace in designing new innovative work systems that significantly reduce the risk of workplace injury".

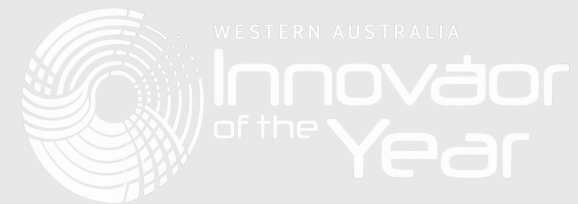
Successfully addressing the major causes of workplace injury

- Major cause of injury (digging and heavy labour)
- The major cause of serious injury (working in traffic)



INNOVATOR OF THE YEAR




Australian Small Business Development Corporation awarded ZERO WASTE Foundations the prestigious Innovation of the Year Award. Shown here is the inventor of ZERO WASTE Foundations being presented the award by the state's premier.

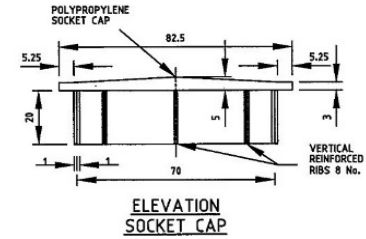
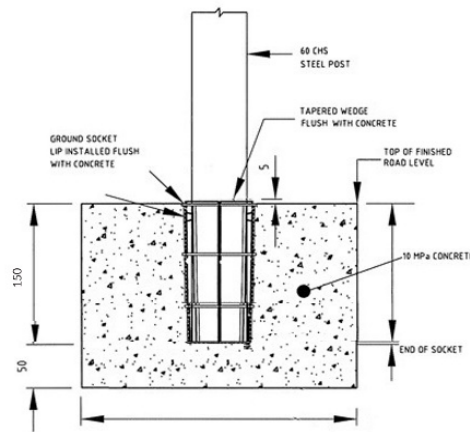
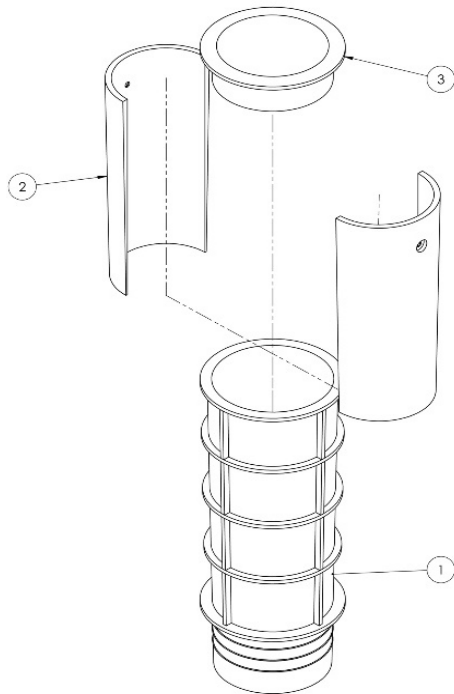


CASE STUDIES

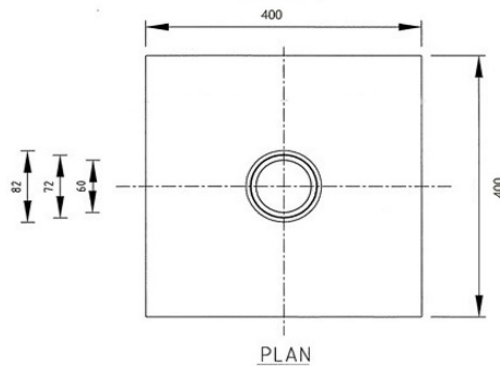
Refer to document “Testing and Approvals” for details and case studies.

- MRWA
- Ventia
- Subiaco
- VCP Streetcare Holland
- Tomen Corporation Japan
- Leighton Contractors
- City of Fremantle
- City of Perth
- City of Bunbury
- Stirling City
- Rio Tinto
- Jesters Pies
- Western Power
- Department of Transport

TASK	HAZARDS	WORKING PROCEDURES
 <p data-bbox="136 544 367 571">Installing Sockets</p>	<ul style="list-style-type: none"> - Bending of the back - Twisting of the back - Working in traffic 	<ul style="list-style-type: none"> • Dial before you dig • Install appropriate traffic management • Dig hole to insert ground socket • Insert Installation tool inside ground socket • Lower Installation tool & socket into hole and fill with concrete. • Operate installation tool from standing position with straight back
 <p data-bbox="136 919 340 946">Installing Items</p>	<ul style="list-style-type: none"> - Bending of the back - Twisting of the back - Working in traffic - Item not secure 	<ul style="list-style-type: none"> • Install appropriate traffic management/ cones • Attach Taper to item using self-drilling screws provided (This can be done prior to going onsite to reduce time on location) • For 2.9 – 3.6 wall thickness posts we suggest pre-drilling • Using two hands, drop item firmly into ground socket • Check item is sufficiently installed to protect from unauthorized removal
 <p data-bbox="136 1374 398 1401">Using Removal Tool</p>	<ul style="list-style-type: none"> - Bending of the back - Twisting of the back - Working in traffic - Trapping of fingers 	<ul style="list-style-type: none"> • Position a minimum of two safety cones or safety barriers at extremity of working space • Make sure the base of the tool as close as possible to the base of the item before applying jerking action • Apply downward quick jerking action to arm of tool • Lift item from ground socket using two arms (for items over 25 kg, 2 people must lift item from ground socket) • Bend knees to insert cap in ground socket/ or insert new item

