



## S4 60 Shallow Fixed Bollard Crash Rated for Malls in Dubai

Protect glass entrances and parking areas – without deep excavation.

- Only 60 mm shallow depth
- Ideal for basement / indoor parking
- SIRA-approved solution for Dubai projects

**S4 60 (S)**  
1500 kg / 112 kph

**SIRA APPROVED**  
SHALLOW FIXED  
CRASH RATED  
BOLLARD

- |                        |                  |
|------------------------|------------------|
| Product Overview       | Method Statement |
| Data Sheet             | Risk Assessment  |
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| Crash Test Calculation | Rebar Schedule   |

# WHY THIS BOLLARD IS IDEAL FOR SHOPPING MALLS

## Main Risk

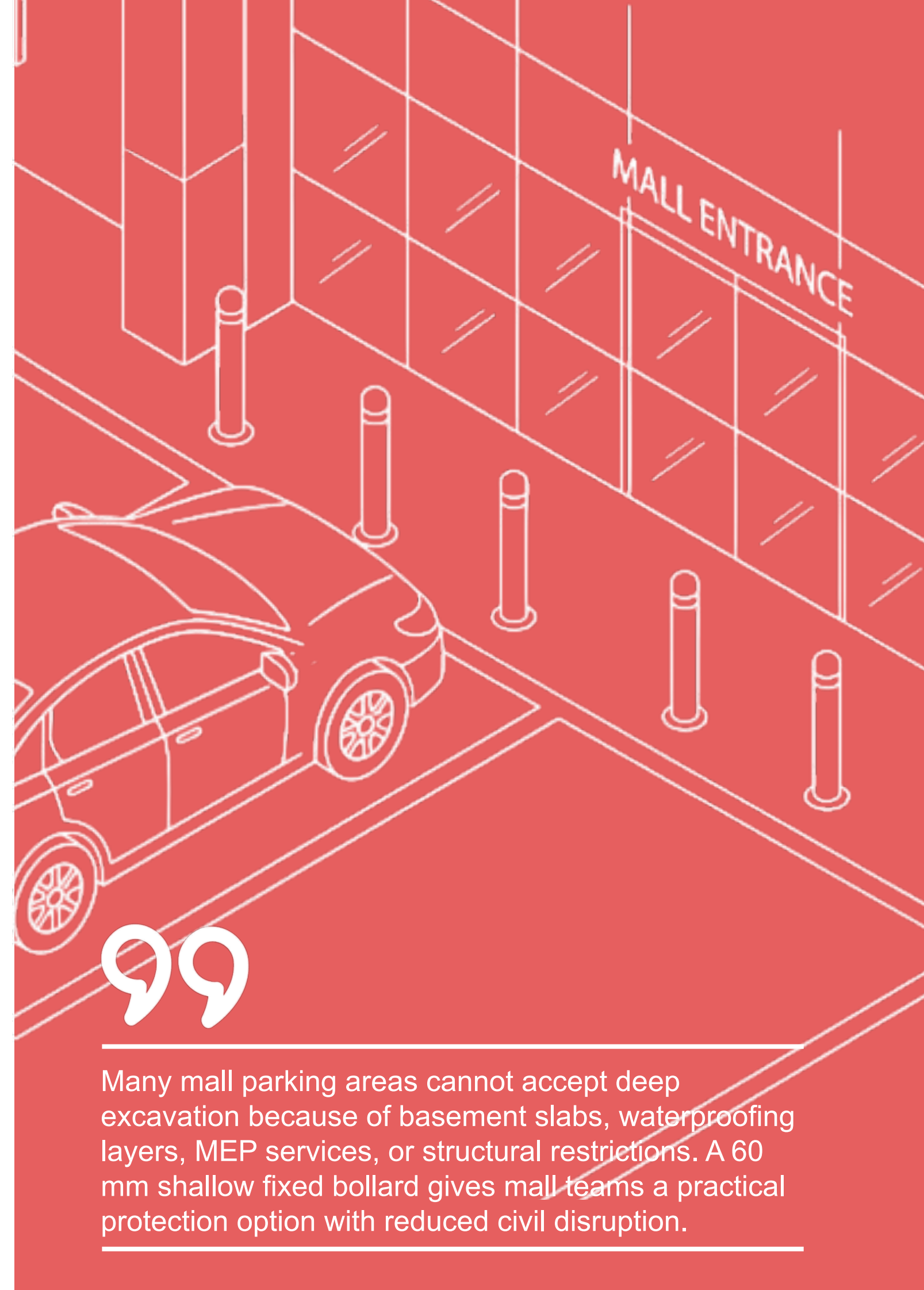
Indoor parking drive lanes often face glass entrances, lift lobbies, shopfronts, and pedestrian waiting areas.

## Main Problem

Most crash-rated bollards require deep excavation, which is difficult in basements, podium slabs, and mall parking structures.

## This Solution

The S4 60 (S) provides a shallow fixed bollard option where only limited depth is available.



Many mall parking areas cannot accept deep excavation because of basement slabs, waterproofing layers, MEP services, or structural restrictions. A 60 mm shallow fixed bollard gives mall teams a practical protection option with reduced civil disruption.

PRODUCT

# Overview

FOR SHALLOW FIXED BOLLARD (S4 60)

# Product Overview – Shallow Fixed Bollard



## General Description

The proposed system is a Security Shallow Fixed Bollard designed for installation within a limited foundation depth (60 mm).

The bollard consists of a structural steel core with an optional stainless steel outer cover, installed within a reinforced concrete slab to provide vehicle mitigation performance based on 1500kg vehicle at 112 kph speed equivalent design principles, where deep excavation is not feasible.

The system is crash engineered tested in accordance with recognized industry practices and design references such as PAS 68 and IWA 14.

## System Configuration

- Bollard Type: Shallow Fixed Bollard
- Installation Depth: ≈ 60 mm below ground
- Height Above Ground: ≈ 1000 mm
- Foundation Type: Reinforced Concrete Slab (Shallow)
- Design Reference: PAS 68 / IWA 14 (Equivalent Design Basis)
- Impact Performance: 1500kg vehicle at 112 kph speed

## Main Components

- Structural Steel Core (Primary load-bearing element)
- Stainless Steel Cover (Decorative & corrosion-resistant layer)
- Reinforced Concrete Foundation (Shallow Slab System)
- Reinforcement Mesh
- Continuous Reinforced Concrete Slab for load distribution
- Local Strengthening around Bollard Locations
- Sleeve / Opening with Reinforcement Frame

## Material & Finish

1. Core Material: Structural Steel (EN 10219 S355J)
2. Outer Cover: Stainless Steel – Satin / Brushed Finish
3. Finish: Hot Dip Galvanizing (core) + SS Cladding (optional)
4. Reinforcement: 12M bars
5. Concrete: As per project specification, C30

## Functional Purpose

The system is designed to:

- Provide perimeter protection and vehicle restriction
- Operate effectively in shallow foundation conditions
- Enhance vehicle mitigation performance through combined steel and reinforced concrete system
- Maintain architectural appearance suitable for urban environments

## Structural Concept

- The steel core contributes to resisting impact forces
- Impact loads are transferred to a reinforced concrete slab system
- Reinforcement mesh distributes forces across the slab
- Additional reinforcement is provided around bollard locations to resist localized stresses
- The system relies on load distribution through a continuous reinforced slab rather than deep anchoring
- The design approach follows 1.5-ton @ 112Kmph performance principles based on PAS 68 / IWA 14

## Installation Methodology

- Surface preparation and leveling
- Placement of reinforcement (top & bottom mesh)
- Installation of sleeves and bollard positioning
- Fixing of local reinforcement around bollards
- Concrete casting and curing
- Installation of stainless steel cover

## Performance Statement

The system is designed as a shallow-mounted vehicle mitigation solution, providing performance equivalent to 1.5-ton @ 112Kmph impact resistance based on structural design principles and load distribution through reinforced concrete foundation and steel core interaction.

This system is SIRA certified crash-tested product in Dubai, UAE, and performance is based on engineering design methodology.

## Key Advantages

- Suitable for restricted excavation depth (60 mm)
- Faster and easier installation
- Integrated structural and architectural solution
- Enhanced vehicle mitigation performance compared to conventional decorative bollards
- Durable and corrosion-resistant
- Designed based on recognized international standards (PAS 68 / IWA 14 equivalent approach)

## Who Benefits?

**Mall Management:** Protects entrances, tenants, and visitors while maintaining a clean architectural appearance.

**Security Team:** Creates a stronger vehicle stand-off line at vulnerable glass-facing areas.

**Facility Management:** Suitable for shallow-depth areas where deep excavation, major slab breaking, or utility diversion is difficult.

