

**Traffic Systems
and Signing**

**TR 2182
Issue B
March 2002**

Specification for Kerbside Pedestrian Detection Systems

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First published 2000

Printed and published by the Highways Agency



 **HIGHWAYS**
AGENCY

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REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of Incorporation of Amendments	Amend No	Page No	Signature & Date of Incorporation of Amendments

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TR 2182B**SPECIFICATION FOR KERBSIDE
PEDESTRIAN DETECTION SYSTEMS****Contents****Chapter**

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1 INTRODUCTION

General

1.1 This specification supersedes TR 2182A from the date of issue.

1.2 The Traffic Signs Regulations and General Directions (TSRGD) provides legislation for the conveyance of instructions to the road user by the use of traffic signals in the UK, apart from Northern Ireland which is covered by "Traffic Signs Regulations (Northern Ireland) 1997".

1.3 The TSRGD also specifies the requirement for Statutory Type Approval for traffic signal control equipment (Chapter 2 Regulations). For ease of reference this will be referred to as 'Approval' throughout this specification.

1.4 All equipment supplied to this specification shall comply, where appropriate and where relevant to the detector technology used, with all the relevant statutory requirements and specifications.

1.5 All microwave equipment approved to this specification shall meet the Department of Trade and Industry (DTI) Radio Communication Agency Performance Specification MPT 1349 (Specification entitled Transmitters and Receivers for the use in the Microwave Band allocated to low power devices), or equivalent Euro norm.

1.6 The equipment defined in this specification is intended for use in connection with traffic signal control equipment. Its purpose is to detect the presence of people (See Chapter 8 Glossary) waiting on the footway, at the kerbside with the intention of using the crossing. The detection system may comprise more than one sensor.

1.7 Once a demand for the pedestrian phase has been registered using the push button, the traffic signal controller checks the output of kerbside detection system to confirm the presence of pedestrians until the pedestrian stage appears. If the detection area becomes unoccupied for more than a preset period, the call will be cancelled and the pedestrian phase will not appear.

1.8 The detection equipment specified in this document is a crucial part of crossings which is defined in the Zebra, Pelican and Puffin Pedestrian Crossing Regulations and General Directions 1997.

1.9 Advice on the provision of above detection equipment is given in the Traffic Advisory Leaflets issued by Department of Transport Local Government & Regions (DTLR).

Scope

1.10 This specification details the functional requirements for detection systems designed to detect people waiting to cross at any authorised, nearside signalled, pedestrian crossing facility.

1.11 The specification outlines the minimum requirements for zones of detection, target size, reliability of operation, output conditions required to interface with the signal controller, functional testing requirements and the Regulations and Standards that must be met by the design authority of the equipment.

1.12 This specification details the functional, constructional, environmental and Electromagnetic Compatibility (EMC) requirements applicable to the detection equipment.

Implementation

1.13 This specification shall be implemented from the date of issue. All new Approvals will be conducted against this specification from that date.

1.14 Existing Approvals issued against TR 2182A will remain valid.

1.15 Any comments or enquiries relating to this document should be addressed to:

Highways Agency
Traffic Control Systems and Lighting Team
c/o Plans Registry
Temple Quay House
2 The Square
Temple Quay
Bristol
BS1 6HA

Email: tss_plans_registry@highways.gsi.gov.uk

2 REGULATIONS

2.1 The product shall comply with all relevant statutes in force at the time of supply, and particular attention is drawn to those implementing European Directives.

2.2 Any requirement of the specification for goods or materials must be made in accordance with the general introduction and clauses 104 and 105 of Volume 1 of the Specification for Highways Works.

Approval

2.3 Equipment manufactured to this Standard will require to be Statutory Type Approved (hereafter referred to as Approval) before it may be operated on public roads within the United Kingdom.