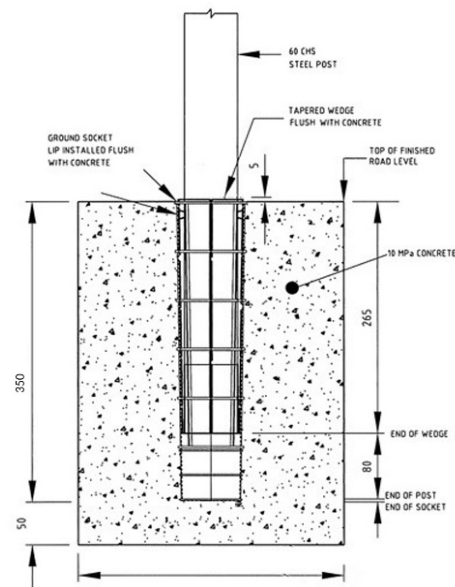
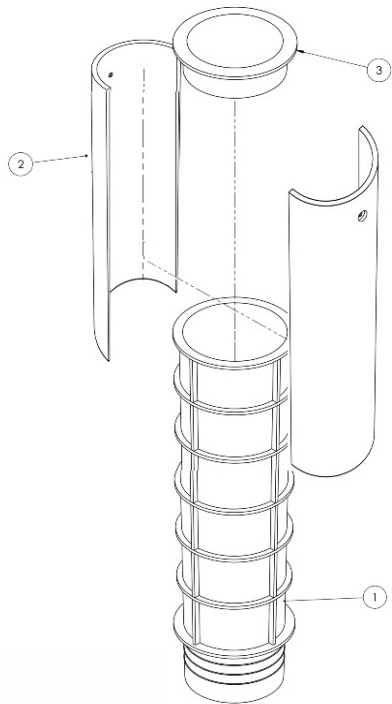


SECTIONAL ELEVATION
FOOTING

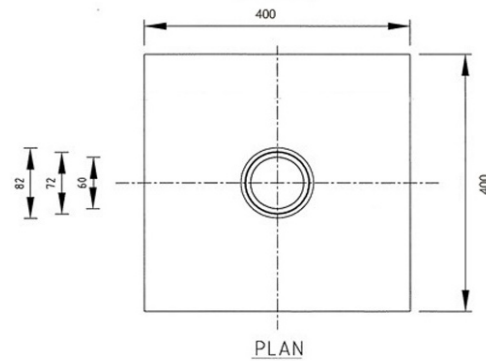


You can install ground sockets from as shallow as 150 mm in solid concrete or asphalt foundations such as concrete footpaths and traffic islands

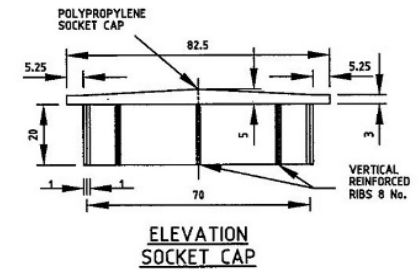
Units are manufactured 350 mm depth and sockets can be truncated at any horizontal rib (easily performed on site if you run into underground obstacles) and base reinserted into the open end of the socket- Refer to Directions for details