**Maintenance Team:** Fixed bollard with no motor, hydraulic unit, control panel, or daily operation requirement.

TECHNICAL

# Data Sheet

FOR SHALLOW FIXED BOLLARD (S4 60)

# S4 60 (s)

## HIGH SECURITY

### SHALLOW FIXED BOLLARD

Ideal for locations that require shallow foundations or have constraints of under-ground utilities

## Mall Application

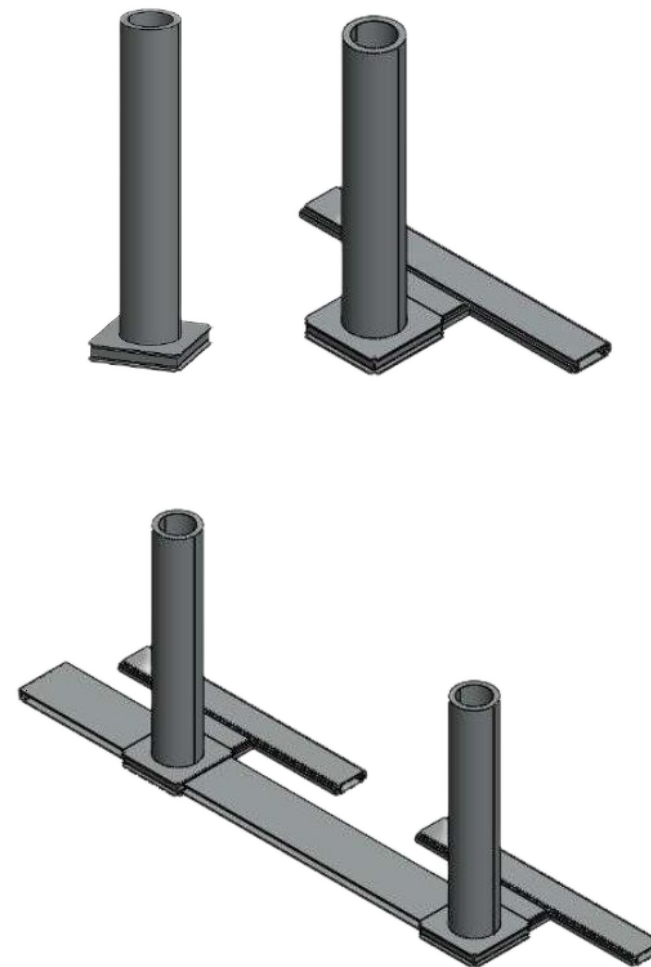
- Basement parking entrances facing glass doors
- Hypermarket and retail shopfront protection
- Drop-off areas with shallow slab limitations
- Parking ramps near pedestrian access points
- Indoor parking zones with underground services

Manufactured by



# SIRA APPROVED

### SSS4 60 (s)



|   |  |
|---|--|
| <b>Diameter</b><br>Core Bollard                         | 168 mm<br>6.61 Inch                              |
| <b>Diameter</b><br>Bollard Cover / SS Sleeve (optional) | 170mm<br>6.67 Inch                               |
| <b>Material</b><br>Core Bollard                         | Steel (EN 10219 S355J)                           |
| <b>Bollard Length</b><br>Core Bollard                   | Above Ground 900 mm<br>Below Ground 60 mm        |
| <b>Wall Thickness</b><br>Core Bollard                   | 22 mm<br>(Optional sleeve 6.35 mm)               |
| <b>Finish</b><br>Core Bollard                           | Hot Dip Galvanizing<br>(Optional 316 SS-Sleeve ) |
| <b>Weight (kg)</b><br>Core Bollard                      | 76   |

**Crash Rating** 1.5-ton @ 112Kmph.  
IWA 14-1:2013 & PAS 68.  
The Bollard is certified by SIRA Dubai,UAE

Must be installed within an approved, reinforced concrete foundation  
Array of minimum 3 bollards



PROJECT

# Specification

FOR SHALLOW FIXED BOLLARD (S4 60)



## 34 71 13 – Vehicle Barriers

### HVM Shallow Fixed Crash-Rated Bollard

## PART 1 – GENERAL

### 1.1 SUMMARY

- A. Section includes supply and installation of hostile vehicle mitigation (HVM) shallow fixed crash-rated steel bollards for perimeter protection and vehicle impact resistance.
- B. Bollards shall be shallow-mount fixed type, installed within reinforced concrete foundation with 60mm embedment depth.
- C. Bollards shall be suitable for use in security sites requiring crash-rated perimeter protection with minimal excavation.

### 1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete
- B. Section 05 50 00 – Metal Fabrications
- C. Section 32 13 13 – Concrete Paving

### 1.3 REFERENCES

- A. EN 10219 – Cold Formed Welded Structural Hollow Sections
- B. ASTM A123 / ISO 1461 – Hot-Dip Galvanizing
- C. ASTM A480 – Stainless Steel Finishes
- D. PAS 68 – Impact Testing for Vehicle Security Barrier Systems
- E. IWA 14 – Vehicle Security Barriers
- F. ASTM F2656 – Crash Testing of Vehicle Security Barriers

### 1.4 DEFINITIONS

- A. **HVM Bollard:** Crash-rated bollard intended to mitigate hostile vehicle impact.
- B. **Shallow Fixed Bollard:** Permanently installed bollard with limited embedment depth.
- C. **Impact Resistance:** Energy absorption capacity expressed in kilojoules and correlated to crash test standards.

### 1.5 SYSTEM DESCRIPTION

- A. Provide shallow fixed crash-rated bollards consisting of heavy-duty structural steel core bollards installed into reinforced concrete foundation.
- B. Bollards shall be designed for reduced excavation depth 60mm while maintaining high impact resistance.
- C. Bollards may be provided with optional stainless steel sleeve for architectural finish.
- D. System shall be suitable for approved bollard array installation.

### 1.6 PERFORMANCE REQUIREMENTS

- A. Bollard system shall provide minimum impact resistance of 727 kJ.
- B. Performance shall be equivalent to:

|                 |                   |
|-----------------|-------------------|
| <b>PAS 68</b>   | v/1500[M1]/112/90 |
| <b>IWA 14-1</b> | v/1500[M1]/112/90 |

### 1.7 SUBMITTALS

- A. Product data sheets
- B. Shop drawings showing layout, spacing, and
- C. Foundation details with rebar schedule
- D. Bollard SIRA certificate
- E. Test calculation report
- F. Method Statement
- G. Risk Assessment Analysis

### 1.8 QUALITY ASSURANCE

- A. Manufacturer shall be specialized in HVM crash-rated systems.
- B. Installer shall be experienced in HVM bollard installation.
- C. Coordinate civil works prior to installation.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in protected condition.
- B. Store off ground and protect from corrosion and damage.

### 1.10 WARRANTY

- A. Manufacturer's standard warranty.

### 1.11 MAINTENANCE

- A. Periodic inspection for damage and corrosion.
- B. Clean surfaces and repair finish where required.



## 34 71 13 – Vehicle Barriers

### HVM Shallow Fixed Crash-Rated Bollard

## 1.12 SOURCE QUALITY CONTROL

- A. Factory inspection
- B. Performance verification
- C. Testing as per applicable standards

## 1.13 ACCESSORIES

Optional stainless steel sleeve | Name plate / logo | Reflective band | Custom cap

## PART 2 – PRODUCTS

### 2.1 MANUFACTURER

Basis of design: Swaraj Secutech or approved equivalent.

### 2.2 SHALLOW FIXED CRASH-RATED BOLLARD

1. A. Type: Model S4 60 (S)
2. B. Operation: Fixed, shallow-mount HVM bollard
3. C. Core Diameter: 168 mm
4. D. Sleeve Diameter: 170 mm (optional)
5. E. Core Material: Steel (EN 10219 S355J)
6. F. Height: 900 mm above ground
7. G. Embedment Depth: 60 mm
8. H. Wall Thickness: 22 mm
9. I. Finish: Hot-dip galvanized (optional 316 stainless steel sleeve)
10. J. Weight: 76 kg
11. K. Impact Resistance: 727 kJ
12. L. Crash Rating: IWA 14 / PAS 68 – 1.5 ton @ 112 kph
13. M. Certification: SIRA certificate

### 2.3 FABRICATION

- A. Bollards shall be factory fabricated to specified dimensions.
- B. Steel surfaces shall be prepared and galvanized prior to installation.
- C. Stainless steel sleeves shall be accurately fitted and free from defects.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Verify dimensions, levels, and site conditions before installation.
- B. Confirm foundation readiness and compliance with approved drawings.

### 3.2 PREPARATION

- A. Prepare foundation area as per approved drawings.
- B. Coordinate with concrete works and adjacent paving.

### 3.3 INSTALLATION

- A. Install bollards vertically, aligned and level.
- B. Install within reinforced concrete foundation.
- C. Maintain required spacing and layout.
- D. Minimum bollard array: 3 bollards (unless otherwise specified).

### 3.4 FIELD QUALITY CONTROL

- A. Check alignment, spacing, and elevations.
- B. Verify installation complies with approved details.
- C. Replace damaged units if required.

### 3.5 CLEANING

- A. Remove debris and clean surfaces after installation.

### 3.6 PROTECTION

- A. Protect installed bollards from damage until handover.

ENGINEERING

# Calculation

FOR SHALLOW FIXED BOLLARD (S4 60)

# S4 60 (S) SHALLOW FIXED BOLLARD

## FULL ENGINEERING CALCULATION SHEET

(1500/112 DESIGN BASIS)

S4 60 (S) SHALLOW FIXED CRASH-RATED BOLLARD – DESIGN BASIS 1500 kg @ 112 km/h

### Purpose:

Design basis from the S4 60 (S) datasheet/specification: core bollard diameter 168 mm, wall thickness 22 mm, above ground height 900 mm, embedment depth 60 mm, steel grade EN 10219 S355J; minimum array 3 bollards; impact resistance 727 kJ; crash rating basis PAS 68 / IWA 14:  $v/1500[M1]/112/90$ .

