Ref. 1454/COR

29th September 2022

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To whom it may concern,

IWA 14-1 Impact-tested product design alterations
Protect Dual Core with Bollard

The following report documents the proposed adaptation of the original *Protect Dual Core*, which was successfully tested in accordance with the impact test standard, IWA 14-1 [1] by MIRA Horiba Ltd. on 23rd March 2022. The *Protect Dual Core* was tested in conjunction with the *Tandem Cycle Parking*.

The Protect Core system is proposed to be marketed with a bollard sleeve.

Test Details

The tested Protect Core with Inspira Protect Litter Bin is described below:

MIRA test report reference	1225361-004-021, dated 26/05/2022
Test Standard	IWA 14-1:2013
Test date	23/03/2022
Test reference	A0011
Rating awarded	V/2500[N1G]/48/90:0.0

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Tested Design

The design of the original tested product is described as follows. The tandem cycle parking system incorporates a *Protect Dual Core* impact structure with ground frames and foundation and *Tandem Cycle Parking* stands.

The tested components are shown in the following manufacturing drawings and in Figure 1 and Figure 2 below:

- BSSMAN2605_A – PROTECT DUAL CORE [4] (i*mpact structure)*
- BSSMAN2607_0 – PROTECT TANDEM CYCLE PARKING DUAL-CORE [5]
- BSSMAN2737_A – PROTECT CORE [6]

Protect Dual Core impact structure

The *Protect Dual Core* impact structure consists of two ground frame assemblies cast into a common foundation. The ground frames are identical to the *Protect Core Medium Duty* as described in reference [6], with the exception of a lateral hoop of reinforcing bar surrounding the baseplate. The ground frames are oriented 90° to the single *Protect Core* test installation.

The *Protect Core* comprises a 750x750mmx10mm thick steel base plate. 650x130x10mm half lap gussets are chamfered and welded around the post, to each other and to the base plate, to form the socket. Four lugs are welded to each of two sides of the baseplate, through which 12mm diameter reinforcing bars are threaded.

The impact post is formed from an 100x8 square hollow section (SHS) and 80x8 SHS inner section. The sections are 1010mm long and welded together on two sides at the top and bottom. A 16mm diameter pin is inserted through the base of the post to secure it into the socket. All steel is S355JR grade structural steel. The *Protect Core Dual* posts are filled with concrete from the same mix as the foundation. The height of the impact posts above finished ground level (FGL) is 783mm.

The ground frame assemblies are cast within a concrete foundation measuring 2350x1300x200mm deep atop a compacted MOT type 1 subbase. In the test installation, 80mm of compacted type 1 was used as a mock surface finish levelled with the ground. The total depth of the foundation below FGL is 280mm.

The concrete specification is C32/40 CEM 1 with 10mm aggregate with no additive to promote curing. The final measured cube compressive strength of the concrete was recorded by MIRA but is unknown for this report.

Protect Tandem Cycle Parking

The *Protect Cycle Parking* is a Ø139.7x2 circular hollow section (CHS) stainless steel grade 304 sleeve with two Ø42.4x3.3 stainless steel tubular arms welded opposite one another. The sleeve is secured to the sides of each impact post with 2no. M8x25 button head fixings. The sleeve is 826mm high from FGL, open at the bottom and not buried below the surface finishes or connected to the foundation.

