ZERO WASTE

IMPACT RECOVERY SYSTEM

Bollards that don’t cost the earth!

Impact Recovery Bollards Protection Bollards impact tested to AS/NZS 3845.2:2017 standards

City of Perth had a problem maintaing bollards in the busy city centre. They came to us to develop a solution that would provide protection for café strips and pedestrians, reduce damage to vehicles and reduce the esculating cost of maintaining their bollards. We developed a low cost and reusable solution to all of these problems.

GOVERNMENT OF WESTERN AUSTRALIA DEPARTMENT OF TRADE

THE SUNDAY TIMES

WORKSAFE

INNOVATOR OF THE YEAR

mainroads WESTERN AUSTRALIA

Index

Did you realize bollards are actually designed to fail?

For a bollard to be impact resistant the footing needs to be substantial and yet when impacted – something's got to give. Surprisingly its more about the footing than the actual bollard!

A surface mount will just bend or be dislodged upon impact, but if a bollard can stop a vehicle, (say an inground steel bollard) then the force is directed to the footing, and something's got to give!

The result is that every year hundreds of thousands of bollards like this one here, **and the expensive concrete footings are repeatedly sent to landfill** creating hundreds of hours of disturbance in our cities and resulting in thousands of tonnes of highly carbon intensive waste

City of Perth and Fremantle had tried everything but could not find a bollard that kept working impact after impact. They tried spring loaded bollards, but they offered absolutely no resistance to impact and quickly wore out becoming floppy over time causing havoc outside the pub! They tried cheap imported stainless steel ones that just dented and rusted within weeks.

When impacted something's got to give!

Unless you incorporate some form of shock absorbing mechanism the bollard and footing will need replacing every time – costing hundreds of thousands over the life of a development

Surface Mount Bollards

When a surface mount bollard is impacted, if the bollard itself is strong enough- the impact force is directed to the base plate, which bends or is ripped from the concrete.

Inground Bollards

When a bollard installed directly in concrete is impacted, if the bollard itself is strong enough to withstand the impact force, it is then directed to the footing, which is dislodged

Poor quality Bollards

Another growing problem is caused by cheap imported bollards made from light walled inferior grade steel or stainless steel and simply crumple upon impact or rust out creating even more landfill.

There is never a good outcome! Some companies sell flexible bollards that are spring loaded (offering very little, if any protection, over-flexing causing dangerous litigation risks). All this work is lining the pockets of the suppliers at your expense and creating hundreds of hours of disturbance and tonnes of unnecessary concrete waste.

City of Perth came to us to develop a solution that would provide protection, reduce damage to vehicles and reduce the cost of maintenace - We developed the Impact Recovery System that provides a low cost and sustainable solution to all of these problems.

It's time to put an end to this madness!

We solved all these problems and more!

But our amazingly talented design team managed to fulfill their wish list and more, designing an add on system that transforms everyday bollards into impact resistant, removable, reusable and relocatable bollards that don't cost the earth!

Safe and secure, yet removable

Bollards had to be removable for events and maintenance but had to also be rigid (not floppy), perfectly aligned, remaining safe and secure and not be deflected by hand – so they appear to be solid inground bollards

Resistant to vehicle impact

The bollard could not simply fold upon impact like spring loaded bollards, it had to provide some resistance to protect the trees they had just planted, and to protect pedestrians and buildings from errant vehicles.

Removable and low cost maintain

When severely impacted instead of the entire footing and bollard having to be replaced- they wanted a low cost means of repairing the damaged bollard and hopefully preserving the concrete and paving

Unlike anything you've seen before, this is truly a game changer

Overcoming 5 of our industry's major problems- Substantially improving saftey & efficiency, saving thousands over the life of a development

For the first time in history instead of repeatedly replacing bollards and the expensive concrete foundations, you can install a bollard that provides both protection and saves you money for deacdes by making both the bollard and surrounding foundations reusable impact after impact

This overcomes many of the biggest problems associated with Bollard repairs

- Damage & waste
- Digging and heavy labour
- On-going consumption
- Disturbance to public

05

overcoming 5 of our biggest problems

1. Carbon waste

With hundreds of thousands of bollards and the surrounding foundations damaged every year, current methods are consuming vast quantities of carbon intensive concrete and steel, with cheap imported bollards exacerbating the problem. We are already borrowing resources from future generations and with rapid urbanisation the damage and consumption is on the rise

2. Growing disturbance

The disturbance caused by repeated repairs has become a major problem in our cities and with rapid urbanisation and growing safety requirements the disturbance, delays, and associated costs are expected to increase dramatically

3. Growing difficulty

Building and maintaining bollards is hard work, requiring hours of digging and heavy labour; often dealing with traffic, pedestrians and a growing number of dangerous underground services, our civil workers are risking their lives and with fast growing urbanization and a growing number of poorly marked underground services, this job is becoming increasingly dangerous.

4. Growing Costs

Repeatedly replacing valuable concrete footings and bollards provides no future benefit so every year the costs continue to grow. With ever increasing environmental pressures and tipping fees; safety requirements such as dial before you dig and traffic management; global unrest and depleting resources, the cost of materials is rapidly increasing and the gap between the growing demand and the finite budgets continues to grow

5. Cost overruns

It's hard enough to budget for maintenance, but it's the unknown variables, such as delays caused by heavy traffic or rain; pedestrian traffic; injury caused by working in traffic; back injuries from digging and heavy labour; or costly damage to the growing number of (often poorly mapped) underground services, that cause havoc with budgets and the risk of cost overruns is growing.

We decided it was time to put an end to this madness making both the bollard and foundation reusable!

Advanced engineering overcomes these problems

.

