

## Technical Specification – Cycle Wands for use as permanent highway infrastructure

### 1 The Specification

- 1.1 Cycle Wands is the term used to describe street furniture compliant with *BS EN 12899-3 Fixed, vertical road traffic signs - Delineator posts and retroreflectors* for use in the segregation of cycle lanes.
- 1.2 The term shall apply to infrastructure installed on the Transport for London Road Network (the TLRN) where Transport for London (TfL) is the designated highway authority and on all remaining highway network where the designated highway authority formally adopts this specification.

### 2 Terms Used

- 2.1 Ground Line – notional horizontal line on the cycle wand post which, when installed correctly, is level with the ground or with the top of the highway infrastructure on which it is installed.
- 2.2 Retroreflector – device, made with technology specified or better, that retroreflects incident light.

### 3 Technical Requirements

#### Cycle Wands Post Type

- 3.1 Cycle Wands shall be cylindrical and shall comply with the requirements of *BS EN 12899-3* and the classes, values and requirements set by this specification.
- 3.2 The Cycle Wands shall be Type D3 as defined in *BS EN 12899-3* – delineator post for ground fixing which are designed to deflect and after the impact test described in Section 5 of this specification, return to an upright position (spring-back or flexible).

#### Cycle Wands Performance Requirements

- 3.3 The Cycle Wands shall present no sharp edges above the ground line.
- 3.4 The Cycle Wands shall be suitable for recycling, creating no un-recyclable waste when decommissioned. This shall be indicated by the appropriate material code and associated labelling.
- 3.5 Where the Cycle Wands are made of recycled material, this shall be indicated by the appropriate material code and associated labelling.

#### Cycle Wands Retroreflector Fixing

- 3.6 Cycle Wands retroreflectors shall be affixed circumferentially to the Cycle Wands Post using an adhesive in accordance with the manufacturer's instructions.
- 3.7 Adhesive properties shall be maintained after weathering tests specified in *BS EN 12899-3* Clause 7.4.1.6 or accelerated ageing in accordance with *BS EN ISO 4892* to replicate 2 years at an incline of 45° facing the equator. Post ageing, the Retroreflector shall achieve 1MPa adhesion to the substrate when tested in accordance with *ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers*.

#### Cycle Wands Post Visual Performance

- 3.8 The daytime visibility of the Cycle Wands (areas without retroreflector) shall be tested in accordance with Clause 7.3.1 of *BS EN 12899-3*, in accordance with the procedures specified in *CIE 15* using Standard Illuminant D65 and CIE 45/0 geometry.
- 3.9 The chromaticity coordinates and luminance of the Cycle Wands Post (areas without

retroreflector) shall be as defined in *BS EN 12899-3* Table 1 for black and *BS EN 13422* Table 3 for red.

#### **Cycle Wands Retroreflector Visual Performance**

- 3.10 The daytime visibility of the Cycle Wands Retroreflectors shall be tested in accordance with Clause 7.3.2.1 of *BS EN 12899-3*, in accordance with the procedures specified in *CIE 15* using Standard Illuminant D65 and CIE 45/0 geometry.
- 3.11 The daylight chromaticity and luminance factor of the Cycle Wands Retroreflector shall be Class CR2 as defined in *BS EN 12899-1* Table 2 for white.
- 3.12 The night-time chromaticity of the Cycle Wands Retroreflectors shall be tested in accordance with Clause 7.3.2.2 of *BS EN 12899-3*, in accordance with the procedure specified in *CIE 54.2* using CIE Standard Illuminant A. Colour functions and calculation methods shall be in accordance with *ISO 11664* (2° visual field).
- 3.13 The corner points of chromaticity regions for retroreflected radiation of the Cycle Wands Retroreflectors shall be as defined in *BS EN 12899-3* Table 2 for white.
- 3.14 The Coefficient of Retroreflection of the Cycle Wands shall be measured in accordance with Clause 7.3.2.3 of *BS EN 12899-3*, in accordance with the procedures in *CIE 54.2*, using CIE Standard Illuminant A and using a photometer head adapted to the relative spectral response of the CIE Standard Photometric Observer.
- 3.15 The minimum initial coefficient of retroreflection  $R_A$  of the retroreflector shall be RA2 as specified in *BS EN 12899-1* Table 4 for white.

#### **Dynamic Impact Resistance of the Cycle Wands**

- 3.16 Cycle Wands Posts shall be tested in accordance with the requirements set in Section 5 of this specification.