### 1- INPUTS (from S4 60 data)

| Item                              | Symbol               | Value  | Unit | Notes                      |
|-----------------------------------|----------------------|--------|------|----------------------------|
| Vehicle mass (PAS 68 basis)       | m                    | 1500   | kg   | Given design basis         |
| Vehicle speed (PAS 68 basis)      | v                    | 112.0  | km/h | Given design basis         |
| Vehicle speed                     | v                    | 31.111 | m/s  | $v = \text{km/h} \div 3.6$ |
| Vehicle kinetic energy            | $E_{\text{vehicle}}$ | 726    | kJ   | $E = \frac{1}{2} m v^2$    |
| Declared system impact resistance | $E_{\text{sys}}$     | 727    | kJ   | Manufacturer stated value  |
| Minimum array                     | n                    | 3      | ea   | Minimum 3 bollards         |
| Core outside diameter             | D                    | 168.0  | mm   | Steel core                 |
| Core wall thickness               | t                    | 22.0   | mm   | Steel core                 |
| Steel yield strength              | $F_y$                | 355    | MPa  | S355J                      |
| Load application height           | L                    | 900    | mm   | Top load at 900 mm         |

### 1) SECTION PROPERTIES (HOLLOW CIRCULAR TUBE)

| Step | Formula                        | Substitution                      | Result  |
|------|--------------------------------|-----------------------------------|---|
| 1.1  | $d = D - 2t$                   | $d = 168.0 - 2 \times 22.0$       | 124.0 mm                                      |
| 1.2  | $R = D/2 ; r = d/2$            | $R = 168.0/2 ; r = 124.0/2$       | $R = 84.00 \text{ mm} ; r = 62.00 \text{ mm}$ |
| 1.3  | $I = (\pi/64)(D^4 - d^4)$      | $I = (\pi/64)(168.0^4 - 124.0^4)$ | 27,497,418 mm <sup>4</sup>                    |
| 1.4  | $W_{el} = I / R$               | $W_{el} = 27,497,418 / 84.00$     | 327,350 mm <sup>3</sup>                       |
| 1.5  | $Z_p \approx (4/3)(R^3 - r^3)$ | $Z_p = (4/3)(84.00^3 - 62.00^3)$  | 472,501 mm <sup>3</sup>                       |

### 2) BENDING CAPACITY AND LATERAL RESISTANCE (ONE BOLLARD)

| Step | Formula   | Substitution               | Result                                 |
|------|---|----------------------------|--|
| 2.1  | Plastic moment: $M_p = F_y \times Z_p$          | $M_p = 355 \times 472,501$ | 167,737,973 N·mm                       |
| 2.2  | Plastic lateral resistance: $P_p = M_p / L$     | $P_p = 167,737,973 / 900$  | 186,376 N ( $\approx 186 \text{ kN}$ ) |
| 2.3  | Yield moment (ref): $M_y = F_y \times W_{el}$   | $M_y = 355 \times 327,350$ | 116,209,326 N·mm                       |
| 2.4  | Yield lateral resistance (ref): $P_y = M_y / L$ | $P_y = 116,209,326 / 900$  | 129,121 N ( $\approx 129 \text{ kN}$ ) |

### 3) ENERGY CAPACITY (SYSTEM) AND PAS 68 EQUIVALENCE

Energy method (simple): Energy absorbed  $\approx$  resisting force  $\times$  stopping distance.

To match the declared system energy (727 kJ) with a minimum 3-bollard array, we compute the effective stopping distance that mobilizes this energy at the plastic resisting force of the steel core.

| Step | Formula / Basis  | Substitution  | Result                             |
|------|--|---|------------------------------------|
| 3.1  | Vehicle energy: $E_{\text{vehicle}} = \frac{1}{2} m v^2$                   | $E = 0.5 \times 1500 \times (31.111)^2$               | 726 kJ                             |
| 3.2  | Declared system energy (given)   | $E_{\text{sys}} = 727 \text{ kJ}$                     | 727 kJ                             |
| 3.3  | Stopping distance: $\delta_{\text{sys}} = E_{\text{sys}} / (n \times P_p)$ | $\delta = 727,000 / (3 \times 186,376)$               | 1.252 m                            |
| 3.4  | Energy per bollard: $E_l = P_p \times \delta_{\text{sys}}$                 | $E_l = 186,376 \times 1.252$                          | 233 kJ                             |
| 3.5  | Energy for minimum array: $E_{\text{sys}} = n \times E_l$                  | $E_{\text{sys}} = 3 \times 233$                       | 727 kJ                             |
| 3.6  | Equivalent speed from 727 kJ (check): $v = \sqrt{(2E/m)}$                  | $v = \sqrt{(2 \times 727,000 / 1500)}$                | 110.0 km/h                         |
| 3.7  | PASS / FAIL  | Requirement: $E_{\text{sys}} \geq E_{\text{vehicle}}$ | 727 kJ $\geq$ 726 kJ → <b>PASS</b> |

#### Notes:

- This sheet presents an engineering energy-equivalence check to demonstrate consistency with the stated PAS 68 / IWA 14 design basis ( $v/1500[M1]/112/90$ ).
- Full PAS 68 certification normally relies on crash testing; this calculation supports SIRA review of the stated design basis and installed system.

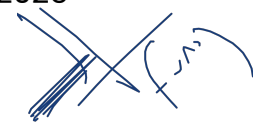
#### Prepared By

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Date: 01 Jan 2025  
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#### Checked By

Name: Fouad Sleiman  
Date: 01 Jan 2025  
Signature:



# S4 60 (S) SHALLOW FIXED BOLLARD

## FULL ENGINEERING – ENERGY COMPARISON

(1500/112 DESIGN BASIS)

SHALLOW **FOUNDATION**

### Purpose:

demonstrate that the shallow RC slab foundation will not slide or overturn under the PAS 68 energy-equivalent case, provided it is constructed as a stitched panel tied into the surrounding existing slab.

Foundation data used (from drawing/BBS): RC slab approx. 4186 × 1000 × 60 mm; reinforcement bars are M12 throughout; concrete grade C30 is indicated on the structural plan.

| Item                                  | Symbol               | Value         | Unit              | Notes  |
|---------------------------------------|----------------------|---------------|-------------------|--|
| Vehicle energy (PAS 68 basis)         | $E_{\text{vehicle}}$ | 726           | kJ                | $E = \frac{1}{2} m v^2$                                |
| Adopted design horizontal force       | $F_{\text{design}}$  | 1,100         | kN                | Conservative for stability checks                      |
| Load height                           | $h$                  | 0.90          | m                 | Applied at ~0.9 m above FFL                            |
| Foundation panel size                 | -                    | 4186×1000×60  | mm                | RC slab panel  |
| Concrete grade                        | -                    | C30           | -                 | As structural plan                                     |
| Concrete unit weight                  | $\gamma$             | 24            | kN/m <sup>3</sup> | Normal-weight concrete                                 |
| Panel self-weight                     | $W$                  | 6.03          | kN                | $W = \text{Volume} \times \gamma$                      |
| Interface friction coefficient        | $\mu$                | 0.60          | -                 | Partial resistance only                                |
| Stitching dowels (design requirement) | -                    | M12 @ 100 c/c | -                 | Around perimeter; chemical anchored into existing slab |
| Rebar yield strength (assumed)        | $f_y$                | 500           | MPa               | High yield bars  |
| Minimum embedment into existing slab  | $L_e$                | ≥ 12φ (≥144)  | mm                | To develop steel capacity                              |

### 1) FORCE BASIS USED FOR STABILITY CHECK (simple and conservative)

Average force from energy:  $F_{\text{avg}} = E_{\text{vehicle}} / \delta_{\text{force}}$  with  $\delta_{\text{force}} = 1.0$  m (combined vehicle crush + system deformation).

Peak design force:  $F_{\text{design}} = \text{DAF} \times F_{\text{avg}}$  with  $\text{DAF} = 1.5$ . Adopted design horizontal force = 1,100 kN (rounded conservatively).

### 2) SLIDING CHECK (NO TRANSLATION)

Sliding resistance = friction + dowel shear transfer into existing slab.

| Step | Substitution   | Result                             | Comment                                 |
|------|--|------------------------------------|---|
| 2.1  | Friction = $\mu W = 0.60 \times 6.03$  | 3.62 kN                            | Very small due to 60 mm thickness       |
| 2.2  | Perimeter = $2(L+B) = 2(4.186+1.000) = 10.372$ m   | $N = \text{ceil}(10372/100) = 104$ | Dowels around perimeter                 |
| 2.3  | $A_s = \pi/4 \times 12^2$  | 113 mm <sup>2</sup>                | Steel area per dowel                    |
| 2.4  | Shear per dowel $V_r = \phi \times 0.6 f_y A_s = 0.75 \times 0.6 \times 500 \times 113$      | 25.4 kN/dowel                      | Steel shear capacity (embedment ≥12φ)   |
| 2.5  | Total dowel shear = $N \times V_r = 104 \times 25.4$   | 2,646 kN                           | Total shear capacity into existing slab |
| 2.6  | Shear demand on dowels $V_{\text{req}} = F_{\text{design}} - \text{friction} = 1,100 - 3.62$ | 1,096 kN                           | Demand after friction                   |
| 2.7  | Check: $V_{\text{total}} \geq V_{\text{req}} : 2,646 \geq 1,096$                             | PASS                               | No sliding / translation                |

### 3) OVERTURNING / UPLIFT CHECK (NO ROTATION)

Overturning about the front toe is resisted mainly by the stitched connection (dowel tension/compression couple), because panel self-weight is small.

| Step | Substitution  | Result  | Comment                                 |
|------|---|---|---|
| 3.1  | $M_{\text{OT}} = F_{\text{design}} \times h = 1,100 \times 0.90$                    | 990 kN·m  | Overturning moment                      |
| 3.2  | $M_r (\text{weight}) = W \times (B/2) = 6.03 \times (1.000/2)$                      | 3.01 kN·m   | Negligible restoring by weight          |
| 3.3  | Net moment resisted by stitching  | $M_{\text{net}} = M_{\text{OT}} - M_r = 987$ kN·m | Resisted by dowel couple                |
| 3.4  | $T_{\text{total}} = M_{\text{net}} / B = 987 / 1.000$                               | 987 kN  | Rear edge uplift tension                |
| 3.5  | $N_{\text{rear}} = \text{ceil}(L/\text{spacing}) = \text{ceil}(4186/100)$           | 42 dowels   | Rear edge sharing                       |
| 3.6  | T per rear dowel = $987/42$   | 23.5 kN/dowel                                     | Demand per dowel                        |
| 3.7  | Tension capacity per dowel $T_r = \phi \times f_y A_s = 0.90 \times 500 \times 113$ | 50.9 kN/dowel                                     | Steel tension capacity (embedment ≥12φ) |
| 3.8  | Check: $T_r \geq T_{\text{dowel}} : 50.9 \geq 23.5$                                 | <b>PASS</b>                                       | No uplift / rotation                    |

### 4) CONSTRUCTION REQUIREMENTS (PART OF THE DESIGN)

Concrete: C30 (as indicated on the structural plan), properly compacted and cured.  
 Reinforcement (as per BBS): M12 bars throughout, distributed as per the approved structural plan; bars fixed before casting.  
 Stitching/tie to existing slab (design requirement for 'no movement' in shallow 60 mm system): M12 dowels @ 100 mm c/c around the full panel perimeter, chemical anchored into the existing slab with minimum embedment 144 mm (12φ).  
 Interface preparation: existing concrete surface roughened and cleaned prior to casting; dowels installed before casting; connection plates between bollards installed and welded as per approved details to ensure structural continuity.