SECTIONAL ELEVATION
FOOTING

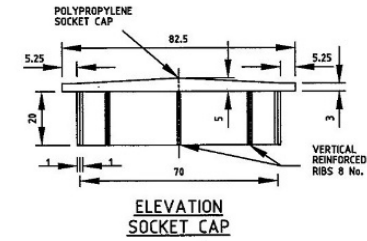
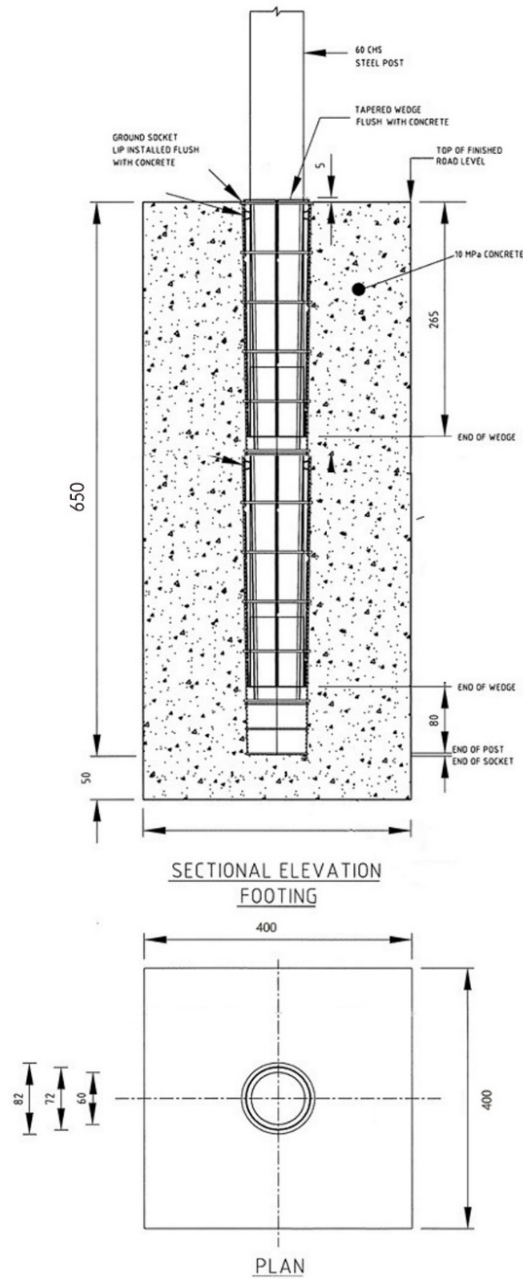
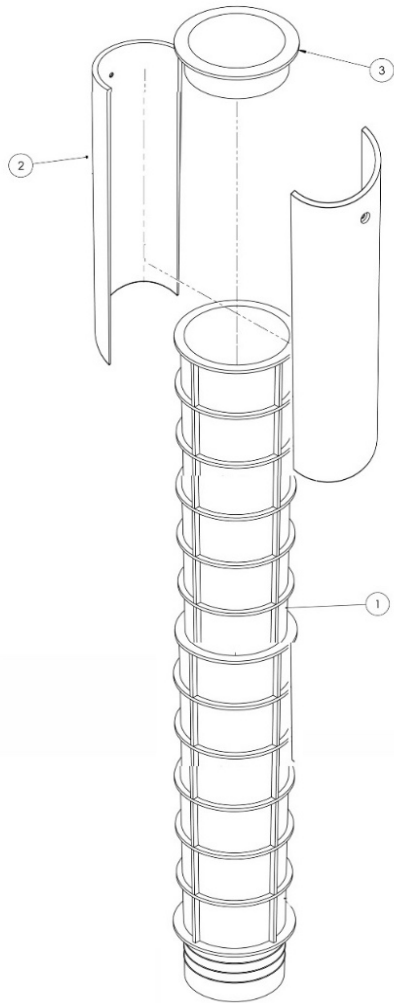


PLAN



ELEVATION
SOCKET CAP

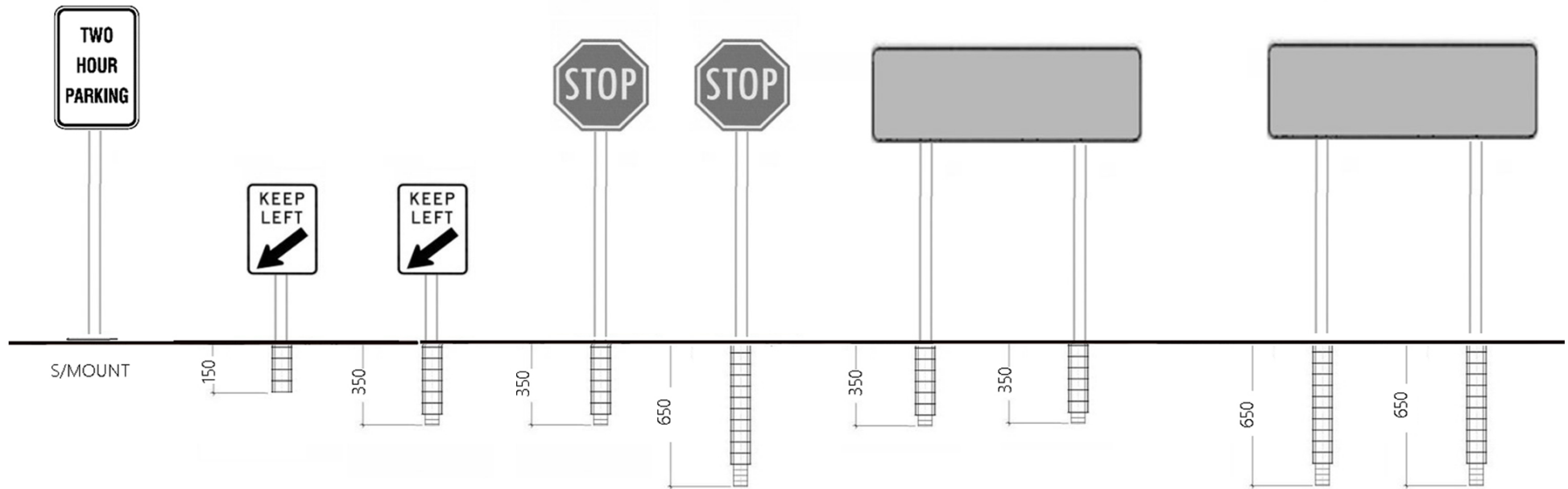
350 mm is the standard depth-suitable for securing most road-side items and street furniture in solid concrete or paved areas