Procedures for Statutory Type Approval

2.4 Details of the Approval procedure may be found in Highways Agency standard TRG 0500.

2.5 TRG 0500 details the relationship between the UK Approval and EC Standards Certification.

2.6 Any anomalies or interpretation of requirements of this standard must be resolved with the Approval Authority.

Applications for Approval

Applications for Approval of equipment or any queries regarding such Approval should be addressed to:

Traffic Systems and Signing Division
Highways Agency
Temple Quay House
2, The Square
Temple Quay
Bristol
BS1 6HA
England

Authorisation

2.7 In the UK, apart from Northern Ireland, any symbols to be displayed on a signal or sign that are not prescribed in the TSR&GD are authorised by the Department for Transport, Local Government and the Regions (DTLR). In Northern Ireland a similar function is performed by the Department for Regional Development.

3 FUNCTIONAL REQUIREMENTS

General

3.1 The function of the detection system is to respond to people who are waiting at the kerbside and intending to cross the carriageway.

3.2 The detection system shall cover zones as required by Figure 3.1, which shows a typical rectangular zone. If detection zones which are other than rectangular are required, then prior agreement of the dimensions of the may detect zone shall be made with the Approval Authority.

3.3 For the purpose of this specification a minimum sized pedestrian is defined as having a height greater than or equal to 1 metre, width 0.5 metres, depth 0.2 metres, mass of 20Kg and with the form and dynamic properties of a walking average five year old child.

3.4 The requirements of 3.3 must include a person seated in a wheelchair or pushchair.

3.5 For the purpose of this specification a maximum sized pedestrian has a height of at least 2.0 metres, width of 0.75 metres, depth of 0.35 metres, mass of 80Kg and with the form of a walking adult.

3.6 The detection system shall respond correctly to both cyclists and pedestrians dressed in a worst case condition relevant to the detector technology used and in a manner appropriate to the normal range of UK weather, including fog, heavy rain and snow at all times of day or night.

Detection Zones

3.7 Tolerances of detection zones have been allowed for by the inclusion of a 'may detect zone' as shown in Figure 3.1.

Must Detect Zone

3.8 The dimensions of the 'Must Detect Zone' shall be detailed in the manufacturers product performance specification.

3.9 Detection tolerances have been allowed for by the inclusion of a 'May Detect Zone' (Figure 3.1).

3.10 A continuous detect condition output, from the detection system, shall be maintained when a minimum sized pedestrian is either stationary or moving within the 'must detect' zone.

3.11 The detector system shall provide the detect condition within 0.5 seconds of a minimum sized pedestrian (3.3) entering the 'must detect' zone.

Presence time

3.12 Four different square locations shall be selected at random from the test grid in the Must Detect zone. A minimum sized pedestrian shall be arranged to move onto one of these locations from outside the test zones and remain stationary for a minimum of 2 minutes before leaving the test zone. The detection system shall give a continuous detect output condition while the minimum sized pedestrian is present in the test zone.

3.13 Repeat this test for the three other locations.

3.14 When a maximum sized pedestrian (3.5) exits the zone of detection the detection system output shall return to the no detect condition within 0.5 seconds.

3.15 The timing in 3.14 may be extended to 2.0 seconds with the prior agreement of the Agency.

3.16 The requirements of 3.14 must include a person seated in a wheelchair.

May Detect Zone

3.17 The detection system may produce either a Detect or No Detect condition in this zone.

Must Not Detect Zone

3.18 The detection system shall provide a 'no detect condition' to a maximum sized pedestrians, in the 'must not detect' zone.

Output Conditions

3.19 The output from the detection system shall be either an open or a closed circuit which is DC isolated from its earth and power supplies. If a polarity sensitive solid state output is used, then internal protection against a reverse voltage shall be provided.

3.20 In the No detect condition, the output shall be a low resistance state in which the output shall continuously present a resistance of not greater than 50 ohms. Reasonable precautions shall be taken to protect the output against sustained voltage or current fault conditions.