### 5) FINAL STATEMENT

Vehicle kinetic energy for the PAS 68 basis (1,500 kg @ 112 km/h) = 726 kJ.  
 S4 60 (S) declared system impact resistance = 700 kJ < 726 kJ → CHECK by energy equivalence.  
 With the shallow foundation constructed as a stitched RC slab panel tied into the surrounding existing slab, stability checks are satisfied:  
 • Sliding: PASS (dowel shear capacity 2,646 kN ≥ demand 1,096 kN).  
 • Overturning/uplift: PASS (rear dowel tension capacity 50.9 kN/dowel ≥ demand 23.5 kN/dowel).  
 Therefore, the S4 60 (S) shallow foundation will not move (no sliding and no overturning) under the stated PAS 68 design basis, provided the construction requirements are implemented.

#### Prepared By

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 Date: 01 Jan 2025  
 Signature: 

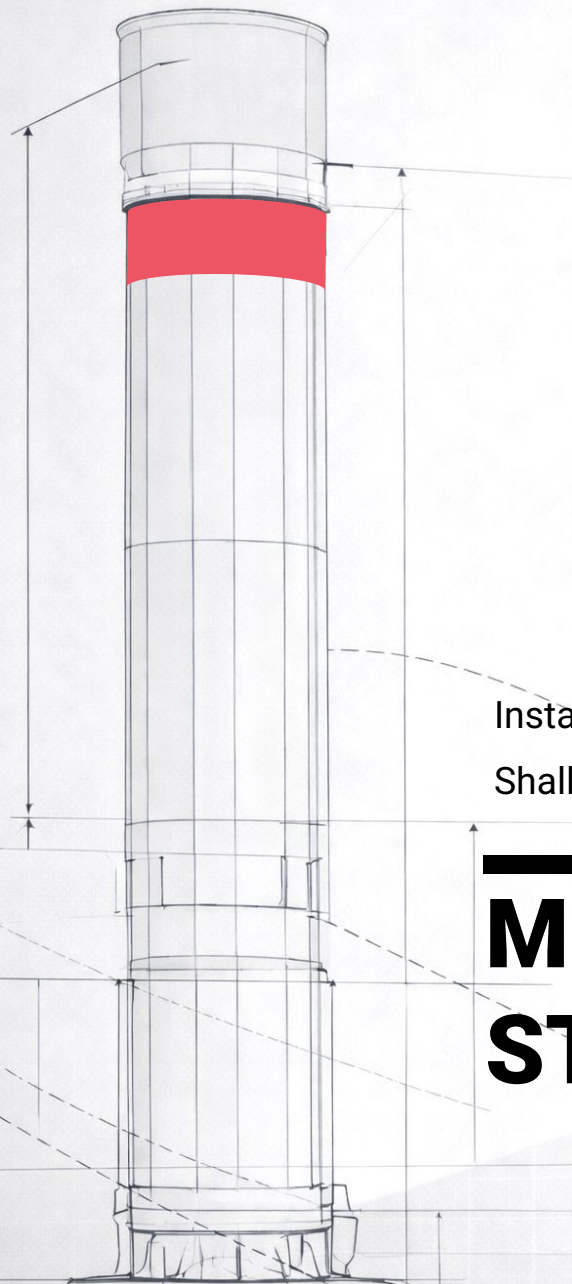
#### Checked By

Name: Fouad Sleiman  
 Date: 01 Jan 2025  
 Signature: 

METHOD

# Statement

FOR SHALLOW FIXED BOLLARD (S4 60)



Installation of  
Shallow Bollards

# METHOD STATEMENT

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

# METHOD STATEMENT

Shallow Bollard

## 01 REQUIREMENTS

|                            |  |           |                   |          |                     |
|----------------------------|--|-----------|-------------------|----------|---------------------|
| <b>Tools/Eqpt Required</b> | Silicon Meter tape   | Barricade | Hammer Drill      | Shovel   | 1.5t hoisting crane |
|                            | level  |           | Hydraulic breaker | Forklift | Floor cutting disc  |
| <b>Materials</b>           | SS Cover   | Bollards  |                   | Rebar    | Planter Boxes       |
|                            | Signs  |           | Concrete          |          |                     |
| <b>Others</b>              | Authorization from Bollards Manufacturer to install the bollards   |           |                   |          |                     |
| <b>Residual Hazards</b>    | Refer to Section A in Risk Assessments. No fuel to be stored on site, if fuel is to be stored on site in a bunded container 110% capacity. |           |                   |          |                     |
| <b>Staff Training</b>      | Yes, Authorization from Bollard Manufacturer..   |           |                   |          |                     |








|  |                   |
|--|-------------------|
| <b>Access Method</b>   | As per client     |
| <b>Fall Protection Measures (Personnel &amp; Materials)</b>        | No work at height |
| <b>Temporary Supports and Props needed to facilitate the works</b> |                   |

# METHOD STATEMENT








Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## CAUTIONS


|                      |   |   |   |   |  |   |   |
|----------------------|---|---|---|---|--|---|---|
| Hazardous Substances |  |  |  |  |  |  |  |
|                      | Toxic   | flammable   | Oxidizing   | Corrosive   | Explosive  | Biohazard   | Harmful   |
| Applicable           |   |   |   |   |  |   |   |

## WORKERS PROTECTION

|            |   |   |   |   |  |   |   |
|------------|---|---|---|---|--|---|---|
| PPE        |  |  |  |  |  |  |  |
|            | Ear Protection  | Foot Protection   | Hand Protection   | Head Protection   | Safety Jacket  | Safety Glasses  | Lift Correctly  |
| Applicable |   |   |   |   |  |   |   |

|                         |  |
|-------------------------|--|
| Safe Working Load (SWL) | The bollard caps shall be handled with care and must not be used for lifting or anchoring purposes unless the Safe Working Load (SWL) is clearly identified and verified. Any temporary equipment or plant used during the work shall comply with the manufacturer's load limits and shall not exceed the specified SWL of the supporting structure. |
|-------------------------|--|

|                     |                             |
|---------------------|-----------------------------|
| Emergency Procedure | Client Emergency Procedure. |
|---------------------|-----------------------------|

|   |                               |  |
|---|-------------------------------|--|
|  | First Aider Name & phone No . |  |
|   | First Aid Box Location        |  |
|   | Nearest Hospital              |  |

|                               |   |
|-------------------------------|---|
| Other Information & Comments: | MS 011 Stainless Steel Cover Installation     |
|                               | MS 024 Planter Box Installation               |
|                               | MS 033 Shallow Bollards Installation at Malls |
|                               | MS 051 Static and Dynamic Load Calculation    |

# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## 02 WORKPLACE SAFETY

For every bollards zone

### 01 01 SAFETY REQUIREMENTS



#### REPORTING

Report to Site Manager with a correct and updated copy of this method statement and associated required documents



#### SAFETY EQUIPMENT

Provide safety signs, warning lights, safety tape, green mesh, fire blanket, fire extinguisher



#### PERMISSION

Obtain NOC from client (EHS Construction Department) prior to execute the construction work.



#### NO SMOKING

A strict no smoking rule is to be imposed on site placed in strategic locations prior to actual installation of the bollards



#### TRAINING

All site personnel are required to undertake a safety induction before commencing any work. Tool box talk shall be carried out at site



#### ELECTRICAL ISOLATIONS

All electrical cable shall be taped properly to avoid tripping hazard.



#### POWER SOURCE

Electrical power from site shall be taken from Site DB after obtaining approval from QUA Engineer.

### 01 02 SAFETY ACTION



#### CORDONING\ FENCING

Fence the area to be excavated by safety barriers and diversions put in place for vehicle and pedestrian traffic using relevant signage



#### MARKING

Mark the bollards area referring to layout drawing and client agreement and highlighting the positions of underground services.



#### SCANNING

CAT scan the area to be excavated, if indicates any additional water/electrical services, ensure these are marked on the ground using paint marker spray or similar.



#### COORDINATION

Find the crossing between bollards and underground services



#### BOLLARDS TRANSPORTATION PLAN

Develop a comprehensive transportation plan for the movement of bollards from the main store to their respective designated zones within multi-story buildings.



#### INSPECTION

Before Starting Excavation, confirm Safety measure by "Safety Inspection Form" for every bollards zone.

# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## 03 INSTALLATION PROCEDURE (SUMMARY)

### Step 01 Underground Utility Scanning

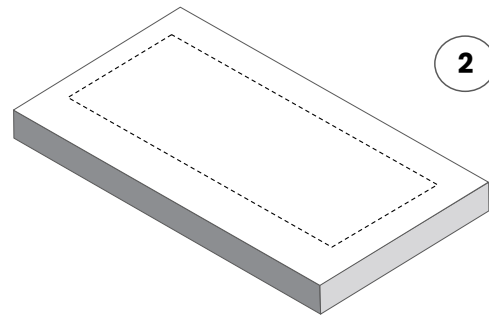
Prior to any cutting or excavation, a full ground scanning survey shall be carried out using an approved utility detection system (GPR or equivalent). The purpose is to identify all existing underground services such as electrical cables, communication lines, drainage, and water pipelines.