You need to purchase additional ground sockets to extend depth of ground socket.

Two ground sockets are joined to form a 650mm ground socket. One socket is truncated and inserted into the second socket.

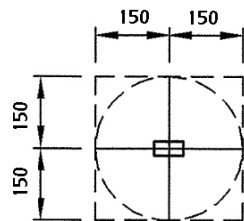
650 mm Depth foundations are suitable for securing large items such as heavy-Duty Impact Recovery bollards (secured using an Extra Heavy-duty internal core) or free-standing items installed in verges or grassed areas.



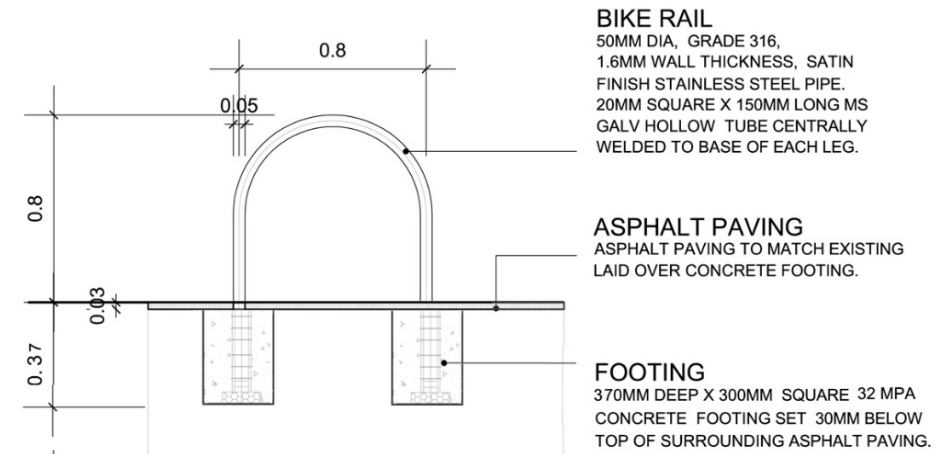
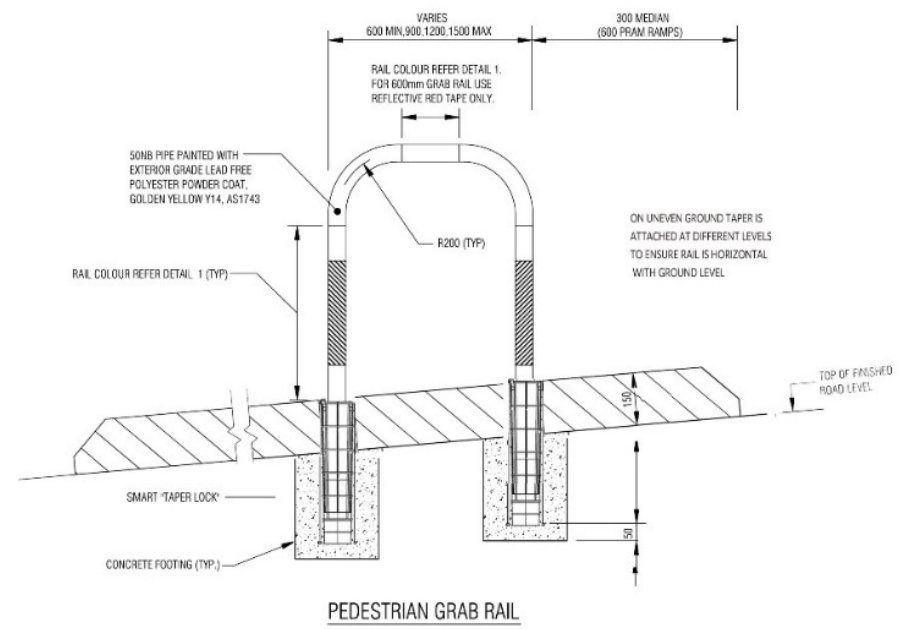
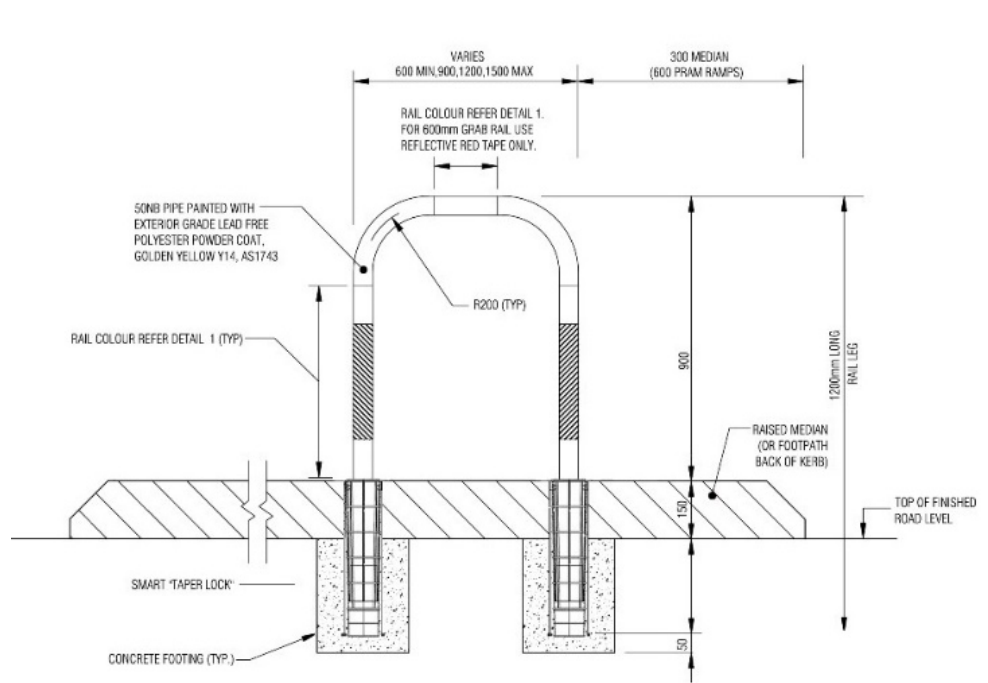
As the socket creates a protective shield and provide friction the entire length of the socket you can install any size or weight sign (plus any wall thickness of post) Simply increase the size of the footings accordingly (depth varies according to speed of vehicles; wind conditions/ soil conditions.) Follow local guidelines for required depth.