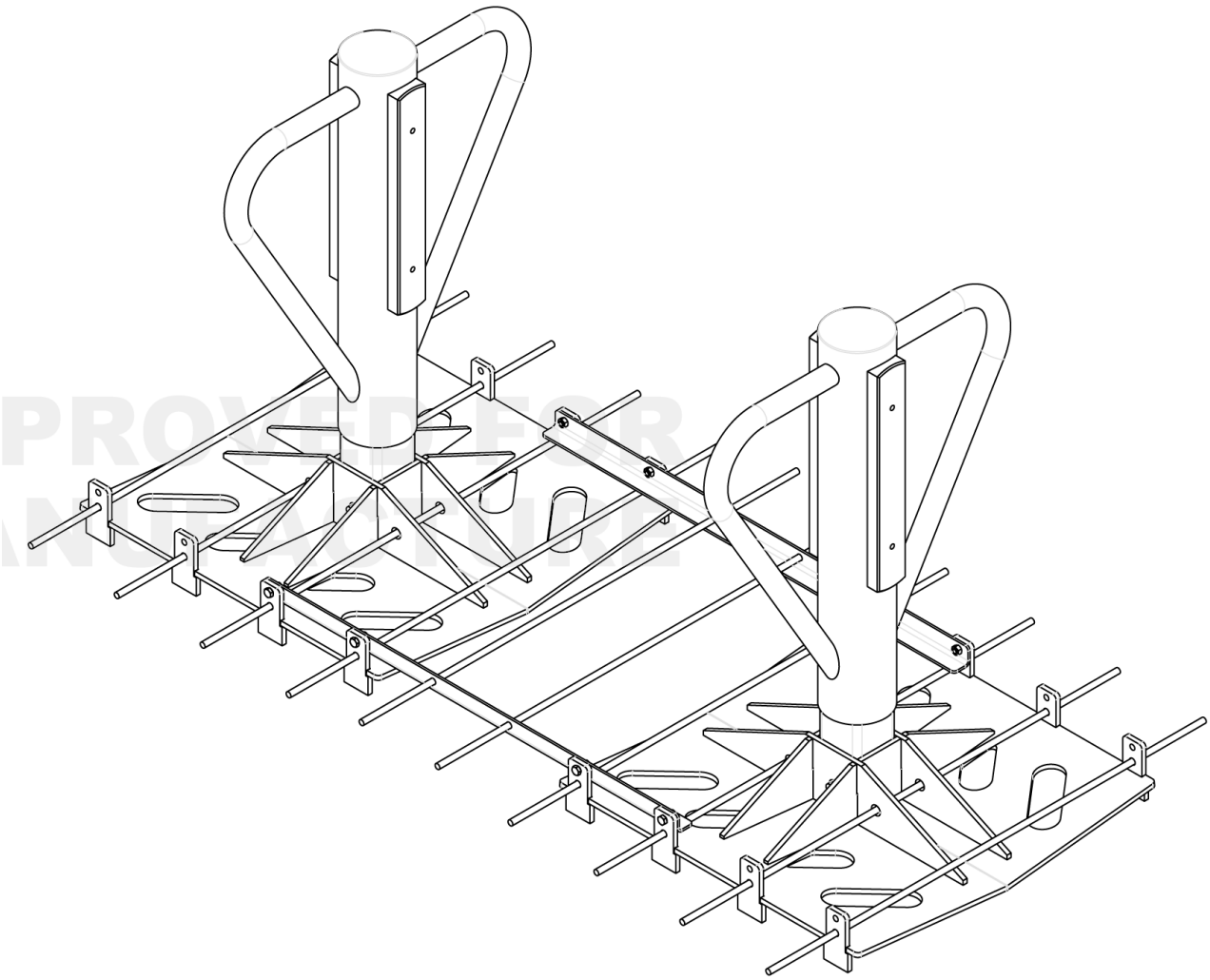

Figure 1: Isometric assembly view of Protect Tandem Cycle Parking with Protect Dual Core, taken from drawing BSSMAN2607_0

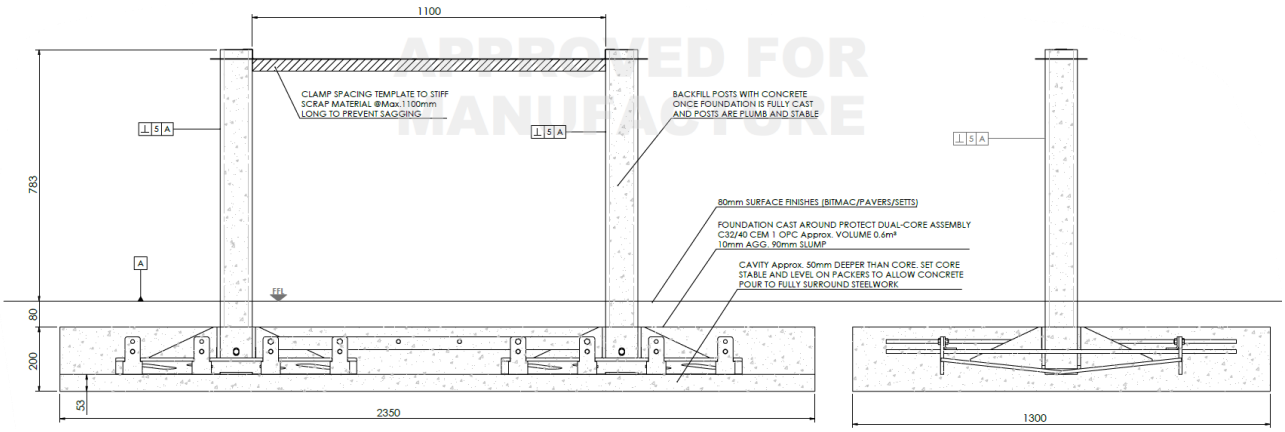

Figure 2: Front and side elevations of the Protect Dual Core, taken from drawing BSSMAN2605_A

Impact Performance

Protect Tandem Cycle Parking Dual-Core

The product was impacted with a 2,500kg N1G class vehicle aimed centrally at the gap between the posts. The cycle stands remained attached to the impact posts but the arms on the impact side were crushed against the posts by the vehicle. The impact posts were bent backwards by some angle, unknown at the time of writing this report.