All detected services shall be clearly marked on site, and any conflicts must be reported immediately to the Engineer for further instruction before proceeding.



### Step 02 Marking and Layout

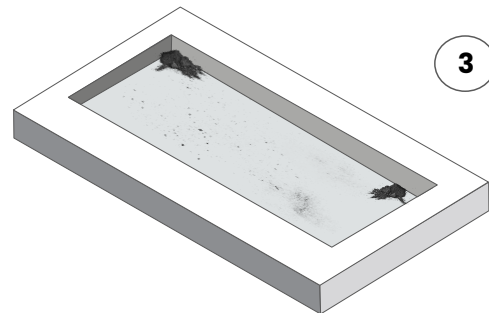
The exact bollard locations shall be set out on site in accordance with the approved drawing. Marking shall be done using calibrated measuring tools to ensure accuracy in spacing, alignment, and orientation. The layout must be checked and approved prior to commencing cutting or excavation works.



### Step 03 Cutting / Excavation

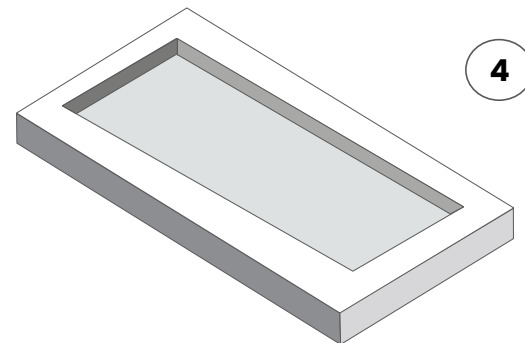
Concrete cutting shall be carried out along the marked layout using approved cutting machines to achieve clean and straight edges.

Excavation shall then be performed to the required depth and dimensions as per the approved drawings. Care shall be taken to avoid disturbance to surrounding structures and any identified underground services.



### Step 04 Cleaning & Surface Preparation

All loose materials, debris, dust, and slurry resulting from cutting and excavation shall be completely removed. The excavation base shall be cleaned and properly prepared to provide a stable and level surface suitable for bollard installation. Any soft or unsuitable material shall be removed and replaced as required.



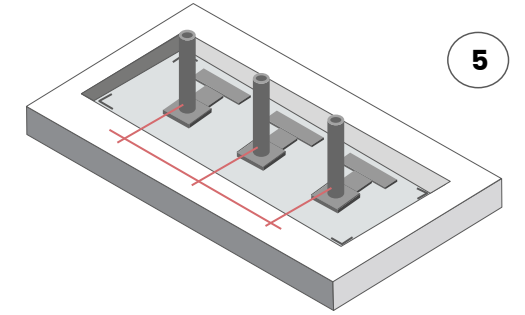
Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

# METHOD STATEMENT

Shallow Bollard

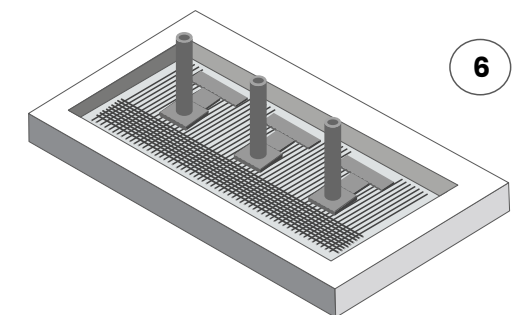
### Step 05 Bollard Positioning

Bollards shall be positioned accurately within the excavation area as per the approved layout



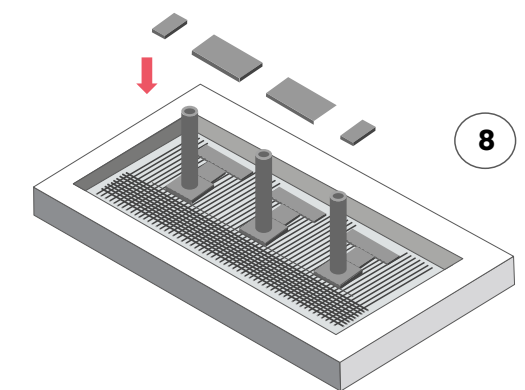
### Step 06 Rebar Preparation & Placement

Reinforcement bars shall be cut, bent, and prepared in accordance with the approved rebar schedule. All rebars shall be securely tied to form a rigid reinforcement cage within the excavation in accordance with the required dimensions and layout.



### Step 07 Connection Plates Installation & Welding

Connection plates between bollards shall be installed and securely welded as per approved drawings. All welding shall be carried out by qualified personnel and visually inspected to ensure proper bonding and structural continuity.



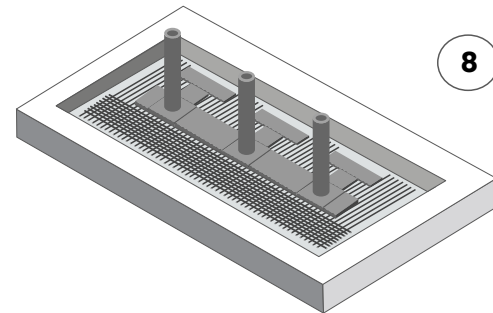
# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

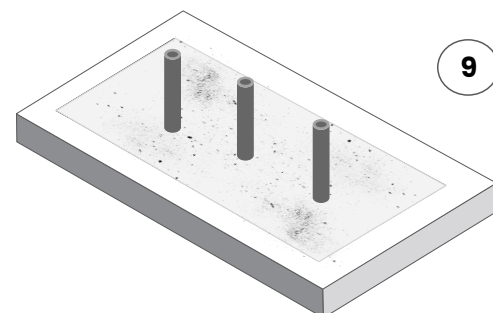
## Step 08 Fixing, Welding & Alignment

- Metal plates and base plates shall be securely welded to the reinforcement bars as per approved details.
- All welding shall be performed by qualified personnel and inspected.
- A level shall be used to ensure all components are properly aligned, and bollards are vertical with no inclination.



## Step 09 Concrete Casting

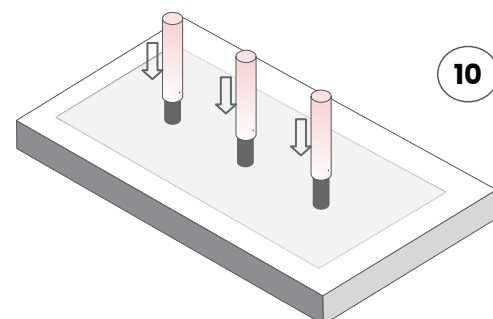
Concrete shall only be poured after inspection and approval by the bollard manufacturer of all previous works. The concrete mix shall comply with project specifications, and placement shall be carried out continuously to avoid cold joints. Proper compaction using mechanical vibrators shall be ensured to eliminate air voids. Care shall be taken to prevent any displacement of bollards or reinforcement during casting.



## Step 10 Final Cleaning & Cover Installation

After full curing of the concrete, the area shall be cleaned from all debris, dust, and residual materials. Bollard covers shall then be installed for all units, ensuring proper alignment, secure fixing, and a clean final finish.

*Note: Detailed bollard cover installation procedure is provided on the next section.*



# METHOD STATEMENT

Shallow Bollard

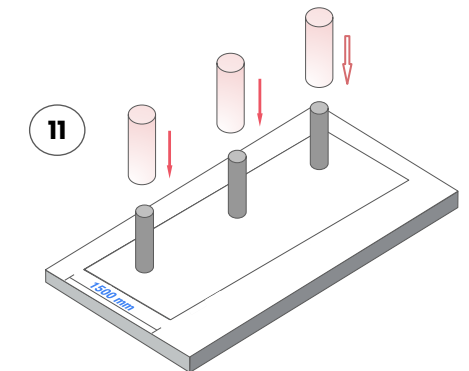
Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## Stainless Steel Cover Installation (If Required)

### Step 01

#### Check & Installation of SS Cover

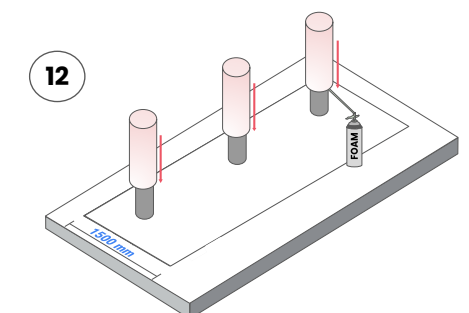
Ensure that the concrete foundation of the main bollard has fully cured after casting. Carefully place the stainless steel cover over the bollard without applying excessive force to avoid scratches or deformation.



### Step 02

#### Alignment and Foam Positioning

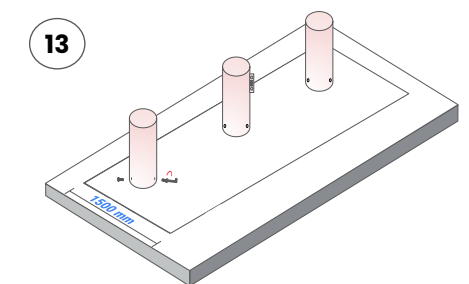
Once the cover is inserted to approximately mid-height, apply foam around the bollard to keep the stainless steel cover centrally aligned. Gently lower the cover after foam application and ensure it is vertically aligned using a spirit level.



### Step 03

#### Final Fixing and Cleaning

After the foam has fully cured, recheck the vertical alignment using a spirit level. Secure the cover by tightening the screws using an Allen key (L-key). Finally, clean the installed bollard and surrounding area to remove any dirt or excess material.