Bollards self-recover

Upon low-speed impact bollards absorb the impact force and slowly self -recover and are removable and reusable following severe impact

No damage to footings

ZERO HERO Foundations remain in pristine condition for the entire lifespan of a development and base plates are reusable following severe impact

Bollards Impact Resistant

ZERO Bollards are made from Australian heavy-duty materials designed to withstand impact without damage, remaining in good condition

Bollard re-usable

Both surface mount and Inground bollards are made removable and reusable following severe impact, saving thousands over the life of a development

Footings reusable

ZERO WASTE foundations remain in pristine condition and surface mount base plates are reusable following severe impact, saving thousands

Simple replacements

Bollards are low cost to maintain. If damaged, they are removed and replaced in less than 5 minutes without the need for digging or heavy labour.

Impact resistant base plate

With square base plates the impact force is concentrated on one anchor- with heavy duty round base plates the impact force is evenly distributed, reducing the risk of damage

Superior protection

Unlike flexible bollards that can over-flex, becoming increasingly weak over time, the strong resistance core provides superior protection against errant vehicles, greatly improving safety

Advanced Polymer Bollard

Unlike cheap imported plastic bollards. Advanced polymer bollards (and bollards covers) provide excellent resistance against denting, chipping and fading- extending the potential lifespan

Technology that transforms

Unlike anything you've seen before

Instead of selling you an expensive bollard, that you would need to continually replace this technology is truly revolutionary- providing the world's first low-cost way to transform everyday bollards into impact resistant, removable, reusable and relocatable bollards that don't cost the earth!

Advanced Engineering

No other system enables you to preserve both the bollard and the expensive foundation.

Using a unique built-in memory that allows the material to flex, cushion and reform repeatedly upon impact from vehicles, the Impact Recovery Rings create a permanent cushion that absorbs the impact force of a vehicle and self-recovers following multiple impacts, substantially improving safety and resilience, by reducing the impact force and substantially reducing the cost of repeated replacements

1. Strong Resistance core
2. Impact Recovery Ring
3. Bollard cover

(Steel, Stainless or Poly)

4 Levels of extreme protection

1. **RESISTANCE CORE** Unlike spring loaded bollards that over-flex, a heavy-duty resistance core prevents deflection of the bollard beyond 20 degrees when impacted by a passenger vehicle

2. **SHOCK ABSORBING** Unlike springs that quickly wear out, creating dangerous litigation risks, our re-usable energy absorbing ZerO Rings create a permanent shock absorbing cushion that absorb the impact force and self-recover, with no reduction in capacity following hundreds of impacts, greatly improving safety and resilience

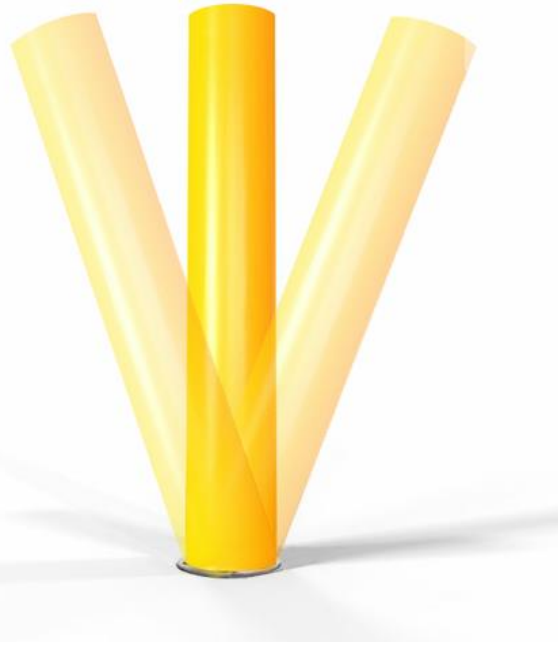
3. **PROTECT BOLLARD CASING** You can secure heavy-duty galvanised steel or impact resistant stainless-steel pipe bollards to provide an impact resistant surface, but we highly recommend using our impact resistant advanced polymer bollards to further reduce maintenance

4. **PROTECT FOUNDATIONS**: You can surface mount your bollards using our ZerO reusable base plate or secure inground using our ZerO Waste Unbreakable ground sockets. Both options continue working and protecting surrounding foundations impact after impact

We get knocked down, but we get up again. You're never going to keep us down!

Unlike spring-loaded bollards, ZerO Bollards cannot be deflected by hand, remaining perfectly aligned safe and secure year after year.

When impacted by a vehicle bollards deflect to a max of 20 degrees and slowly self-recover.
When severely impacted (truck or utility vehicle) replacements take less than 5 minutes and the bollard, expensive concrete footings and ZerO Rings are reusable impact after impact, saving thousands over the life of a development.



Upon Low Impact
Bollards remain rigid and appear to be solid inground bollards but when impacted by a vehicle they absorb the impact force deflecting a maximum of 20 degrees and self-recovering, with no diminished capacity following hundreds of impacts.

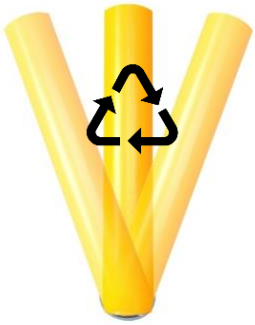
Severe Impact
When severely impacted instead of the entire footing being dislodged, the inner resistance core bends allowing the bollard to fold but not be dislodged- preventing any further forward movement of the vehicle and enabling fast reinstatement

Fast efficient replacements
Replacements are simple Following severe impact bollard is easily removed (resistance core replaced) and reinstated in around 5 mins Bollards and ZerO Rings are re-usable impact after impact

Impact Tested

Tested from 10 – 110 kmph

Footings have ben tested to withstand high speed impact and remain in tact. Awarded Innovator of the Year by Dept of Commerce for developing the world's first means of preserving valuable foundations for the entire lifespan of a development



BOTH LABORATORY AND INSITU IMPACT TESTED AT 10 - 110 KMPH

ZERO DAMAGE TO FOUNDATIONS

Zero damage to concrete footing or surrounding paving impact after impact for the entire lifespan of a development.