3.21 In the detect condition, the output shall be a high resistance. This shall continuously present a resistance of at least 100 Kohms. The output must be able to withstand 50 volts DC across it continuously.

Visual Indicator

3.22 An indicator, visible from the footway, shall be provided to show the detect condition. This is to enable the operation of the detector system to be verified.

Self Test Facility

(Surface mounted systems only)

3.23 The detection system test facility shall be enabled when a test pulse with the following characteristics is received from the signal controller:

Voltage.....+ 3.5V to 27.0Vd.c.

Duration 500ms ± 50mS

Period.....1 to 3 minutes

Minimum source current..... 10mA ± 0.5mA

Line potential (No pulse)..... <0.75V

3.24 During the period of no pedestrian demand, a test pulse, generated by the traffic signal controller, is sent to the surface mounted detector interface. On receipt of this pulse, the surface mounted detection system interface shall poll each sensor to verify as far as possible, the operational status of the system.

3.25 If the operational status of the detection system is satisfactory then the output shall be set to the detect condition within 50ms for a period of 350 to 500ms.

3.26 If the status is unsatisfactory, or inconclusive, then the output shall not change, but remain in the no detect condition, in response to the test pulse.

NOTE: The traffic signal controller monitors the response to the test pulse and will take action accordingly.

Failure Conditions

3.27 An interruption of the power supply to the detection system, or any sensor, shall after an interval not exceeding ten seconds, automatically produce a detect condition.

3.28 The equipment shall regain its operational performance, as required by this specification, within 10 seconds of restoration of the power supply.

Mutual Interference

(Above ground systems only)

3.29 The detection system shall not affect, or be affected by, the operation of another similar equipment when correctly mounted and operated in the following positions:

- i) back to back with the housings 25 ± 10mm apart;
- ii) at right angles with the backs of the housings 25 ± 10mm apart;
- iii) face to face 8m apart;
- iv) side by side 10m apart, facing the same direction.

Functional Testing

3.30 The objective of the functional testing is to prove compliance with Functional Requirements of this specification.

3.31 Compliance with the performance requirements will require evidence of the target(s) used. (See 3.3 to 3.6).

3.32 Test conditions shall represent the worst case conditions for the technology used, see 3.6. The manufacturer shall provide evidence to support this worst case requirement.

3.33 The test area shall extend beyond the ‘may detect’ zone to provide a must not detect zone. This should be at least 1 metre wide and should surround the entire ‘may detect’ zone.

3.34 The test area shall be arranged into 0.5 x 0.2 metre strips along the width and length of the area.

3.35 The strips forming the width shall be lettered and the strips forming the length of the test area shall be numbered. (See A1 and A2).

3.36 Test grid areas shall be completed to indicate either by a tick or a cross, the detect or no detect conditions (see 3.20 and 3.21) for targets in each square as required by:

Pedestrian(s) and Cyclist(s)(3.6)

Min. sized Pedestrian (3.3)

Max. sized pedestrian..... (3.5)

3.37 Video evidence shall be provided to support the activity of 3.36. The video image must include a visual indicator to show the detect condition.

Above Ground Detectors

3.38 The test zones shown in A1 and A2 shall be used.

Surface Mounted Detectors

3.39 The test zones shown in Appendix B shall be used.

3.40 The test area shall be representative of typical paving and, if relevant, road surface material.

3.41 For each occupancy test of 3.10, the pedestrian target shall remain in each complete 0.2 x 0.4 metre test area, for a minimum of 5 seconds.