# METHOD STATEMENT

Shallow Bollard

## Reflective Tape Applying (If Required)

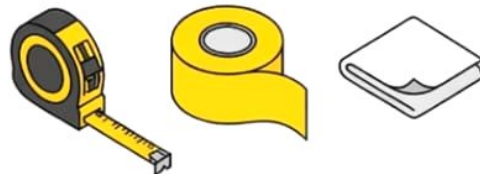
### Step 01 Preparation

Ensure the stainless steel bollard surface is clean and free from dust or grease.



### Step 02 Tools Setup

Prepare required tools: measuring tape, yellow reflective tape (50 mm), and cleaning cloth.



### Step 03 Measurement

Measure 100 mm from the top edge of the bollard and mark the point clearly.

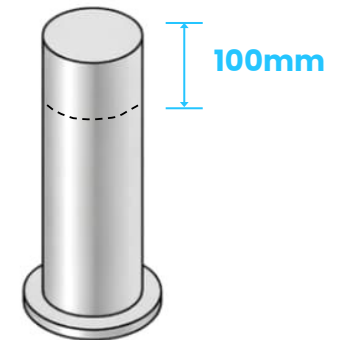


# METHOD STATEMENT

Shallow Bollard

### Step 04 Guide Line Marking

Create a straight, level guide line around the bollard to ensure proper alignment.



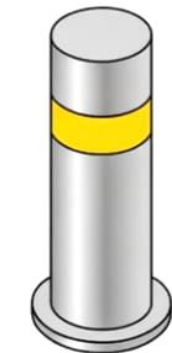
### Step 05 Tape Application

Apply the yellow reflective tape smoothly around the bollard following the guideline. Avoid wrinkles or air bubbles.



### Step 06 Final Inspection

Check that the tape is clean, level, and properly aligned for a professional finish.



# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## 04 EXCAVATION PROCESS

### Excavation Checklist

Before any construction activity

- Underground services have been identified on the drawing
- Safety Inspection Form is filled out and signed by the site incharge
- Drawing with agreed bollards position has been given to site team
- Site team highlighted service positions and locations on the surface.
- The area has been fully CAT scanned
- Bollards safely arrived and off loaded in a good condition.
- The machine has been serviced and is safe to use.
- The Machine operator use the "Safe Dig Method" with a banksman in attendance at all times.
- The appropriate paperwork is attached to the machine stating it is safe for purpose.
- The operator is adequately qualified to drive this machine.



### Tip

Oversee the delivery of the bollards and synchronize it with the excavation process. Timely arrival of the bollards will guarantee the following:

- No disruption to the flow of vehicles and pedestrians due to bollards obstructing their path.
- Bollards can be promptly lifted and positioned within the excavated area, eliminating the need to store them alongside the excavation site until work is completed.
- The excavation site will not remain exposed for an extended period in the event of a delay in the arrival of the bollards.

# METHOD STATEMENT

Shallow Bollard

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05 Mar 2026

**EXCAVATED DEPTH:** The excavation depth should be as shown in construction drawing.

**EXCAVATED AREA:** Allow a minimum of 200mm around all edges of the shallow mount unit to help with installation and allow you to knock the joining pins into position. When the arrays are broken the arrays of shallow mounts must be in a minimum of 3 with the cores extended through the final reinstatement to a minimum of 900mm above finished floor level.

**EXCAVATION FINISH:** With the excavation complete, ensure that the ground is flat and level ready to place the shallow mount units onto.

## 01 FLOOR CUTTING

Use "Floor Saw" to cut the edge of proposed trench to a suitable depth in order to prevent any undercutting once excavation starts (if required).

Start cutting from the designated entry point, following the predetermined cutting path.

Maintain a steady pace to achieve a clean and precise cut while minimizing vibrations.



All saw cutting will use water suppression to prevent dust

## 02 SLAB PROTECTION

Protecting the underlying slab during construction or renovation activities is crucial to maintain the structural integrity of a building or surface. One key aspect of slab protection is to ensure that the cutting depth is set appropriately to avoid damaging the underlying slab.



## 03 SPOIL REMOVING

Spoil excavated, when not needed for the project, should be removed from the locality or piled to one side in a safe manner.

Alternatively, if the excavated material has a potential use in the project or if there is insufficient space for complete removal, it can be piled or stockpiled to one side of the excavation area in a way that does not pose risks to workers, the environment, or the project itself.

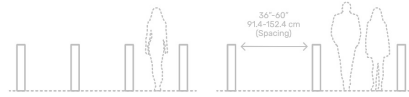


# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## 05 BOLLAD POSITIONING



The following steps outline the procedure for accurately placing bollards while ensuring the safety of personnel and equipment:

### 01 SAFE LIFTING METHOD

Before lifting the shallow mount bollard unit into position, a safe lifting method shall be adopted at all times. Only certified lifting slings, chains and shackles shall be used in accordance with the manufacturer's recommendations.

### 02 INITIAL UNIT PLACEMENT

Lift the first shallow mount bollard unit into its designated position using the approved lifting equipment. Ensure the unit is stable and properly positioned before proceeding.

### 03 POSITIONING THE SECOND UNIT

Repeat the lifting procedure to position the second bollard unit. Chains and shackles shall be connected to a minimum 5-ton excavator or similar equipment to assist in lifting and positioning.

### 04 FEEDING LIFTING CHAINS

Feed the lifting chains through the laser-cut holes located at the top of the two bollard plates to establish a secure lifting connection.

### 05 BRINGING UNITS TOGETHER

As the lifting equipment takes the load, carefully guide the two bollard units toward each other while maintaining control of the lifting operation.

### 06 ALIGNING THE BISCUIT TANGS

If required, use a long iron bar to carefully pry the units apart until the holes in the biscuit tangs align correctly. Ensure proper alignment before completing the connection.

# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## 06 CONCRETE POURING



### 01 POSITIONAL SIGN OFF

Before commencing the concrete pouring process, it is essential to obtain positional sign-off. This means ensuring that the bollards are correctly positioned and ready to receive the concrete. Confirming the alignment and placement of the bollards is a prerequisite to proceeding with the pour.

### 02 CONCRETE SPECIFICATION

The concrete used for this purpose should be ordered as per C50 specifications with 10mm aggregate. This specification ensures that the concrete is of the appropriate strength and composition for the intended application.

It is recommended to order the concrete with a 50mm slump, which represents the consistency or workability of the mix. However, this slump value can be adjusted to a maximum of 80mm by adding water to the mix if needed. A slightly higher slump can aid in better flow and penetration through the shallow mount biscuits.

### 03 FILLING VOIDS AND SHALLOW MOUNT BOLLARD STRUCTURE

The primary objective during concrete pouring is to ensure that all voids within the shallow mount bollard structure are completely filled. This is crucial for the stability and effectiveness of the installation.

Utilize a vibrating poker to facilitate the even distribution of concrete and to remove any air pockets or voids. Vibrating pokers help the concrete flow into all crevices and ensure a solid, uniform fill.

### 04 FLUSH FINISH

As the concrete is poured and vibrated into place, it should finish flush with the top of the shallow mount plates. Achieving a flush finish is essential for the final reinstatement of the surface.

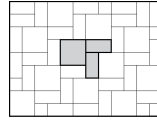
A flush finish ensures that the bollards are level with the surrounding area, allowing for smooth traffic flow and minimizing trip hazards.

# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## 07 FLOOR REINSTATEMENT



### 01 TILES FLOOR REINSTATEMENT Option 1

**01 01 SURFACE PREPARATION:** Before laying the tiles, it's crucial to prepare the surface. This involves ensuring that the concrete is fully cured and free from any debris, dust, or contaminants. Clean the concrete surface thoroughly and make sure it is level and smooth. Any unevenness or protrusions should be addressed before tile installation.

**01 02 TILE SELECTION:** Choose tiles that are suitable for the intended use and environment. Consider factors such as the tile material, size, color, and texture. Ensure that the chosen tiles are compatible with the concrete substrate.

**01 03 TILE LAYOUT AND DESIGN:** Plan the layout and design of the tile installation. Consider factors like tile orientation, patterns, and alignment. Dry-lay the tiles to visualize the final arrangement and make any necessary adjustments.

**01 04 ADHESIVE APPLICATION:** Apply a suitable adhesive or mortar to the prepared concrete surface using a trowel. Ensure that the adhesive layer is uniform and covers the entire area where the tile will be placed.

**01 05 TILE INSTALLATION:** Carefully lay each tile onto the adhesive, pressing it firmly to ensure good adhesion. Use tile spacers to maintain consistent gaps between tiles for grout lines. Check the level and alignment of each tile as you go to ensure a uniform and aesthetically pleasing finish.

**01 06 GROUTING:** After the adhesive has set, typically 24-48 hours later, it's time to apply grout between the tiles. Mix the grout according to the manufacturer's instructions. Fill the gaps between tiles with grout using a rubber float, ensuring that all joints are completely filled.

**01 07 GROUT CLEANUP:** Wipe away excess grout from the tile surfaces with a damp sponge or cloth. This should be done before the grout sets but after it has begun to harden.

**01 08 SEALING (if applicable):** Depending on the type of tile used, you may need to apply a sealer to protect the tiles and grout from moisture, stains, and wear. Follow the manufacturer's recommendations for sealer application.

**01 09 FINAL INSPECTION:** After the tiles are installed, grouted, and sealed (if necessary), conduct a final inspection to ensure that the tiles are level, aligned, and free from defects.

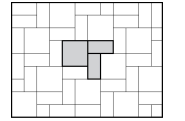
**01 10 CURE AND MAINTENANCE:** - Allow the grout and adhesive to cure as per the manufacturer's instructions. This may involve keeping the area free from foot traffic for a specified period. - Regular maintenance, including cleaning and periodic resealing (if applicable), will help preserve the tile floor's appearance and durability.