As a guide:

- You can surface mount heavy Gauge 3.6 mm wall thickness posts using the re-usable base plate.
- You can install small signs and signs installed into solid concrete footings (concrete footpath or traffic island from as shallow as 150 mm)
- You can install large signs into solid concrete footings (concrete footpath or traffic island) from as shallow as 350 mm Depth.
- Free standing signs (in soil) should be installed to depth a min of 650 mm depth
- Allow 50 mm for rubble beneath socket for drainage (must pierce hole in ground socket if you want drainage)



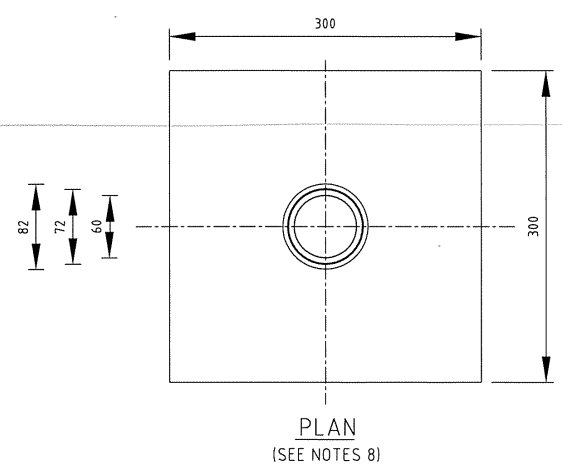