#### **Corrosion Resistance of Cycle Wands Posts**

- 3.17 All steel parts used in the Cycle Wands shall be hot dipped galvanised in accordance with *BS EN ISO 1461* or stainless steel in accordance with *BS EN ISO 3506*. Aluminium parts do not require additional protection against corrosion.

#### **Natural Weathering of Cycle Wands Posts**

- 3.18 All properties shall be maintained after weathering tests specified in *BS EN 12899-3* Clause 7.4.1.6 or accelerated ageing in accordance with *BS EN ISO 4892* to replicate 2 years at an incline of 45° facing the equator.

#### **Dynamic Impact Resistance of the Cycle Wands Retroreflectors**

- 3.19 When tested in accordance with *BS EN 12899-3* Clause 7.4.2.2 using a 20mm diameter steel ball dropped from a height of DH2 (a drop height of 400mm), the retroreflector shall show no cracking or delamination outside a 12mm radius centred on the point of impact.

#### **Water Resistance of the Cycle Wands Retroreflectors**

- 3.20 After exposure in accordance with *BS EN 12899-3* Clause 7.4.2.4, the retroreflectors shall have no water or water vapour intake on the optical parts. Water or water vapours into the edges of the retroreflectors shall not be deemed to indicate failure.

#### **Durability of the Cycle Wands Retroreflectors**

- 3.21 The retroreflector shall be exposed for 3 years in accordance with *BS EN ISO 877-2*, Method A

and then be tested in accordance with *BS EN 12899-1* Clause 4.1.1.5.

#### **4 Cycle Wands Fixings**

- 4.1 The Cycle Wands shall have fixings capable of affixing the Cycle Wands to the carriageway at the ground line with no discernible gap between post and the ground line.
- 4.2 The Cycle Wands shall be installed using a male threaded bolt (attached to the underside of the Cycle Wands post) that screws into a female resin anchored cup in the carriageway.
- 4.3 All fixings shall be galvanised steel or stainless steel, treated as specified in Clause 3.17.
- 4.4 The bottom of the Cycle Wands Post shall have a male threaded M24 bolt, 30mm in length attached to a larger sealing insert section 20mm in length as shown in Appendix 1.
- 4.5 The top of the insert section of the Cycle Wand Post shall be at ground line and shall be provided with a seal to ensure water and salt do not come into contact with metal parts.
- 4.6 The Cycle Wands Post shall be installed by screwing into a female threaded capped cup which shall be cored in situ in the carriageway 70mm deep using a 52mm core bit, and resin anchored into ground as shown in Appendix 1.
- 4.7 The resin shall be left to cure in accordance with the manufacturer's guidance before the Cycle Wand Post is installed.
- 4.8 The Cycle Wands Post shall be installed to a torque of between 30Nm and 35Nm. The cup shall remain fixed in place throughout the installation.
- 4.9 Installation of the Cycle Wands Post to the minimum torque specified in Clause 4.8 shall be achievable by a single operative using a single tool.

#### **Cycle Wands Screw Cap**

- 4.10 A plastic screw cap shall be available to seal the anchor cup from water and debris in the event that the Cycle Wands Post is temporarily removed from the carriageway.
- 4.11 The screw cap shall be as shown in Appendix 1 and align with Clauses 4.4 and 4.5. This shall be removable with a flat head screwdriver.

#### **5 Additional Test Requirements**

- 5.1 This section presents additional specific test methods required in addition to those described in the standard prescribed above. Cycle Wands shall be tested in accordance with this section.