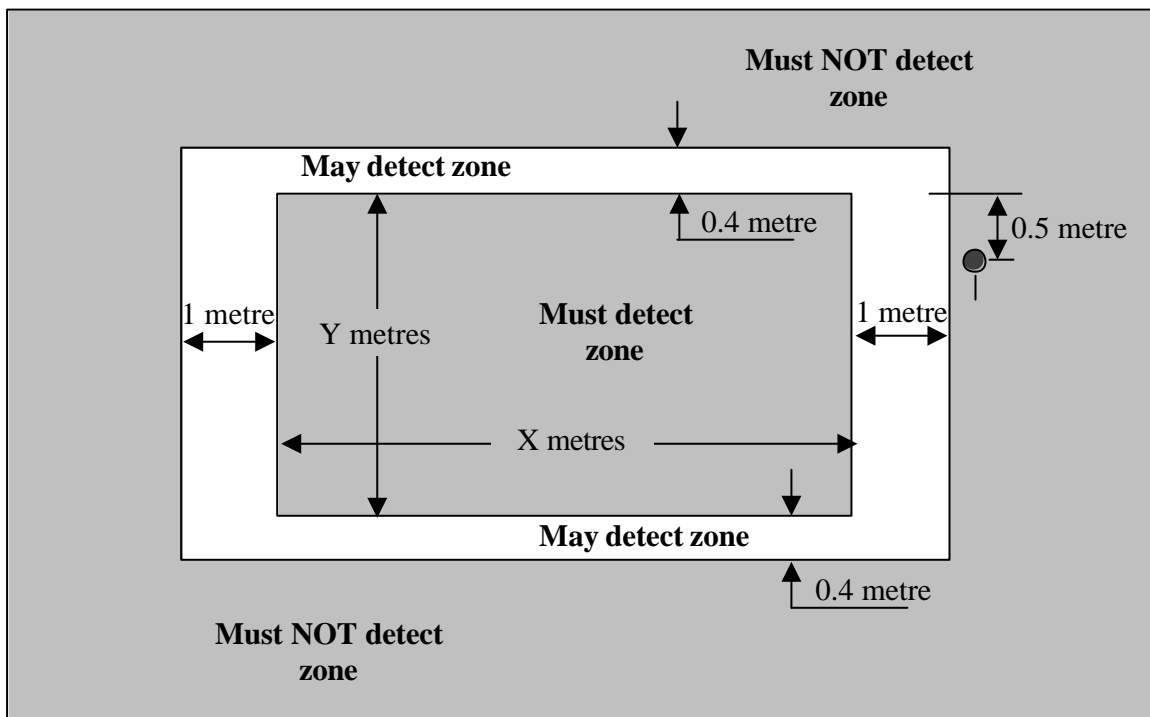
3.42 For Approval, a test schedule and supporting results will be required to prove compliance with 3.10 to 3.18 inclusive.

Impact Test

3.43 The surface mounted detection system, and its installation technique, must ensure that the detect condition is not produced in response to an impact.

3.44 A 10 Kg load shall be dropped freely from a height of 1 metre onto areas of 0.1 x 0.1 metres forming a strip immediately surrounding the outside of the ‘may detect’ zone.

3.45 The detection system shall not respond and remain in the no detect condition during the complete test as defined in 3.44.



- Above Ground Detector mounting pole position
- X & Y - These dimensions are declared by the supplier

Figure 3.1

Kerbside Zone of Detection

NOTE: The detection system shall be so designed that the line of the kerb corresponds to the 0.4 metre wide May Detect Zone which is closest to the mounting pole position.

4 SAFETY AND RELIABILITY

Safety

4.1 Where a supplier produces different detectors in housings of a similar appearance, due care shall be taken to clearly identify the detectors.

4.2 The detection system shall incorporate sufficient processing to maintain performance in adverse conditions.

Reliability

4.3 The vehicle detection system shall have a MTBF (Mean Time Between Failure) prediction figure of greater than or equal to 20,000 hours in continuous operation.

4.4 The detector shall perform as defined by this specification with a confidence limit of not less than 90% for not less than:

- A period of five years after delivery to the purchaser, or:
- The number of operations corresponding to 10,000,000 vehicles having been detected.