ZERO WASTE Foundations have no breakable components so continue working for the entire lifespan of a development

ANY STRENGTH RESISTANCE CORE

Impact tests were performed on 2.3 / 2.9 / 3.6 / 5mm and solid rod. 2.3- 2.9 bends too easily upon impact from vehicle. We suggest using a minimum of 3.6 mm wall thickness steel which brings a passenger vehicle travelling >5 kmph to a stop and bends upon impact at high speed or impact from heavy vehicle

ZERO DAMAGE TO BOLLARD

Tests used 3.6 resistance core 300 mm Height. Bollards were impacted at 3-60 kmph. At low speed the bollard deflects up to 20degrees at which time the driver was aware of hitting the bollard and reversed off- allowing the bollard to self-correct. At high speed the internal resistance core bent at ground level and needed replacing.

Safe & Secure

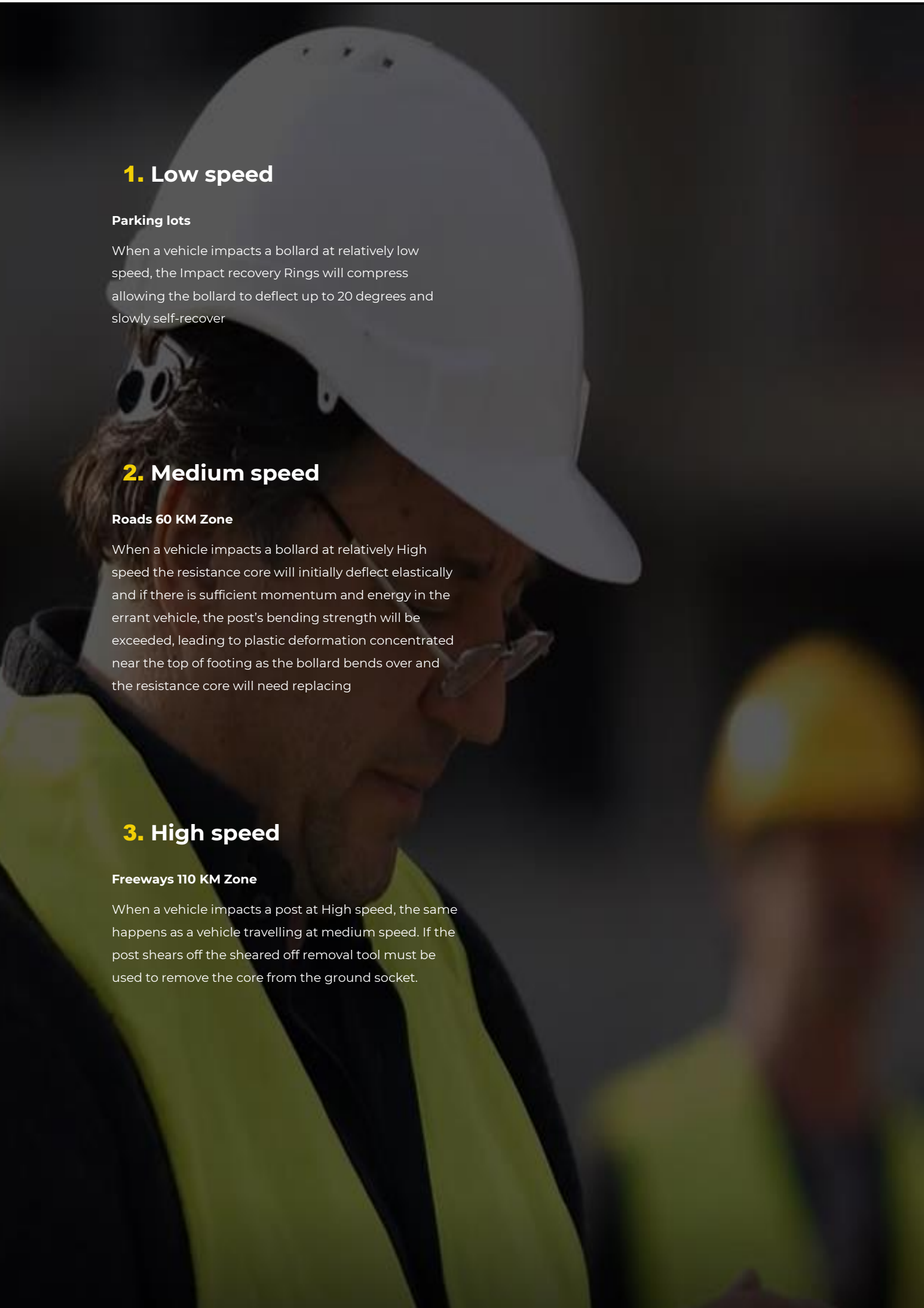
Bollards remain rigid and appear to be solid inground bollards – they cannot be deflected by hand (like other flexible bollards), remaining perfectly aligned safe and secure year after year.

Upon Low Impact

When impacted by a vehicle they absorb the impact force deflecting a maximum of 20 degrees and self-recovering, with no diminished capacity following hundreds of impacts.

Severe Impact

When severely impacted the resistance core bends allowing the bollard to fold but not be dislodged- preventing any further forward movement of the vehicle and enabling fast reinstatement



1. Low speed

Parking lots

When a vehicle impacts a bollard at relatively low speed, the Impact recovery Rings will compress allowing the bollard to deflect up to 20 degrees and slowly self-recover

2. Medium speed

Roads 60 KM Zone

When a vehicle impacts a bollard at relatively High speed the resistance core 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 bollard bends over and the resistance core will need replacing

3. High speed

Freeways 110 KM Zone

When a vehicle impacts a post at High speed, the same happens as a vehicle travelling at medium speed. If the post shears off the sheared off removal tool must be used to remove the core from the ground socket.

Protection Bollards

Impact Recovery Bollards are classified as Protection Bollards crash tested using AS/NZS 3845.2:2017

Impact Tested
Vehicle Mass 1860 kg
Speed 10 km/hr
Installed 350 mm Depth in asphalt.