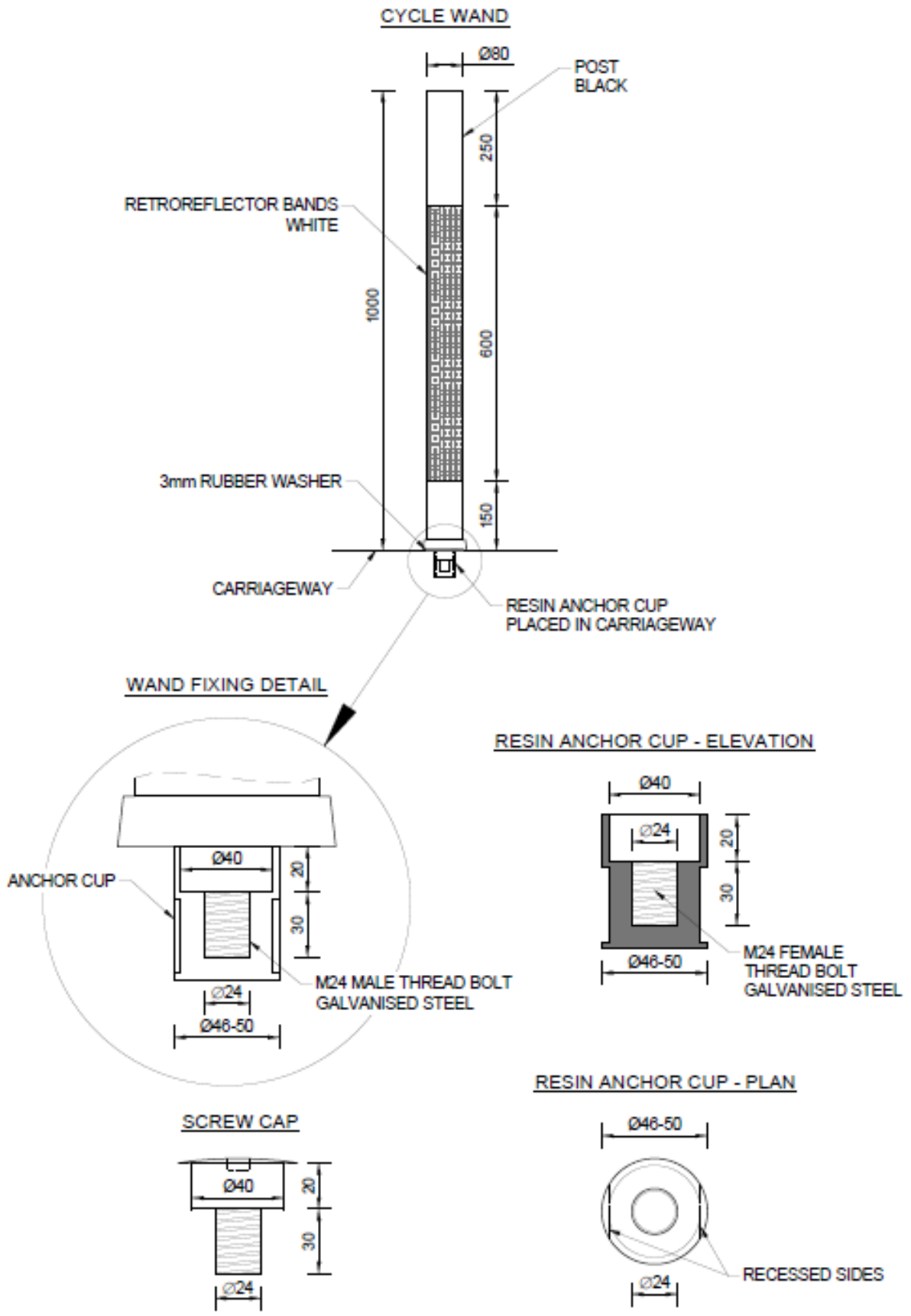
#### **Dynamic Impact Resistance Test for Cycle Wands**

- 5.2 The Cycle Wands shall be aged as specified in Clause 3.19.
- 5.3 Post-ageing, the Cycle Wands shall be installed in an asphalt pavement using fixings that comply with Section 4.
- 5.4 The Cycle Wands shall be dynamically loaded for 100 cycles using a vehicle no less than 5,000kg at 10mph, where one cycle is the vehicle driving forwards over the Cycle Wand and then reversing over the Cycle Wand along the same axis to finish in the starting position as shown in Appendix 2. All cycles shall be wheel-over impacts. The Cycle Wands shall be able to bend to ground level and return to an upright position each time. Measurement of the deflection shall be undertaken 24 hours after the dynamic test. The Cycle Wands Post shall not be damaged or have a permanent deflection exceeding 5% of the height above the ground line or 5° from true vertical.
- 5.5 The Cycle Wands shall also be tested for direct wheel-over impact. The Cycle Wands shall be impacted 5 times at 30mph using a vehicle no less than 5,000kg. Measurement of the deflection