4.5 The data contained in MIL-HDBK 217 shall be used (where applicable) for reliability prediction.

5 ELECTRICAL REQUIREMENTS

5.1 If the detectors are fitted with plugs, then they shall be a Bulgin Buccaneer type plug, Series PX0728/P 9 Pole (or equivalent) with connection designations as in Table 5.1:

Contact	Circuit	Core Colour
Pin 1	24v	Red
Pin 2	24v	Black
Pin 3	Earth/screen	Green/screen
Pin 4	Common	White
Pin 5	Output	Yellow
Pin 6	Spare	Blue
Pin 7	Spare	Violet
Pin 8	Spare	Orange
Pin 9	Spare	Pink/brown

Table 5.1

Bulgin Plug Pin Designations

NOTE: In the power on, no detect condition the output (Pin 5) is Closed circuit with respect to Common (Pin 4). In the detect condition the output changes to open circuit with respect to Common, see 3.19 to 3.21.

5.2 Alternatively, the detector may be supplied with a flying lead made of cable generally in accordance with Def-Stan 61-12 (Part 4) 7/0.2mm PVC insulated, overall braid screened, PVC sheathed (code 7/2/10C or equivalent). The terminated cable shall have a minimum length of 1 metre and the same colour designations as in Table 5.1.

Power Supply

5.3 Detection systems designed to operate to the requirements of this specification, shall require a nominal 24 volt \pm 20% supply either AC (RMS, 50Hz) or DC.

Earthing

5.4 Fixed non-current carrying metal parts of detection systems shall be bonded together and connected to earth. All electrical connections shall comply with the relevant sections of BS 7671 Regulations for Electrical Installations.

6 ENVIRONMENTAL AND EMC PERFORMANCE

6.1 The detector housings shall be designed to at least meet a BS EN 60529 IP rating of IP 56.

Environmental Testing

6.2 The detection equipment shall meet the environmental tests criteria defined in BS 7987:2001 (Harmonisation Document HD 638 S1) in agreement with the Approval authority for:

- i) Dry Heat – Class AB3 (+60° C).
- ii) Cold – Class AE2 (-15° C).
- iii) Damp Heat – Class AK2 (2 cycles).
- iv) Water Penetration – as required for IP56.
- v) Random Vibration – Class AJ2 – (2 hours in each of the 3 axes).

NOTE: The Dry Heat and Cold tests may be replaced by the Change of Temperature Test.

EMC Requirements

6.3 The equipment shall be designed to avoid the production of undue electromagnetic interference and to have immunity from external electromagnetic interference.

6.4 Proof of conformity shall be demonstrated by compliance with BS EN 50293.

7 CONSTRUCTION

General

7.1 The detector shall be constructed of materials that will withstand the rigours of the environment in which it is intended to operate. Proof of compliance shall be by testing to the requirements detailed in Chapter 6 Environmental and EMC Performance.

7.2 Detectors and detection equipment shall be contained within housings that meet the EMC requirements of Chapter 6 Environmental and EMC Performance.

7.3 The housings of 7.2 shall be designed to have a minimum service life of 10 years, with appropriate maintenance.

7.4 Sensors shall be tamper proof when installed. Fixings shall be designed so that the sensor maintains alignment under all weather conditions.

7.5 Equipment housings shall be coloured grey, black, brown, dark green or dark blue in accordance with the Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997.

Above Ground Sensors

7.6 The housing shall be supplied with a fixing bracket as detailed below, which will permit a detector to be accurately aligned to satisfy the performance requirements.

7.7 The bracket shall be supplied with a locking arrangement capable of maintaining the alignment of a detector and should be designed to resist vandalism.

7.8 The manufacturer shall supply alignment procedures to permit maintenance staff to verify detector alignment on site.

7.9 Three M6 x 10 mm tapped holes or M6 studs of length 15 to 30 mm, with fixing bolts or nuts, and shake proof washers shall be provided for fixing the housing, as shown in Figure 7.1.

7.10 Other mounting arrangements may be acceptable with prior agreement.

Surface Mounted Sensors

7.11 The surface and appearance of the sensor(s) shall be compatible with tactile paving as required by Disability Unit Circular 1/91.