SPECS	Bollard	Socket	Reo Cage
DIAMETER	150 mm	60 mm	550 mm
LENGTH	1560 mm	650 mm	800 mm
WEIGHT	6 kg		34 kg

Impact tests were performed on 2.3 / 2.9 / 3.6 / 5mm and solid rod. 2.3 bends too easily upon impact from vehicle. We suggest using a minimum of 3.6 mm wall thickness steel which brings a passenger vehicle travelling >10 kmph to a stop and bends upon impact at high speed or impact from heavy vehicle.

Result of multiple impacts:

Bollard did not penetrate or show potential to penetrate the occupant compartment or present an undue hazard to other traffic, pedestrians or personnel in a work zone (e.g. Zero disturbance to footing resulting in zero debris)

Tests used 3.6 resistance core 300 mm Height. Bollards were impacted at 310 kmph in test situation to replicate impact in a carpark. In situ bollard have been impacted up to 60 km/hr.

At low speed the bollard deflects up to 20 degrees at which time the driver was aware of hitting the bollard and reversed off- allowing the bollard to self-correct. At high speed the internal resistance core bent at ground level and needed replacing.

Maximum containment level, being passenger vehicles travelling between 10 - 60km/hr the Impact Recovery System substantially reduces risk of injury to vehicle occupants due to its impact absorbing qualities.

VIEW VIDEO →

Advanced engineering

ZERO WASTE Foundations are unlike anything you've seen before, made using advanced polymers, they are light years ahead of other fixing devices on the market providing a level of durability previously unseen

ZERO WASTE Foundations are both laboratory and in-situ tested from 10 - 110kmph demonstrating no deformation following hundreds of impacts, without any damage to the surrounding foundations.

1. Advanced polymers

ZERO WASTE Technologies are made using a advanced polymers (previously only used in Aerospace industry) selected as they provide unique shock absorbing and self-healing properties, making them highly suitable for this application.

The unique built-in memory allows the material to flex, cushion and reform repeatedly upon impact from vehicles, without wear and tear over time

2. Unbreakable

This is where it gets really Smart. The locking device to secure your bollard uses friction to secure items, which ensures bollards remain perfectly aligned, safe and secure year after year,

Because it requires no pins or padlocks the locking device continues working year after year, and that bollards are easily removable (using tools provided) no matter how long between removals, overcoming all the problems associated with metal devices

The built-in memory allows the material to reform repeatedly upon impact from vehicles. When a damaged bollard is removed, the ground socket returns to its original shape without wear or tear, protecting the surrounding concrete and paving from damage impact after impact.

Over 300kg of upward force is required to remove the resistance core from the ground socket. The locking capacity remains undiminished, and bollards remain removable using tools provided, following hundreds of impacts.

Re-usable

We have developed the world's first product that enables you to secure almost any design of bollard on **ZERO WASTE** Foundations, making the bollard self- recover from impact and even re-usable following severe impact.

Almost unlimited design options. You can secure your own bollards or buy the bollard and Impact Recovery System from us.

When severely impacted (truck or utility vehicle) the resistance core can bend and need replacing. Replacements take less than 5 minutes.

A securing stud is removed from the base of the bollard and the bollard slipped of the rings. The rings are removed from the core using a screwdriver and secured to a replacement core.

The bollard, expensive concrete footings and ZerO Rings are reusable impact after impact, saving thousands over the life of a development.

Fast efficient replacements

Replacements are simple Following severe impact bollard is easily removed (resistance core replaced) and reinstated in around 5 mins

Bollards & Rings Reusable

Bollards and ZerO Rings are removed using a security Allen key and screwdriver and re-used time and time again. Withstanding hundreds and hundreds of impacts

Massive return on investment

Foundations remain pristine condition for the entire lifespan of a development. Bollards and Rings are re-usable and the only cost for replacements when badly impacted is the internal core and around 5 minutes labour.

Safer more sustainable bollards

For a bollard to be impact resistant the footing needs to be substantial and yet when impacted – something's got to give. The result is that thousands of bollards and concrete footings are repeatedly replaced and sent to landfill. Unless you incorporate some form of shock absorbing capabilities, the bollard and footing will need replacing every time.

S/MOUNT IRS

Suitable for solid concrete footpaths and foundations. Secured using five evenly spaced concrete anchors. Base is reusable

350 DEPTH IRS

We recommend 350 mm Depth footings for most applications in solid concrete footing and paving (with concrete footing below

650 DEPTH IRS

We recommend 650 mm Depth footings for free standing footings and large items or signs in windy conditions (such as desert signage)

We get knocked down, but we get up again. You're never going to keep us down!

Bollards can be secured using the Impact Recovery System. Bollards cannot be deflected by hand, remaining perfectly aligned safe and secure year after year. When impacted by a vehicle they deflect to a max of 20 degrees and self-recover. When severely impacted (truck or utility vehicle) the resistance core can bend and need replacing. Replacements take less than 5 minutes. The bollard, expensive concrete footings and ZerO Rings are reusable impact after impact, saving thousands over the life of a development.

Upon Low Impact

Bollards remain rigid and appear to be solid inground bollards but when impacted by a vehicle they absorb the impact force deflecting a maximum of 20 degrees and self-recovering, with no diminished capacity following hundreds of impacts.

Severe Impact

When severely impacted instead of the entire footing being dislodged, the inner resistance core bends allowing the bollard to fold but not be dislodged- preventing any further forward movement of the vehicle and enabling fast reinstatement

Fast efficient replacements

Replacements are simple Following severe impact bollard is easily removed (resistance core replaced) and reinstated in around 5 mins Bollards and ZerO Rings are re-usable impact after impact

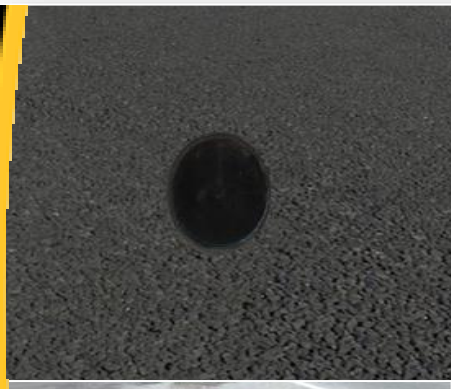
ZERO WASTE Foundations

Good quality concrete can last 100 years but paid set will not. If you want your foundations to last, you must use good quality concrete 30MPa for bollards subject to impact

ZERO WASTE Unbreakable Foundations create a protective impact absorbing and self-healing shield between the item and the valuable concrete foundations, protecting the foundations from damage extending the lifespan of the foundations.