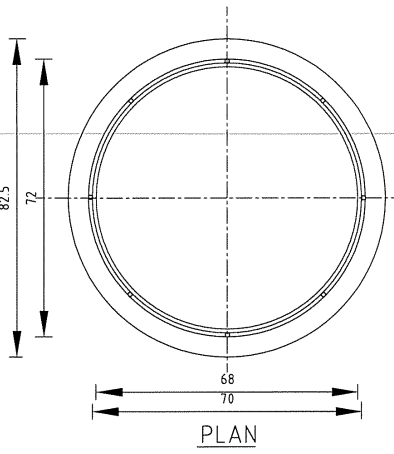
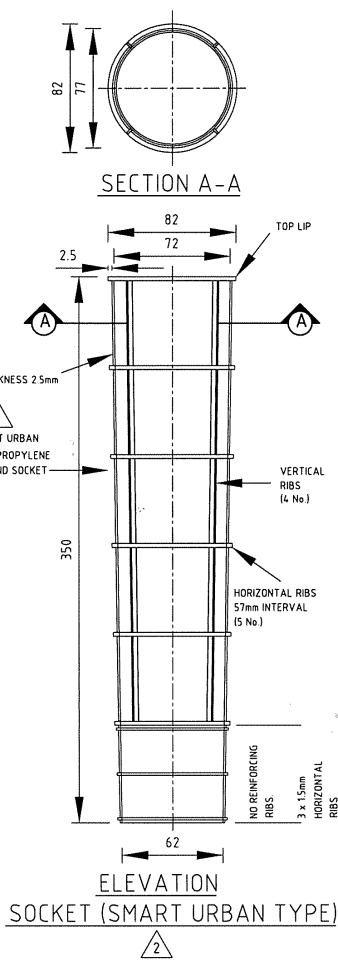
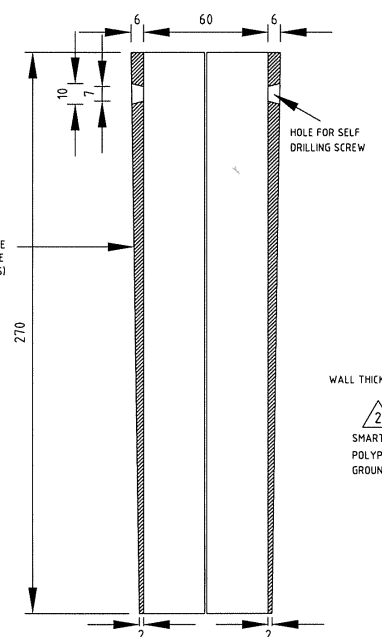
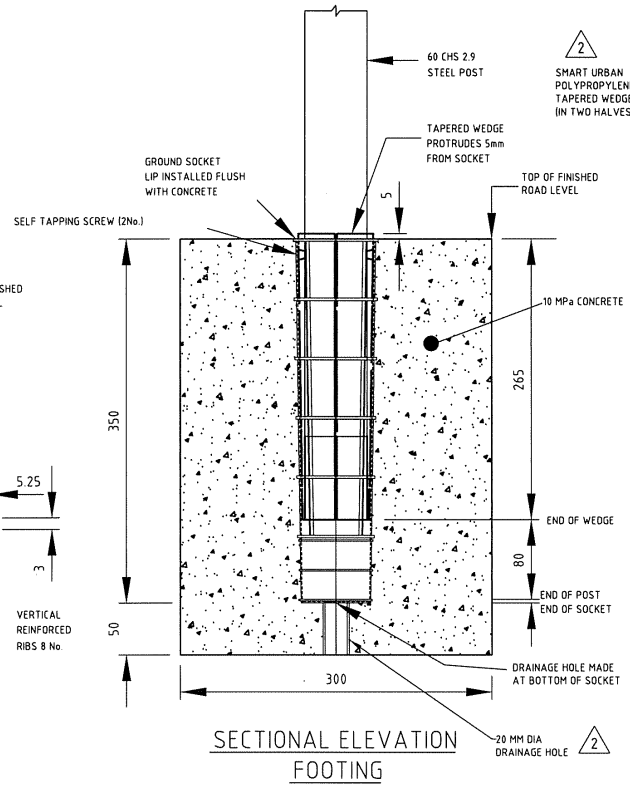
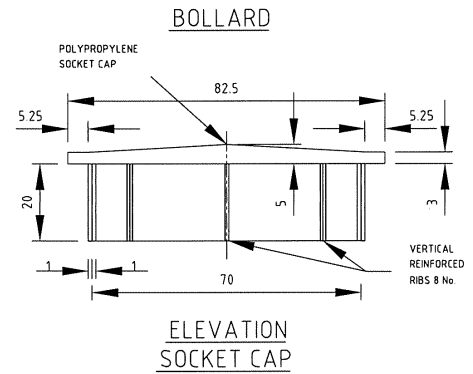
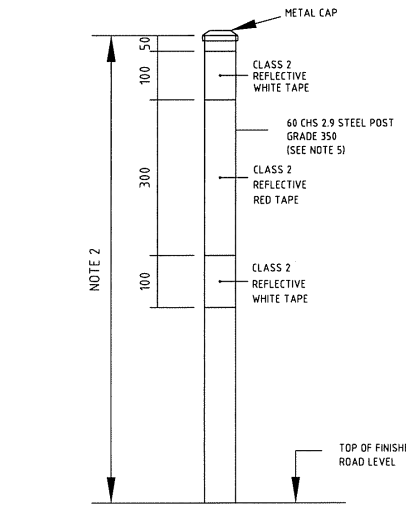
AREA	SIGN SIZE	
	A & B	C & D
METROPOLITAN PERTH AND BUILT-UP AREAS	76x38x2.0 RHS or 60.3 CHS 2.3	75x50x2.5 RHS 60.3 CHS 2.9
RURAL AREAS SUBJECT TO TROPICAL CYCLONES (REGIONS C&D - DWG. 9430-506)	75x50x2.5 RHS 60.3 CHS 2.9	75x50x2.5 RHS 60.3 CHS 2.9
RURAL AREAS NOT SUBJECT TO TROPICAL CYCLONES (REGIONS A&B - DWG. 9430-506)	76x38x2.0 RHS or 60.3 CHS 2.3	75x50x2.5 RHS 60.3 CHS 2.9