7.12 The basic sensor module shall be 0.4 metres square.

7.13 The installation method shall ensure that the detection system will operate reliably in the intended environment.

7.14 The manufacturer shall specify the base construction required for the consistent operation of the sensor and the proposed fixing technique. All brackets, bolts or other fixing components shall be supplied.

7.15 The manufacture of the sensors shall take into consideration the load patterns of pedestrians, wheelchairs, cycles and pushchairs.

Connections

7.16 Connection requirements to the detectors are defined in Chapter 5 Electrical Requirements.

7.17 All connections shall be clearly identified.

Marking and Labelling

7.18 The title, supply voltage and serial number of the equipment shall be clearly marked on the external surface of its housing.

7.19 All marks and labelling shall be in English or internationally agreed symbols.

7.20 All internal and external controls such as switches and electrical sockets, which are externally accessed, shall be clearly identified.

7.21 Markings shall maintain legibility throughout the life of the equipment in the specified environmental condition.

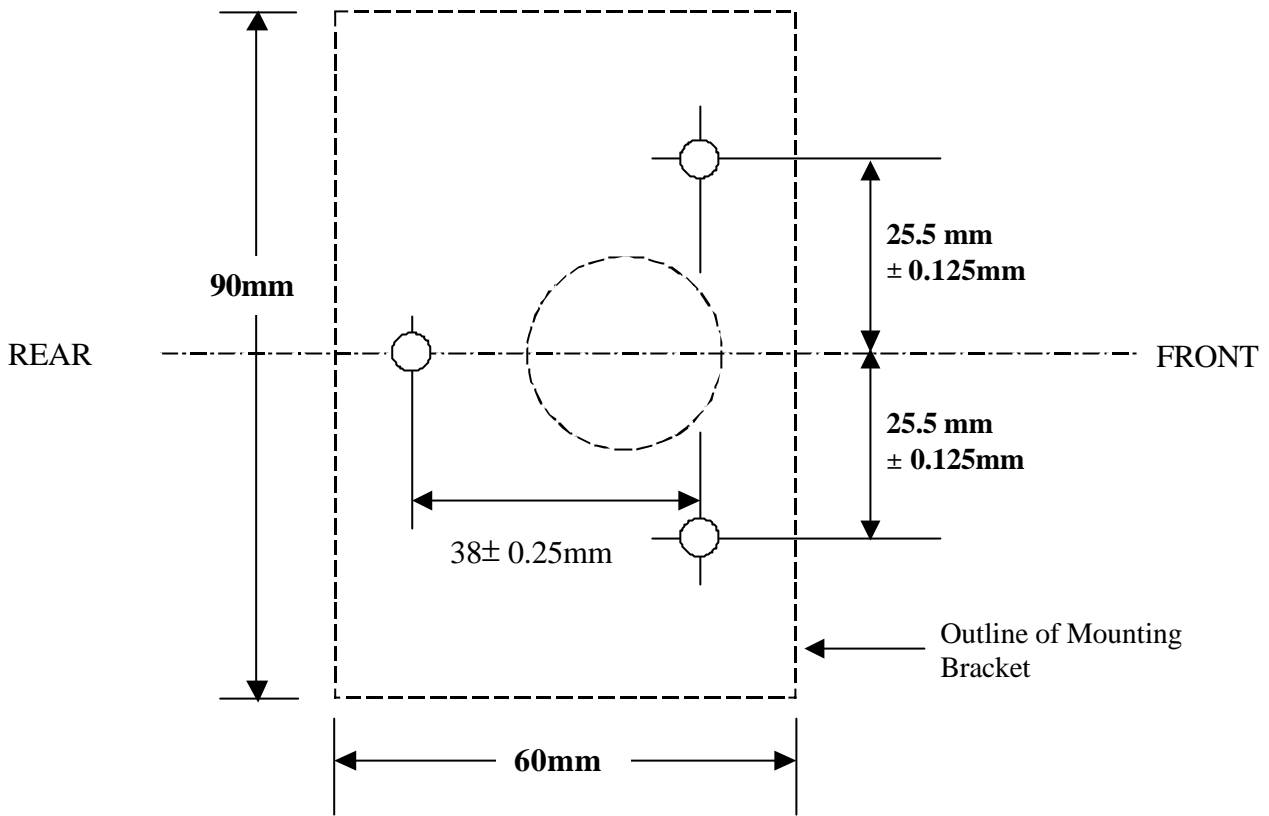


Figure 7.1
Pole mounting Arrangement for above Ground Detector Showing Fixing Stud
(or Bolt) Locations on Base of Detector

8 GLOSSARY

Definitions

For the purpose of this specification the following definitions shall apply.

Detect Condition: The state when people are sensed.

Detection System: A system consisting of a detector or a number of detection sensors, configured to provide a single output.

Detection Zone: The area within which a person is detected by the detection system.

Equipment Supplier: The design authority and/or provider of the detection system.

No detect condition: When no people are sensed.

Cyclist: A person riding a bicycle or sitting on a stationary bicycle.

People or Person waiting to cross: Any authorised user of the crossing implied in this specification. (e.g. pedestrian, cyclist, equestrian etc.)

Equestrian Crossing: A parallel signalled crossing facility designed for both pedestrians and riders on horseback.

Puffin Crossing (Pedestrian User-Friendly Intelligent): A pedestrian signalled crossing that uses a nearside pedestrian signal and pedestrian detection to optimise signal timings.

Detector or Sensor: Device giving a signal for detection or measurement of a physical property to which it responds.