Socket installed flush with ground level

Socket must not protrude- it must be installed flush with ground level to avoid damage when items are impacted and trip factors if item is removed.



Taper finishes flush with ground level

When item is installed, the Taper must finish flush with ground level to avoid damage when items are impacted, ensuring taper is re-usable

WORKSAFE

Replacements are simple Following severe impact bollard is easily removed (resistance core replaced) and reinstated in around 5 mins without disturbance to public or foundations

worksafe

Advanced Polymer bollards

Advanced Polymer Bollards absorb impact from vehicles and self-recover without scratching or chipping like steel bollards. They won't rust or corrode or dent like a steel bollard and tyre marks can be simply wiped off with a damp cloth

Steel bollards

Heavy walled Steel Bollards can be secured inground, or surface mounted using the Impact Recovery System. Standard colour Safety Yellow – but can be supplied in any colour and polished designer caps available.

Stainless steel bollards

Heavy walled Stainless-steel Bollards absorb impact from vehicles and self-recover without denting or scratching (scratches don't show as we use a satin brushed finish- the most durable finish) Highly resistant to rust and corrosion- Aussie made to last!

STEEL BOLLARD
150/ 165 mm ⌀ Galvanised Bollards have a design life of 30 years- but powder coating has a design life of only 5 years in direct sunlight, (15 years with primer)

ADVANCED POLYMER
Advanced Polymer Bollards 150 mm ⌀ x 1200/1500/1800 L in Safety Yellow have a design life of around 50 years (25 years in direct sunlight).

STAINLESS
Stainless Steel Bollards 168 mm ⌀ x 1200 H in Satin Finish (most durable) have a design life of around 30 years if maintained properly

When installed directly in concrete the design life of steel is reduced considerably

Bollards that don't cost the earth!

Our Impact Recovery Bollards are the Rolls Royce of bollards (designed to last a lifetime) without the expensive price tag!

Not only are they low cost to buy, they outlast and outperform alternative bollards, saving you thousands and keeping carbon intensive concrete and steel from landfill over the next 100 years.

Advanced Polymer

Our Advanced Polymer is highly durable material designed to withstand impact from a vehicle and the harsh Australian environment. Polyethylene is an efficient electrical insulator, making it great for applications where safety is paramount. We use a crosslinked UV stabilized HDPE, Ultra-High Molecular Weight Polyethylene (UHMW PE) thermosetting polymer providing excellent impact resistance, and high tensile strength.

Benefits

- Abrasion Resistant
- High impact resistance
- Low coefficient of friction
- Abrasion resistant
- Scratch and marking resistant
- Chemical resistant
- Water and moisture resistant
- UV Resistantshatter resistant
- Long-wearing
- Corrosion resistant
- Strength tested to AS/NZS 4766:2006
- UV20 Protection to ASTM D2565
- Australian Made

Do Bollards Need to Be Filled with Cement?

This is one of the biggest misconceptions regarding bollards. Most people fill bollards with cement because they p believe it will provide additional strength. But the truth is that a steel bollard is stronger WITHOUT cement.

Try this experiment.

Take a wooden dowel and push it into a plastic straw and break it in half. What happens? With the dowel inside the straw, the straw has nowhere to bend, so not only does the dowel snap, so does the straw.

If you bend the straw by itself, it will not break in two. The theory and principles are the same with steel.

The downside of concrete filling Bollards

First, cement is wet. What happens when steel is exposed to moisture? It rusts, reducing your bollard's expected lifespan from 30 years to as little as 3 years.

Secondly, if an impact occurs, you want the bollard to absorb the impact. Although okay for very low speed environments, where high-speed collisions are a possibility concrete may actually increase the risk of catastrophic failure. This is because concrete cannot flex or absorb energy, so the impact force has to go somewhere, and it finds the weakest spot (usually the base of the bollard).

Disadvantages of concrete filling a bollard:

- **Brittle:** Concrete has low tensile strength and is not good at absorbing shock. While it may be successful at stopping vehicles, it risks cracking and failing.
- **Inflexible:** Unlike steel, concrete does not bend or deform upon impact, meaning it may not be able to withstand extremely high forces without breaking.
- **Permanence:** Concrete filled bollards are very difficult to remove if bollard access requirements change in the future.
- **Waste:** The concrete creates more landfill

In some situations, such as areas requiring high impact absorption, concrete may therefore reduce rather than enhance performance.

Stop putting cement into bollards. It will save money on unnecessary cement and labour costs, save concrete and steel from landfill and most importantly, it will save lives.

Protection?

Have you ever sat at a cafe drinking your cup of coffee and the only protection is a bolted down wrought iron fence or flimsy bollard? The only thing between you and the traffic are the bolts. Most are rusted out and offer only a visual deterrent as they won't stop a vehicle. How safe did you feel?

Will those bolts protect you?

When a surface mount bollard is impacted, if the bollard itself is strong enough to not bend - the impact force is directed to the base plate, which bends or is ripped from the concrete – either way they are costly to replace and offer little protection. A "flexible" bollard offers no protection- but we have a solution you will love!

We have developed a Surface Mount Bollard that provides protection and is reusable following even severe impact.

These bollards self-recover from low-speed impact and are removable and reusable (foundations and bollard are both reusable) impact after impact. Unlike spring loaded bollards, we keep working, providing protection year after year.

Impact Resistance

Polyethylene and polypropylene are frequently used in construction, military and industrial applications that require impact resistance and toughness. Impact resistance is the ability of a material to resist both fracture and deformation when temporary force is applied.