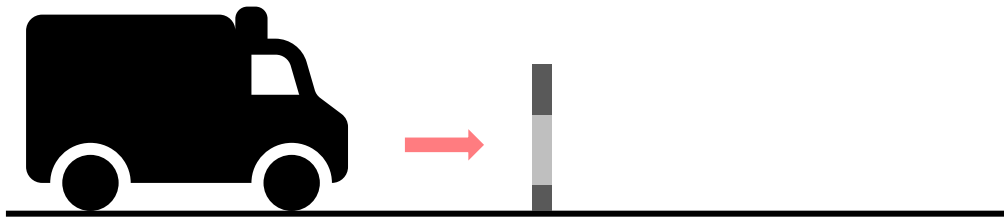
shall be carried out 24 hours after the impact test. The Cycle Wands fixings shall remain in-situ and the Cycle Wands Post shall not be damaged or have a permanent deflection exceeding 5% of the height above the ground line or 5° from the true vertical.

- 5.6 The tests do not have to be carried out in succession and different Cycle Wands may be used for the tests described in 5.4 and 5.5 above.
- 5.7 Damaged Cycle Wands shall be cracked and/or deformed. Surface scuffing is expected due to the forces exerted on the Cycle Wands in the tests.
- 5.8 Test results shall be supplied in accordance with Appendix 3.

**APPENDIX 1: Standard Detail for Cycle Wands**



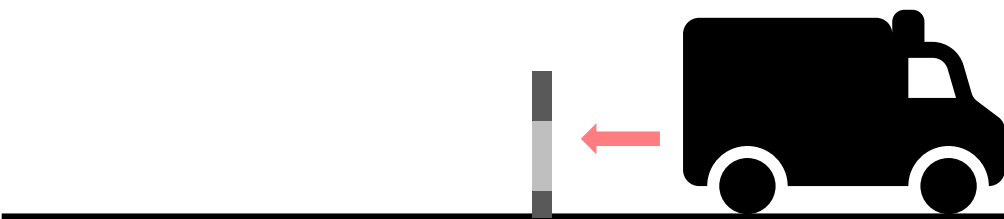
**APPENDIX 2: Dynamic impact resistance testing description for Cycle Wands**



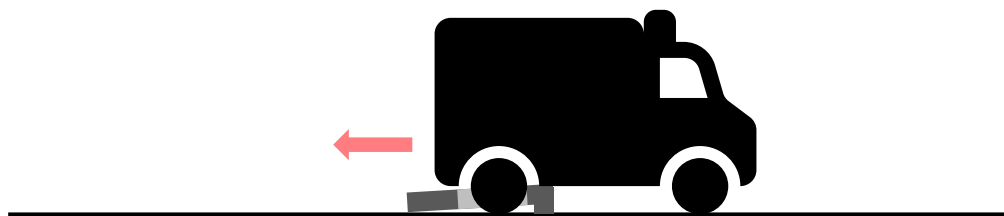
Step 1: Starting position



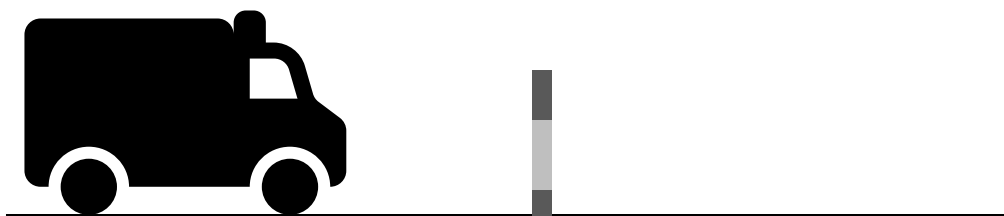
Step 2: Drive forwards over Cycle Wand



Step 3: Stop after fully clearing Cycle Wand



Step 4: Reverse over the Cycle Wand along same axis



Step 5: Finish in starting position (after fully clearing Cycle Wand) for one cycle

**APPENDIX 3: Dynamic Impact Resistance Test Submission Form**

Product Details			
<b>Assessor Name:</b>		<b>Test Date:</b>	
<b>Company Name:</b>			
<b>Product Name:</b>			
Test Results			
<b>Video Link 1:</b>	<i>Insert link(s) to video in .mp4 format. Video must show a side view of test from outside the vehicle. Video must be time stamped, uninterrupted and show entire test, including installation, testing, and removal of Cycle Wand.</i>		
<b>Video Link 2:</b>	<i>Insert link to video in .mp4 format. Video must show front-facing view of vehicle windshield/dashboard with speedometer reading fully visible.</i>		
<b>Image(s):</b>	<i>Insert image(s) below showing measurement of deflection following test.</i>		