There was no visible damage observed to the concrete foundation below the surface finishes.

The vehicle was brought to a dead stop by the posts and was immobilised by the impact. Therefore the product was awarded a pass rating with zero penetration in accordance with IWA 14-1 [1].

Proposed Design

Protect Bollard Dual

The bollard consists of a thin-gauge sleeve to be places over the *Protect Core* impact posts. The impact core is coupled with the same dual ground frame as per the tested system.

The bollard sleeve will be offered in two designs shown in the following drawings and Figure 3 below:

- *Flat Top* – BSSGA2891_0 [7]
- *Semi-dome Top* – BSSGA2892_0 [7]

The bollard sleeves are shown as 139.7x2 stainless steel grade 304, but will also be offered in galvanised mild steel, 139.7x3.2.

The bollard sleeves will be lightly secured to the face of the impact post with self-drilling screws positioned within the impact zone (at least 250mm above FGL), covered with Sapele hardwood bumper strips. The bollard will sit 900mm above FGL and finish a few millimetres below the ground finishes. The sleeve is straight-ended; there is no flange or anchorage into the surface finishes or to the foundation.

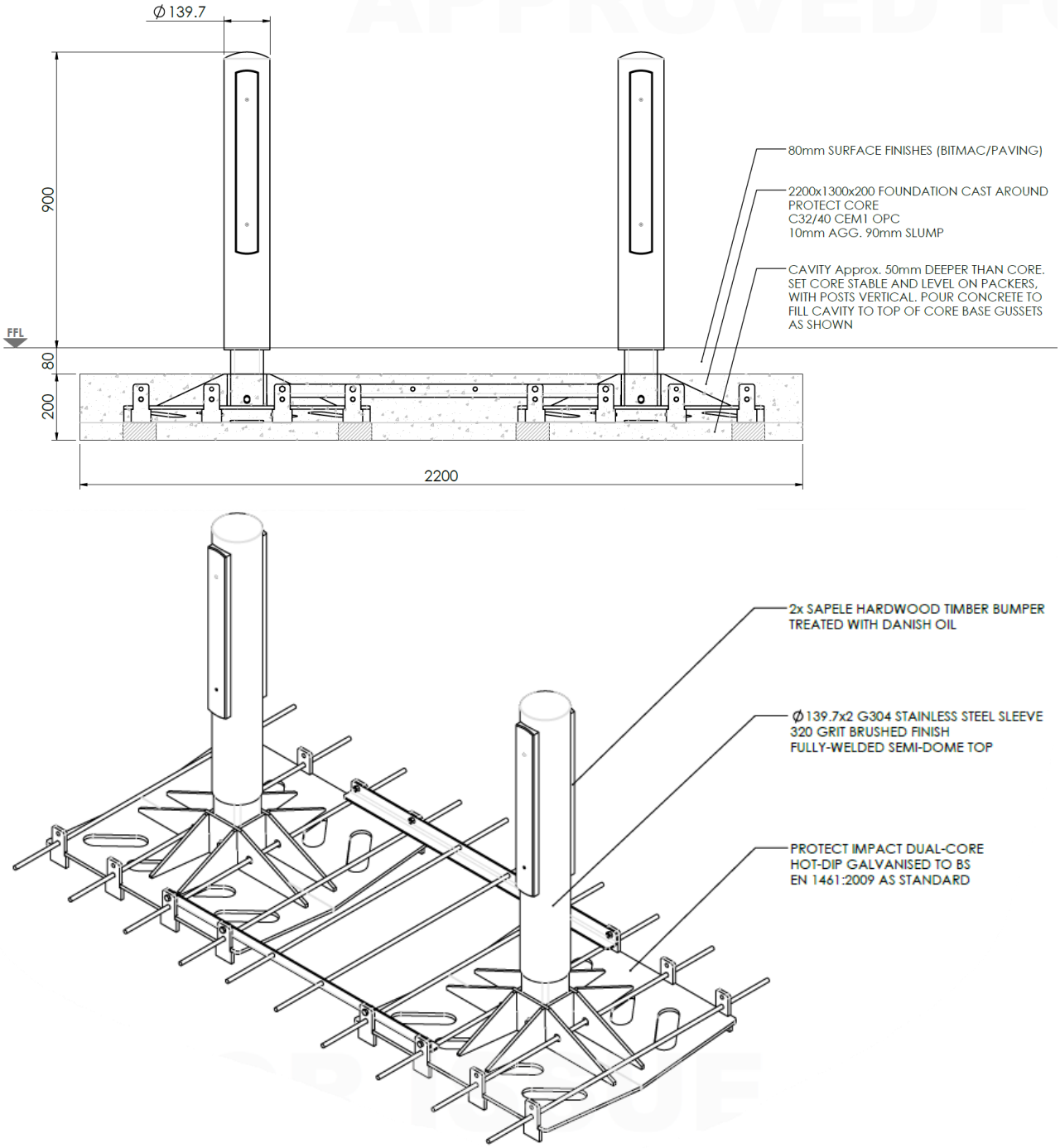

Figure 3: Front elevation and isometric of proposed Protect Bollard design, taken from drawing BSSGA2891_0

Concluding statement – RSES

The impact core, ground frame and foundation of the proposed *Protect Bollard Dual (Flat Top and Semi-Dome Top)* design are identical to the *Protect Dual Core* tested on 23/03/2022 in conjunction with the *Tandem Cycle Parking*. The proposed bollard sleeve design will be offered in both 2mm thick stainless steel or 3.2mm thick galvanised mild steel. The sleeves will have no connection to the surface finishes or foundation and go down to approximately finished ground level.

It is considered that the tubular arms of the tested *Tandem Cycle Parking Dual* system had a negligible effect on the impact performance and consequential rating of the tested system. Therefore the bollard sleeves, which have the same basic form as the cycle parking sleeves, are likely to exhibit the same behaviour and response.

It is noted that the foundation concrete must be specified as per the test condition, using the specified C32/40 grade concrete.