High impact resistant plastics

Unlike steel Bollards (and most imported plastic Bollards on the market made from old fashioned plastics that over time fade and become brittle), our Bollards have unique properties and benefits that allow them to perform in demanding environments. Whilst the impact resistance of a plastic is temperature-dependent (becoming brittle below 15° , **HDPE** retains its properties in even low temperatures.

Heavy Duty Design

Unlike most plastic Bollards on the market with thin 1-3 mm wall thickness, our Bollards and Bollard Covers are roto moulded from a solid piece of Advanced Polymer material, with heavy duty 7 mm walls which ensures that they are structurally sound and robust enough to withstand light impact from a vehicle and self-recover.

Looking good is also important to us!

Solid 7 mm walls also ensure our Bollards and Bollard Covers remain looking good impact after impact. Made suing a durable, versatile thermoplastic that offers fantastic impact resistance and tensile strength. Since its molecules are packed together so tightly, this material boasts incredible toughness and rigidity combined with the ability to absorb impact force.

Unlike steel that will distort when impacted, our Poly Bollard Covers will flex under extreme conditions and recover. If scratched, they are the same colour throughout and when scuffed by vehicle tyres, they can simply be wiped clean. We can even self-recover from light impact, or (when installed suing the ZERO WASTE Impact Recovery System) we become re-usable following even the most severe impact.

SPECS

Tensile strength at 72°F: 1,400 psi
Tensile modulus: 57,000
Tensile elongation at break: 100%
Flexural modulus: 29,000 psi

Impact Resistant

Impact Recovery

UV Stabilisation

Many metals will rust and corrode as they weather and wither away. Steel, however, can be strengthening against oxidisation when chromium is added or protected from rust and oxidisation using galvanising. There are different grades of stainless steel. Kitchen sinks, for example, are often made of a high-grade of stainless steel.

Similarly, UV stabilisers are to bollards like what the chromium is to steel. When added to the polymer mix, the plastic is protected against becoming brittle in the Sun. UV stabilizers in the polymer protect the Bollard against the harmful UV rays, preventing it from bulging, warping, or going brittle over time, inhibiting and absorbing the harmful UV light that causes it break down.

So, in the same way that some steels are called stainless, you could similarly label UV stabilised poly a type of "stainless poly". Of course, all material has a finite life. Stainless steel will still rust and corrode, it just takes much longer for this to happen.

Testing UV Protection Levels in Polyethylene

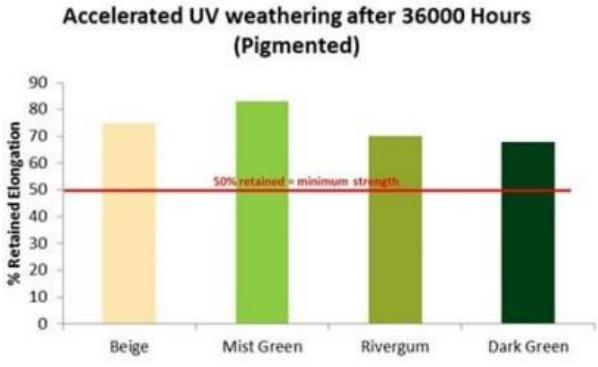
UV protection levels in polyethylene are assessed under highly controlled conditions of high intensity UV radiation with similar wavelengths to those from the Sun. Samples are removed from the UV weatherometer every few thousand hours and stretched in a tensile tester to determine how much they can still stretch.

This provides the % Elongation of the test sample. This value is compared to the value obtained for the set that was not placed in the weatherometer and recorded on a graph as the % Retained Elongation. The % Retained Elongation decreases as degradation increases. Once the Elongation drops to 50% the poly sample is deemed to have failed. After 36,000 hours of accelerated UV weathering, pigmented SUPA UV poly samples retained well over 50% of their original elongation properties.

SUPA UV Polyethylene

Australia experiences some of the highest levels of UV radiation in the world. As such, leading edge technology is required to ensure our bollards remain reliable and durable for a long time. UV8 level of stabilisation has been considered the minimum required for good long-term protection in Australia. Rotathene® SUPA UV, provides a much higher level of protection than the Australian industry standard (AS/NZ 4766:2006).

Through careful selection of a high-quality Polyethylene base polymer specifically designed for tank use, advanced additives such as UV stabilisers and antioxidants, pigmented "SUPA UV" provides a UV36 level of stabilisation.



Sun Resistance

Our Advanced Polymer Bollards and Bollard Covers are made of a plastic material unlike traditional plastics. Many have seen the effects on plastic objects that are exposed to harmful UV-rays. Over time, they become brittle, chalk and crack as the polymer elongation drops, that is, the structural integrity of traditional plastics. The natural conclusion is that plastic Bollards won't last long in the Sun.

With the latest advancements this is no longer the case, especially not with our Advanced Polymer Ultra-High Molecular Weight Polyethylene (UHMW PE) thermosetting polymer and Rotathene® SUPA UV poly our Advanced Polymer Bollards and Bollard Covers **provide more than 4.5 times the UV8 protection required by the Australian standards (AS/NZ 4766:2006).**