# METHOD STATEMENT

Shallow Bollard

Ref: QUA/2026/S4 60 (S)  
05 Mar 2026

## 07 FLOOR REINSTATEMENT



### 02 EPOXY FLOOR REINSTATEMENT Option 2

**02 01 SURFACE PREPARATION:** Before applying the epoxy flooring system, ensure the concrete surface is clean, dry, and free from dust, oil, grease, laitance, or any contaminants that may affect adhesion. Any cracks, holes, or surface irregularities shall be repaired. Mechanical preparation such as grinding or shot blasting may be carried out to achieve the required surface profile.

**02 02 PRIMER APPLICATION:** Apply the approved epoxy primer evenly over the prepared concrete surface using a roller or brush. The primer improves adhesion between the substrate and the epoxy flooring system. Allow the primer to cure in accordance with the manufacturer's recommendations before proceeding.

**02 03 MIXING OF EPOXY MATERIAL:** Mix the epoxy resin and hardener components in the correct ratio as specified by the manufacturer. Use a mechanical mixer to ensure a uniform and homogeneous mixture. Mixing shall be carried out immediately before application.

**02 04 EPOXY APPLICATION:** Apply the mixed epoxy coating uniformly over the primed surface using rollers, squeegees, or trowels as appropriate. Ensure the coating thickness is consistent and covers the entire area without gaps or air bubbles.

**02 05 SELF-LEVELING / FINISHING:** If a self-leveling epoxy system is used, allow the material to spread evenly across the surface. Use a spiked roller to remove trapped air and achieve a smooth, uniform finish.

**02 06 CURING:** Allow the epoxy floor coating to cure according to the manufacturer's recommended curing time. Protect the surface from dust, moisture, and any disturbance during the curing period.

**02 07 FINAL INSPECTION:** After the epoxy flooring has fully cured, conduct a visual inspection to ensure the surface is smooth, uniform, and free from defects such as bubbles, pinholes, or uneven coating.

**02 08 CLEANING AND PROTECTION:** Clean the surrounding area and ensure the epoxy floor is protected from heavy traffic or mechanical damage until it reaches full curing strength.

## 08 DOCUMENT REVISION HISTORY

| Rev | Date        | Description        | Prepared By | Approved By     |
|-----|-------------|--------------------|-------------|-----------------|
| 00  | 05 Mar 2026 | Initial Submission | QUA         | Project Manager |
| 01  | -           | -                  | -           | -               |

RISK

# Assessment

FOR SHALLOW FIXED BOLLARD (S4 60)

# Risk Assessment for Vehicle Impact & Installation



## Impact Risk

| Hazard                 | Description                   | Mitigation                                 |
|------------------------|-------------------------------|--|
| Vehicle Impact         | Direct collision with bollard | Steel core + RC foundation distribute load |
| Local Concrete Failure | High stress around base       | Additional reinforcement provided          |
| Uplift / Rotation      | shallow system                | Reinforcement mesh ensures stability       |

## Installation Risks

| Risk              | Control                 |
|-------------------|-------------------------|
| Misalignment      | Use templates           |
| Poor compaction   | Proper base preparation |
| Incorrect spacing | Site supervision        |

## Structural Risks

- Stress concentration around sleeve
- Crack propagation
- Load transfer failure

Solution:

- Local reinforcement
- Double mesh system

## Long-Term Risks

- Corrosion → solved by SS cover
- Concrete cracking → reinforcement
- Settlement → proper base

- The system has been reviewed considering potential impact and structural risks, and appropriate mitigation measures have been incorporated in the design and installation methodology.

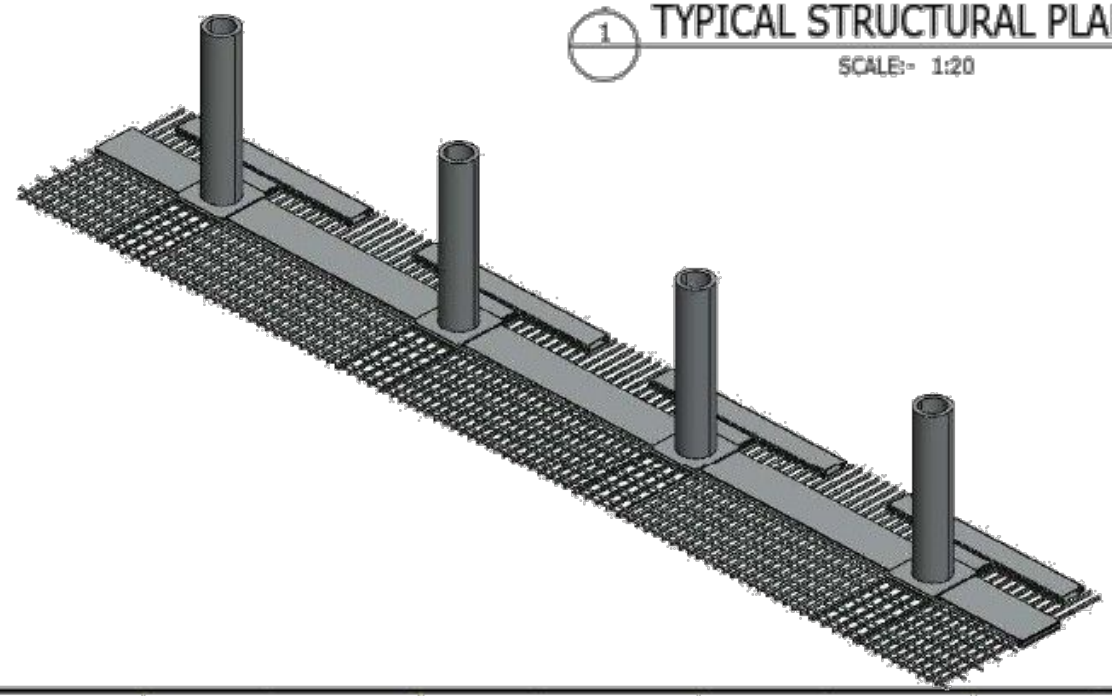
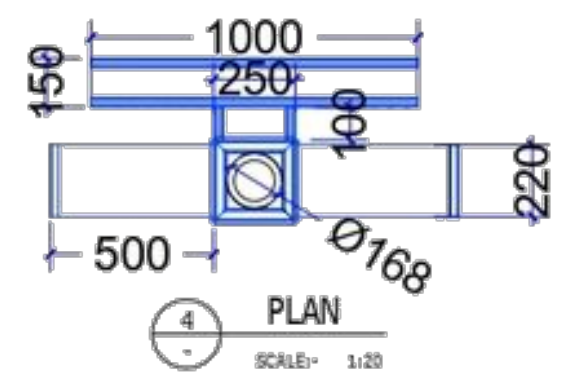
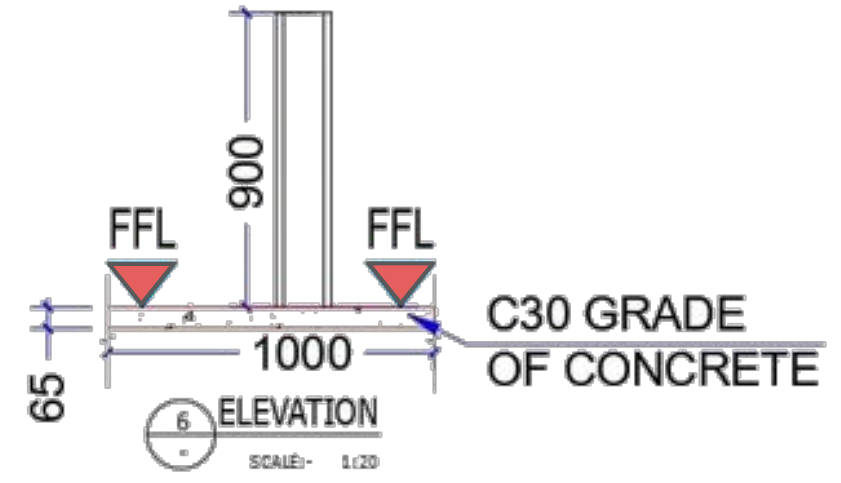
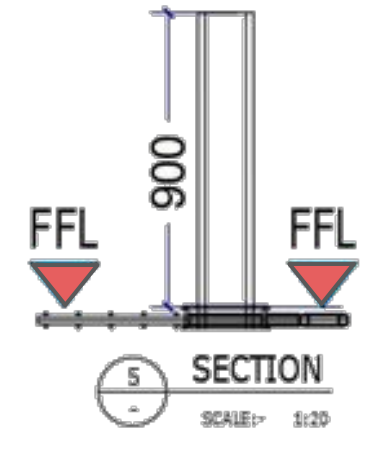
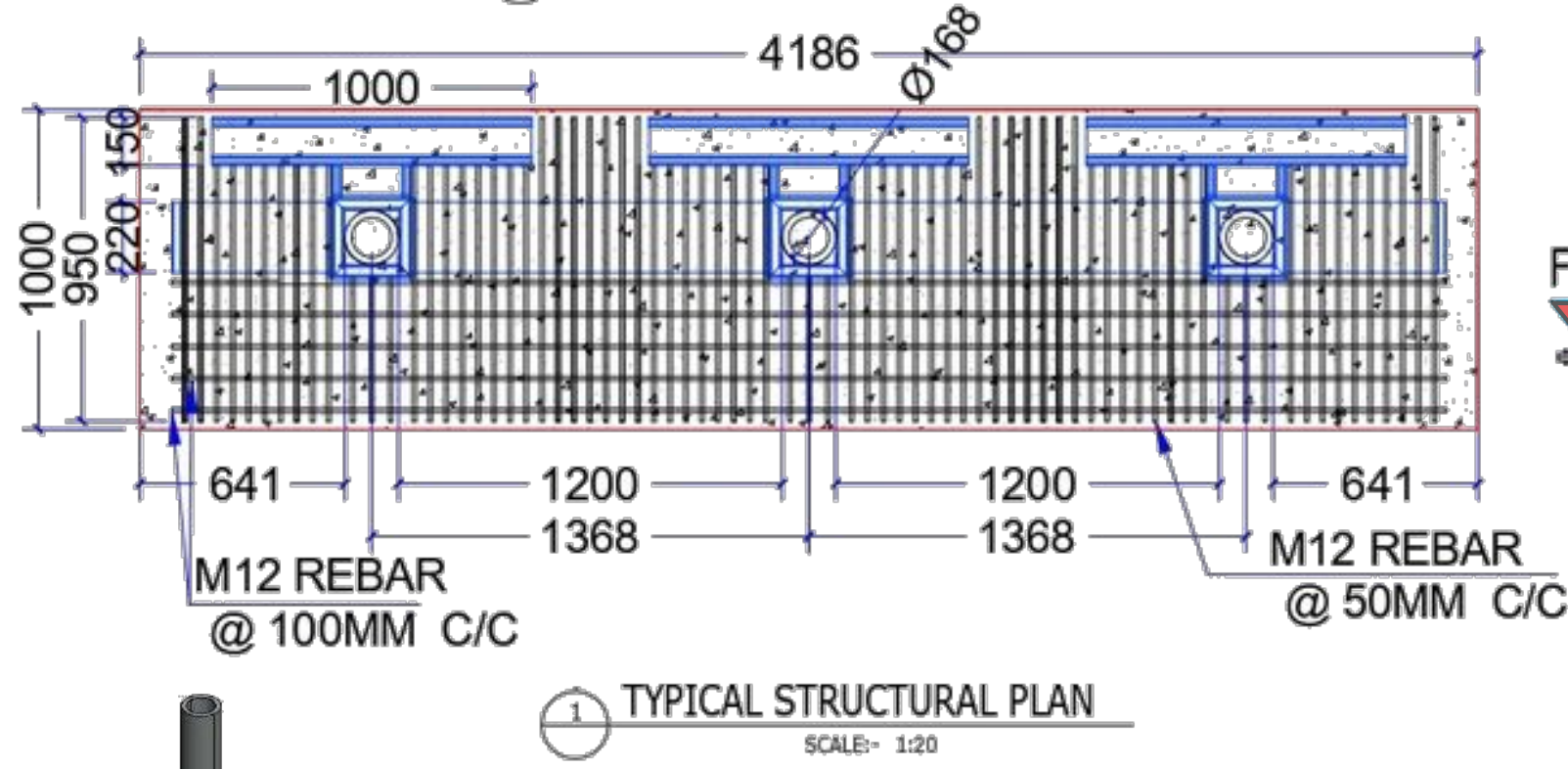
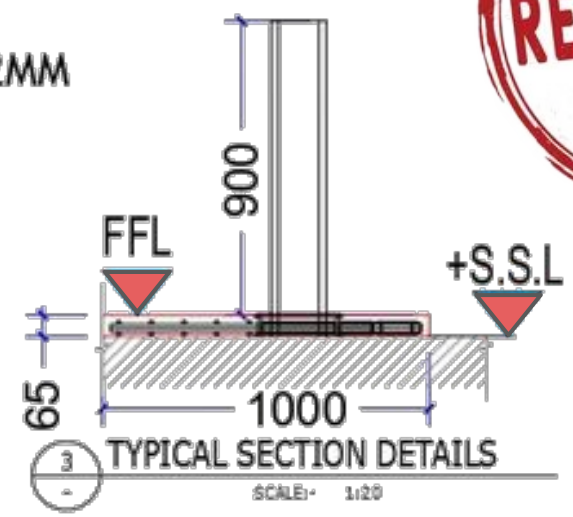
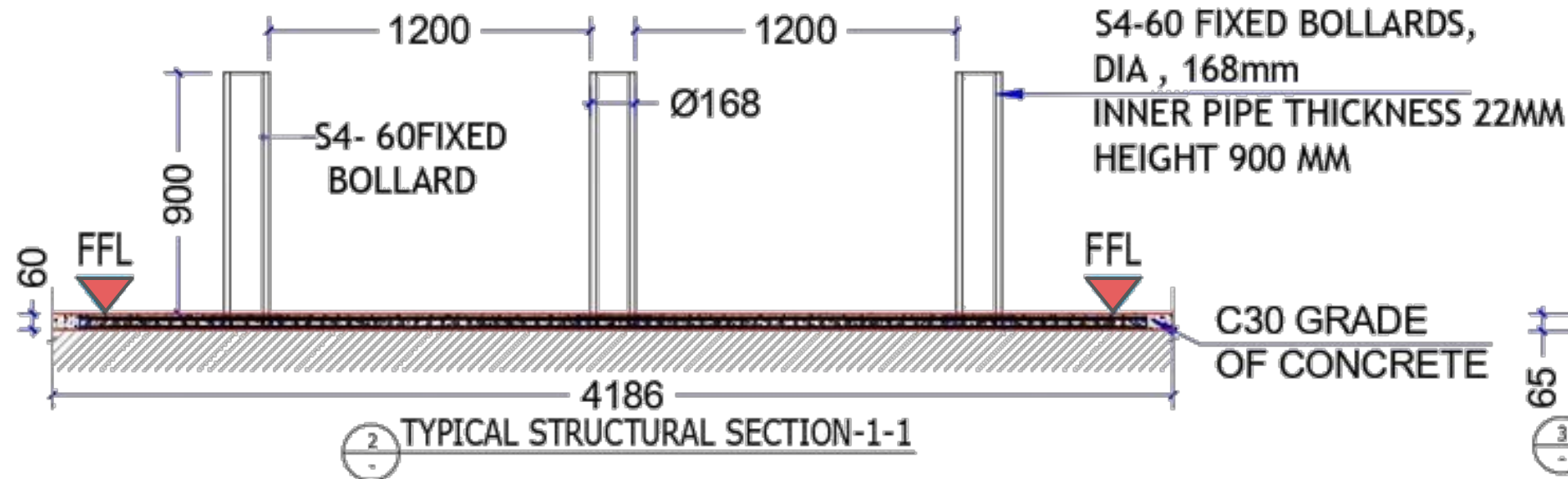
TECHNICAL