Based on the observations made during the impact test and an assessment of the drawing information provided we accept that the proposed *Protect Bollard* should not compromise the impact resistance of the underlying *Protect Dual Core* impact system. It is noted that the aforementioned impact test was conducted with the vehicle aimed centrally to the system – the gap between two posts. On this basis, we believe the performance and penetration of the proposed *Protect Bollard Flat Top* and *Semi-Dome Top* sleeves, in either stainless steel or mild steel materials, would be similar to that of the *Protect Tandem Cycle Parking Dual Core*, when impacted by a 2,500kg vehicle at 30mph.

The above statement is based upon a desktop study of the impact test results and comparison of the data made available to DGA. This study does not replicate a full, live impact test and the actual performance may differ to the expert opinion of the author.

RSES Member Mark Coates IEng MICE RSES (Principal HVM)

Signed 

Document References

[1] IWA 14-1:2013 – *Vehicle Security Barriers – Part 1: Performance Requirement, vehicle impact test method and performance rating*

[2] HORIBA MIRA Ltd, reference 1223164-004-021 / A0011, *Test Memorandum of Performance – Protect Tandem Cycle Parking Dual Core*, 28/03/2022
File name: HORIBA MIRA Report 1223164 004 028 01 Y0019 Bailey Streetscene Ltd Inspira Protect Litterbin.pdf

[3] HORIBA MIRA Ltd, test report reference 1225361 004 021 01 A0011 *Bailey Street Furniture Protect Tandem Cycle Parking*, 26/05/2022

[4] Bailey Streetscene Ltd drawing reference BSSMAN2605_A, *Protect Dual Core*, revision A, 21/06/2022
File name: BSSMAN2605_A - PROTECT DUAL-CORE.PDF

[5] Bailey Streetscene Ltd drawing reference BSSMAN2607_0, *Protect Tandem Cycle Parking Dual-Core*, 10/02/2022
File name: BSSMAN2607_0 - PROTECT TANDEM CYCLE PARKING DUAL-CORE.PDF

[6] Bailey Streetscene Ltd drawing reference BSSMAN2737_A, *Protect Core Medium Duty 1.5t*, revision A, 01/09/2021
File name: BSSMAN2737_A - PROTECT CORE.PDF

[7] Bailey Streetscene Ltd drawing reference BSSGA2889_0, *Protect Bollard – Flat Top Dual*, 21/06/2022
File name: BSSGA2891_0 - PROTECT BOLLARD_DUAL_FLAT TOP.PDF

[8] Bailey Streetscene Ltd drawing reference : BSSGA2890_0, *Protect Bollard – Semi-Dome Dual*, 21/06/2022
File name: BSSGA2892_0 - PROTECT BOLLARD_DUAL_SEMI-DOME TOP.PDF