ASTM or UL test	Property	LDPE	HDPE	UHMW
	PHYSICAL			
D792	Density (lb/in³) (g/cm³)	0.033 0.92	0.035 0.96	0.034 0.93
D570	Water Absorption, 24 hrs (%)	<0.01	<0.01	<0.01
	MECHANICAL			
D638	Tensile Strength (psi) at 72°F	1,400	4,600	5,800
D638	Tensile Strength (psi) at 150°F	400	400	400
D638	Tensile Modulus (psi)	57,000	200,000	80,000
D638	Tensile Elongation at Break (%)	100	400	300
D790	Flexural Strength at Yield (psi)	1,500	4,600	3,500
D790	Flexural Modulus (psi)	29,000	174,000	88,000
D695	Compressive Strength (psi)	1,400	4,600	3,000
D695	Compressive Modulus (psi)	54,000	100,000	80,000
D732	Shear Strength (psi)	-	-	3,000
D785	Hardness, Shore D	D45	D69	D62-D66
D256	IZOD Notched Impact (ft-lb/in)	No Break	1.3	No Break
	THERMAL			
D696	Coefficient of Linear Thermal Expansion (x 10^{-5} in./in./°F)	-	6	11
D648	Heat Deflection Temp (°F / °C) at 66 psi at 264 psi	 120 / 48 116 / 46	 170 / 76 176 / 80	 203 / 95 180 / 82
D3418	Approx. Melting Temperature (°F / °C)	244 / 118	260 / 125	275 / 136
-	Max Operating Temp (°F / °C)	160 / 71	180 / 82	180 / 82
C177	Thermal Conductivity (BTU-in/ft²-hr-°F) (x 10^{-4} cal/cm-sec-°C)	 - -	 - -	 2.84 10.0
UL94	Flammability Rating	HB	HB<	HB
	ELECTRICAL			
D149	Dielectric Strength (V/mil) short time, 1/8" thick	460-700	450-500	2300
D150	Dielectric Constant at 1 MHz	2.25-2.30	2.30-2.35	2.30-2.35
D150	Dissipation Factor at 1 kHz	0.0002	0.0002	0.0005
D257	Surface Resistivity (ohm/square) at 50% RH	> 10^{15}	> 10^{15}	> 10^{15}
D495	Arc Resistance (sec)	135-160	200-250	250-350

ZERO RINGS

IMPACT RECOVERY RINGS

Currently available in 3 dimensions to secure steel, stainless steel and Advanced Polymer bollards, but can be manufactured to suit almost any bollard size or shape- call us to discuss requirements.

A small investment for a lifetime of savings.

You can purchase ZerO Rings to secure your own bollards on ZERO WASTE Unbreakable Foundations or ZerO Reusable Base plate. Two rings required per bollard. Secured to resistance core using clamp provided. Removable and reusable following hundreds of impacts.

CODE	IMPACT RECOVERY RINGS	WEIGHT
IRR-150	Ring to fit 150 Poly Bollard	1 kg
IRR-165	Ring to fit 165 mm Steel Bollard	1 kg
IRR-168	Ring to fit 168 mm Stainless Steel Bollard	1 .25 kg
IRR-150-SF	Super-flex Ring to fit 150 mm Poly Bollard	1 kg

Secure almost any design bollard

STEEL BOLLARD
Australian made 150/ 165 mm ⌀ galvanised steel x 1250H quality powder coated safety yellow

STAINLESS BOLLARD
Australian made 168 mm ⌀ stainless-steel heavy-duty pipe x 1200H with satin finish

POLYMER BOLLARD
Advanced Polymer bollard 150 mm ⌀ x 1200-1800 H in Safety Yellow smooth finish

Our standard range of bollards

- **Galvanised steel**
  Std unit powder coated Safety Yellow, but can be powder coated colour of choice
- **Stainless steel**
  Satin finish- the most durable finish
- **Advanced Polymer bollards**
  Std unit Safety Yellow, but available in almost any colour- including stone look grey or brown (ask for a colour chart) and can be polished for high shine.

POLYMER BOLLARD
150 x 1200 H

POLYMER BOLLARD
150 x 1500 H

POLYMER BOLLARD
150 x 1800 H

Footing depth

SMOUNT IRS
Heavy Duty Reusable base plate. Suitable for solid concrete footpaths and foundations.

350 DEPTH IRS
As bollards deflect 350 depth foundations are suitable for most applications in solid concrete footings

650 DEPTH IRS
For free standing footings and bollards that may be subject to severe impact such as trucks or forklifts

Concrete can last 100 years

Good quality 30 MPa concrete can last 100 years, but rapid set is not impact resistant so will not last beyond one or two impacts. Elastomers cannot be used as the added flexibility reduces the holding power of the socket and they simply will not last 100 years

We suggest using 30MPa or greater if you want your footings to last. NB: The footing must be large enough to ensure it is not dislodged when the bollard is impacted (this depends on speed of vehicles/ weight/ soil conditions so differ from location to location)

NOTE It is no longer the bollard casing taking the brunt of the force, but the Resistance core that is designed to bend upon impact.

See notes below

Low Impact

Bollards in carparks are generally hit at low speed and so a surface mount foundation is a good option that also provides low-cost installation using 5 evenly spaced flush mounted concrete anchors

Medium Impact

For bollards that may be subject to impact from passenger vehicles going up to 60km/hr a 350 mm depth foundation (on a 400 mm depth quality concrete footing) will be sustainable.

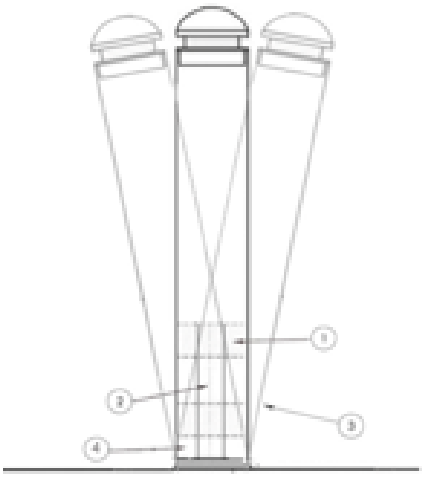
Severe Impact

For free standing footings or bollards that may be subject to severe impact such as trucks or forklifts we suggest increasing the foundations to 650 mm depth

VIEW BROCHURE

ZERO IRS

IMPACT RECOVERY SYSTEM



UNIT INCLUDES

1. 2 x Impact Recovery Rings
2. Resistance Core
3. Bollard Casing
4. Securing stud

TOOLS

Surface mount require an Allen key and screwdriver
Removal tool also required for In-ground version

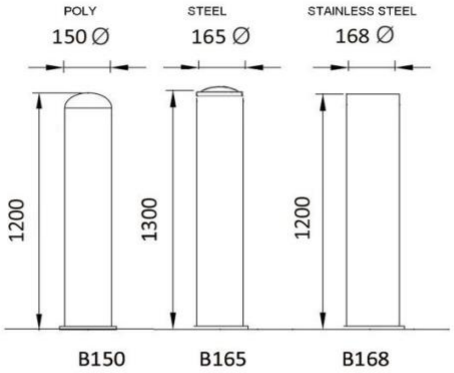
Base Plate is 10 mm thick and 200 mm diameter with solid upright spigot. Core is a CH Steel 3.6 wall thickness, secured to base plate using an embedded grub screw. In-ground ZERO WASTE Foundations are made from impact absorbing self-healing material and use a self-locking taper to lock the internal core into the socket (only removable using tools provided).