# Drawing

FOR SHALLOW FIXED BOLLARD (S4 60)

# S4 - 60 FIXED BOLLARD

**FOR REFERENCE ONLY**



NOTE : ALL DIMENSIONS ARE IN MILLIMETER (MM)

|   |          |                    |      |
|---|----------|--------------------|------|
|   | Name     | Sign               | Date |
|   | Drawn    | Mr. ADL            |      |
|   | Checked  | Mr. Girish         |      |
|   | Approved | Mr. AMITESH KHATTA |      |
| Title: S4-60 FIXED BOLLARD DRAWING (SET OF 02 FIXED BOLLARD)<br>Site: |          |                    |      |

| NO. | DESCRIPTION         | REV. | DATE |
|-----|---------------------|------|------|
| 0   | ISSUED FOR APPROVAL | 00   |      |
| 1   |                     |      |      |
| 2   |                     |      |      |
| 3   |                     |      |      |

Company Name: **SWARAJ SECUTECH PVT LTD**  
 E MAIL : info@swarajsecutech.com  
 WEBSITE : www.swarajsecutech.com  
 PHONE : 2764283181  
 MOBILE : 7874682796  
 ADDRESS : Survey no 1427, Rajpur Jhulasan Road Near Dayton Cooltech, Dharpur, Chokdi, Jhulasan, 382705

REBAR BENDING

# Schedule

FOR SHALLOW FIXED BOLLARD (S4 60)

# REBAR BENDING SCHEDULE

**Project:** Bollard Foundation  
**No:** S4 60(S)/RBS/00  
**Element:** RC Slab (4186 × 1000 × 60 mm)  
**Cover (top):** 5 mm  
**Reinforcement:** All M12 rebar

| Bar Mark | Description                      | Dia (mm) | Shape Code | Length (mm) | No. | Total Length (m) | Unit Wt (kg/m) | Total Wt (kg) |
|----------|----------------------------------|----------|------------|-------------|-----|------------------|----------------|---------------|
| B1       | Transverse Bars (Full Length)    | 12       | 00         | 950         | 18  | 17.10            | 0.888          | 15.2          |
| B2       | Transverse Bars (Reduced Length) | 12       | 00         | 800         | 42  | 33.60            | 0.888          | 29.8          |
| B3       | Transverse Bars (Short Length)   | 12       | 00         | 442         | 9   | 3.98             | 0.888          | 3.5           |
| B4       | Longitudinal Bars                | 12       | 00         | 4000        | 5   | 20.00            | 0.888          | 17.8          |

## Steel Summary

| Dia   | Total Length (m) | Weight (kg) |
|-------|------------------|-------------|
| 12 mm | 74.68            | 66.3        |

## General Notes

- All dimensions are in mm unless stated otherwise
- Reinforcement: M12 bars throughout
- Cutting & bending as per BS 8666
- Bars to be properly fixed before casting
- Reinforcement distribution as per approved drawing

## Engineering Note

Reinforcement is detailed to ensure adequate load distribution and localized strengthening at bollard locations, enhancing structural performance of the foundation system.

STAINLESS STEEL

**Cover**

FOR SHALLOW FIXED BOLLARD (S4 60)

# OPTIONS OF STAINLESS STEEL BOLLARD CAP DESIGN



Flat top with  
sharp edge



Flat top with  
chamfer edge



Slope top



Dome top



Semi dome top 1



Semi dome top 2



Semi dome top 3



Semi dome top 4

# Need to protect a mall glass entrance?

## ebollard can help with:

- Site review
- Bollard layout proposal
- Shallow foundation coordination
- SIRA-related documentation
- Supply and installation
- Method statement and handover documents



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