INSTALLING GRABRAILS/ BIKE RACKS/ BARRIERS ON ZERO WASTE FOU DANTIONS (60 MM)

AMENDMENTS

NO.	DESCRIPTION	APPROVED & DATE
1	SPICING ADDED IN NOTE 3 LENGTH OF POST IN THE SOCKET IS CHANGED TO 345mm. 20mm DIA DRAINAGE HOLE IS TO BE DRILLED INSTEAD OF PVC PIPE. NOTE 8 ADDED.	D. LANDMARK 16.01.09
2	20mm DIA DRAINAGE HOLE ADDED. CHANGE AUSPOSTS TO SMART URBAN AMENDED.	<i>[Signature]</i> 6.5.14.



NOTES:

- SMART URBAN REMOVABLE BOLLARDS TO BE INSTALLED TO MANUFACTURER'S SPECIFICATIONS AND THIS DRAWING.
- HEIGHT OF BOLLARD TO BE 900MM ABOVE FINISHED ROAD LEVEL UNLESS OTHERWISE SPECIFIED IN THE DESIGN DRAWINGS.
- THE SPACING OF BOLLARDS SHOULD BE IN ACCORDANCE WITH THE DESIGN DRAWINGS.
- THE SOCKETS SHOULD BE CAPPED WHEN NOT USED.
- BOLLARDS AND METAL CAPS SHALL BE COVERED WITH EXTERIOR GRADE LEAD FREE POLYESTER POWDER COAT.
- THE FINISHED COLOUR AND SPECULAR GLOSS VALUE SHALL BE EQUIVALENT TO GOLDEN YELLOW Y14 AS SPECIFIED IN AS2700.
- ALL DIMENSIONS IN MILLIMETERS.
- AS AN ALTERNATIVE TO THE 300x300x400mm DEEP CONCRETE FOOTING, THE FOOTING MAY BE BORED USING A 350mm DIA. AUGER TO GIVE CYLINDRICAL 400mm DEEP FOOTING.

Government of Western Australia
MAIN ROADS Western Australia
 TECHNOLOGY AND ENVIRONMENT DIRECTORATE
 ROAD AND TRAFFIC ENGINEERING BRANCH
 WATERLOO CRESCENT EAST PERTH 6004
 Telephone (08) 9323 4111 Fax (08) 9323 4449

FILE NUMBER	06/7698
DESIGNED / DRAWN	SOORI DATE 26.06.08
VERIFIED	D. LANDMARK DATE 26.06.08
APPROVED	R. GROVE DATE 26.06.08

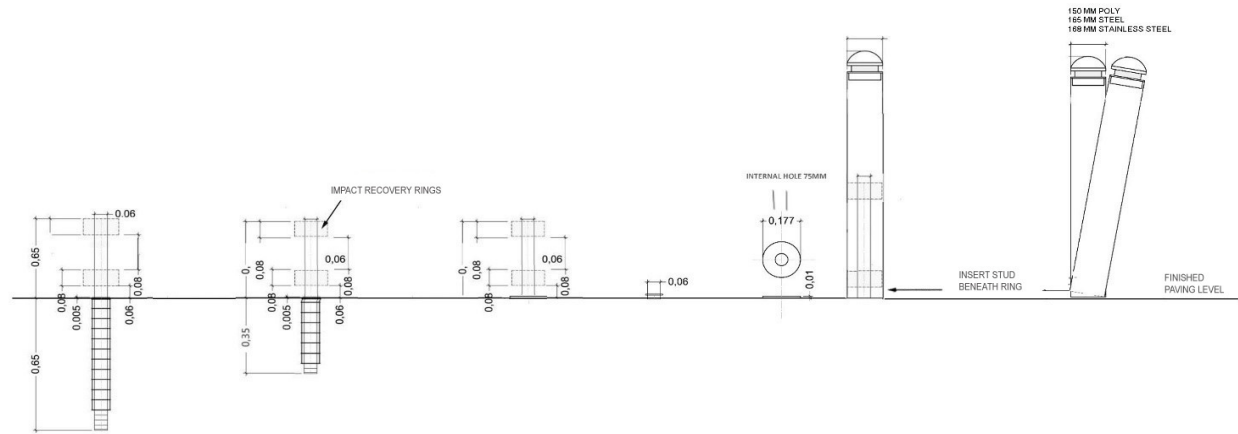
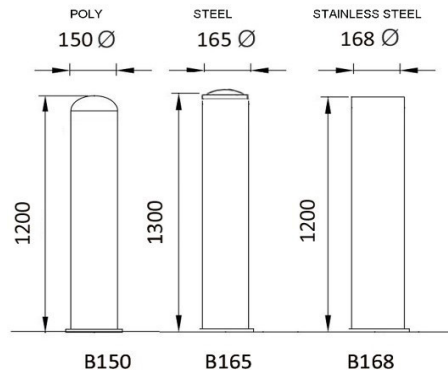
STANDARD DRAWING
 REMOVABLE BOLLARDS
 FOR USE ON ROADS UP TO 110 km/h