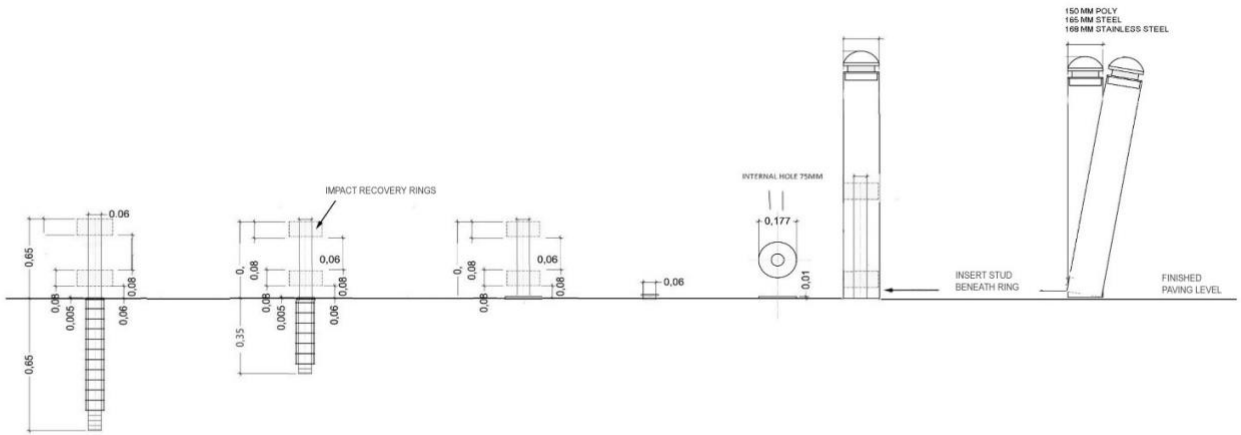
INSTALLATION

Refer to Specs for ZERO WASTE Foundations which can be installed when pouring new concrete footpaths or footings or retrofitted by core drilling or removing pavers.

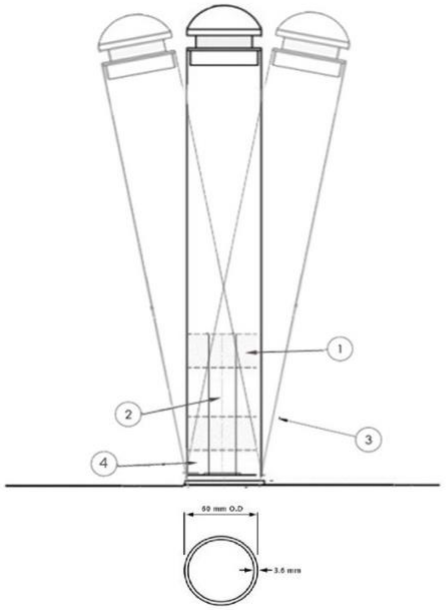
Surface Mount Base Plate is bolted down using 5 evenly spaced recessed concrete anchors (supplied) to evenly distribute impact force and prevent damage to the base plate

CODE	DETAILS	WEIGHT
IRR-150	Ring to fit 150 Poly Bollard	1 kg
IRR-165	Ring to fit 165 mm Galvanised Steel Bollard	1.25 kg
IRR-168	Ring to fit 168 mm Stainless steel Bollard	1.3 kg
ICORE-SM	3.6 CHS Post x 300 mm	1 kg
ICORE-350	3.6 CHS Post x 650 mm	2 kg
ICORE-650	3.6 CHS Post x 950 mm	3 kg





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 THICKESS
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

ZEROWASTE
IMPACT RECOVERY SYSTEM

Tasks	Hazards	Safe working procedures	Precautions
Installing Sockets	- Bending of the back - Twisting of the back - Working in traffic	• 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 • Once concrete has cured spin tool to remove • Safely dispose of waste (recycle if possible)	- Use installation tool to avoid bending of the back - When possible, it is advisable for user to face on-coming traffic - If item is not ready to install- insert cap to avoid tripping factors/ entry of dirt and grit - Insert cap before pouring asphalt to avoid trip factors/ ingress of asphalt
Installing Items	- Bending of the back - Twisting of the back - Working in traffic - Item not secure	• Install appropriate traffic management • Attach Taper to item using self-drilling screws provided (This can be done prior to going onsite to reduce time on location) • Using two hands, drop item firmly into ground socket • Check item is sufficiently installed to protect from unauthorized removal	- Avoid bending of the back - Avoid twisting of the back - When possible, it is advisable for user to face on-coming traffic - Make sure taper finishes flush with round level to provide adequate resistance against unauthorised removal
Using Removal Tool	- Bending of the back - Twisting of the back - Working in traffic - Trapping of fingers	• 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 quick jerking action using both arms • 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	- Always operate tool from a standing position facing tool - Keep back straight - Use quick jerking action as it requires less force - When carrying tool hold arms together with upright to avoid trapping fingers - When possible, it is advisable for user to face on-coming traffic

THANKS FOR BEING A ZERO HERO

By installing ZERO WASTE Foundations you are helping reduce waste and the on-going consumption of concrete (the world's most dangerous material).

Thank you for helping build a better future not only for your company and your clients, but also for future generations.