LOCAL AUTHORITY	DRAWING NUMBER	AMEND
	200831-0014-2	

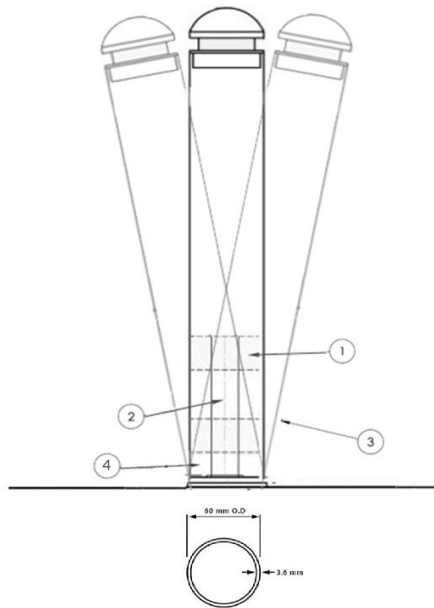
SCALE: N.T.S.

MODIFY DATE

A3



650 MM DEPTH 350 MM DEPTH SURFACE MOUNT CAP PROTECTIVE BASE PLATE BOLLARD

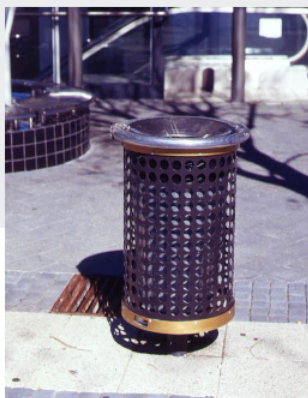
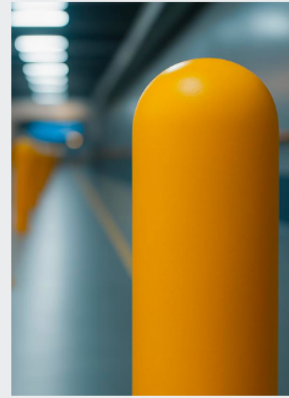


COMPONENTS

1. IMPACT RECOVERY RINGS
2. INTERNAL CORE 300 MM HIGH 3.6 WALL THICKNESS
3. BOLLARD CASING - POLY/ STEEL OR STAINLESS
4. SECURING STUD (SECURITY STUD AVAILABLE)

Stud is inserted in hole at base of bollard and sits below the bottom Impact Recovery Ring

INSTALLING IMPACT RECOVERY BOLLARDS ON ZERO WASTE FOUNDATIONS (60 MM)



WEIGHTS AND DIMENSIONS

CODE	FOUNDATIONS	QTY	WEIGHT	DIMENSIONS
ZWF-350	350 mm ZERO WASTE Foundations	25	12 kg	400 X 400 X 400
ZWF-350	350 mm ZERO WASTE Foundations	1	1 kg	350 x 60 x 60
ZWF-GS	350 mm ZERO WASTE Ground socket	25	8.5 kg	400 X 400 X 400
ZWF-GS	350 mm ZERO WASTE Ground socket	1	0.8 kg	350 x 60 x 60
ZWF-T	Taper Pair	75	30 kg	300 x 300 x 150
ZWF-T	Taper Pair	1	0.4 kg	165 x 10 x 76
CODE	INTERNAL CORE		WEIGHT	DIMENSIONS
TOOL-REM	Removal Tool	1	12kg	800 x 200 x 100
TOOL-REM	Tool Pack	1	14kg	800 x 200 x 200



SCAN CODE FOR
SPECIFICATIONS

ZEROCIVIL.COM
0414628511
hello@zerociivil.com