Signal Controller: An electric equipment designed to control pedestrian and vehicular signals and their sequences.

Toucan Crossing: A signalled crossing designed for both pedestrians and cyclists using nearside signals and pedestrian detection to optimise signal timings.

Target: A person or dynamically equivalent object used for the purpose of testing.

Vehicles: Motor vehicles designed for use on the public highway

Abbreviations

For the purpose of this specification the following abbreviations shall apply.

DTI Department of Trade & Industry

DTLR Department of Transport Local Government & Regions

EMC Electromagnetic Compatibility

MTBF Mean Time Between Failures

TSRGD Traffic Signs Regulations and General Directions

9 REFERENCES

9.1 This specification incorporates by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in the text and the publications listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to apply.

British Standards

9.2 British Standards are published by the British Standards Institution, London.

Contact: +44 (0) 1344 404 429

BS 7671	Requirements for Electrical Installations
BS 7987:2001	Road Traffic Signal Systems
BS EN 50293	Electromagnetic Compatibility Road Traffic Signal Systems Product Standard
BS EN 60529	Specification for Degrees of Protection Provided by Enclosures (IP Code)

Specifications

9.3 Specifications are published by the Highways Agency.

Contact: +44 (0) 117 372 8300

tss_plans_registry@highways.gsi.gov.uk

TRG 0500	Statutory Approval of Equipment for the Control of Vehicular and Pedestrian Traffic on Roads other than Motorways.
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Other Publications

	Traffic Signs Regulations and General Directions
	The Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997
	Volume 1 Specification for Highways Works
	Disability Unit Circular 1/91
Def Stan 61-12	Wires, Cords, and Cables, Electrical - Metric Units Part 4: Cables, Special Purpose, Electrical (Sub-Miniature Electric Cables)
Directive 89/336/EEC	EMC Regulations 1992, (Statutory Instrument 1992 No 2372)
MIL. HDBK 217	Reliability Prediction of Electronic Equipment
MPT 1349	Transmitters and Receivers for the use in the Microwave Band Allocated to Low Power Devices (DTI Specification)

10 HISTORY

Approval of this document for publication is given by the undersigned:

Issue A January 1997

Issue B March 2002

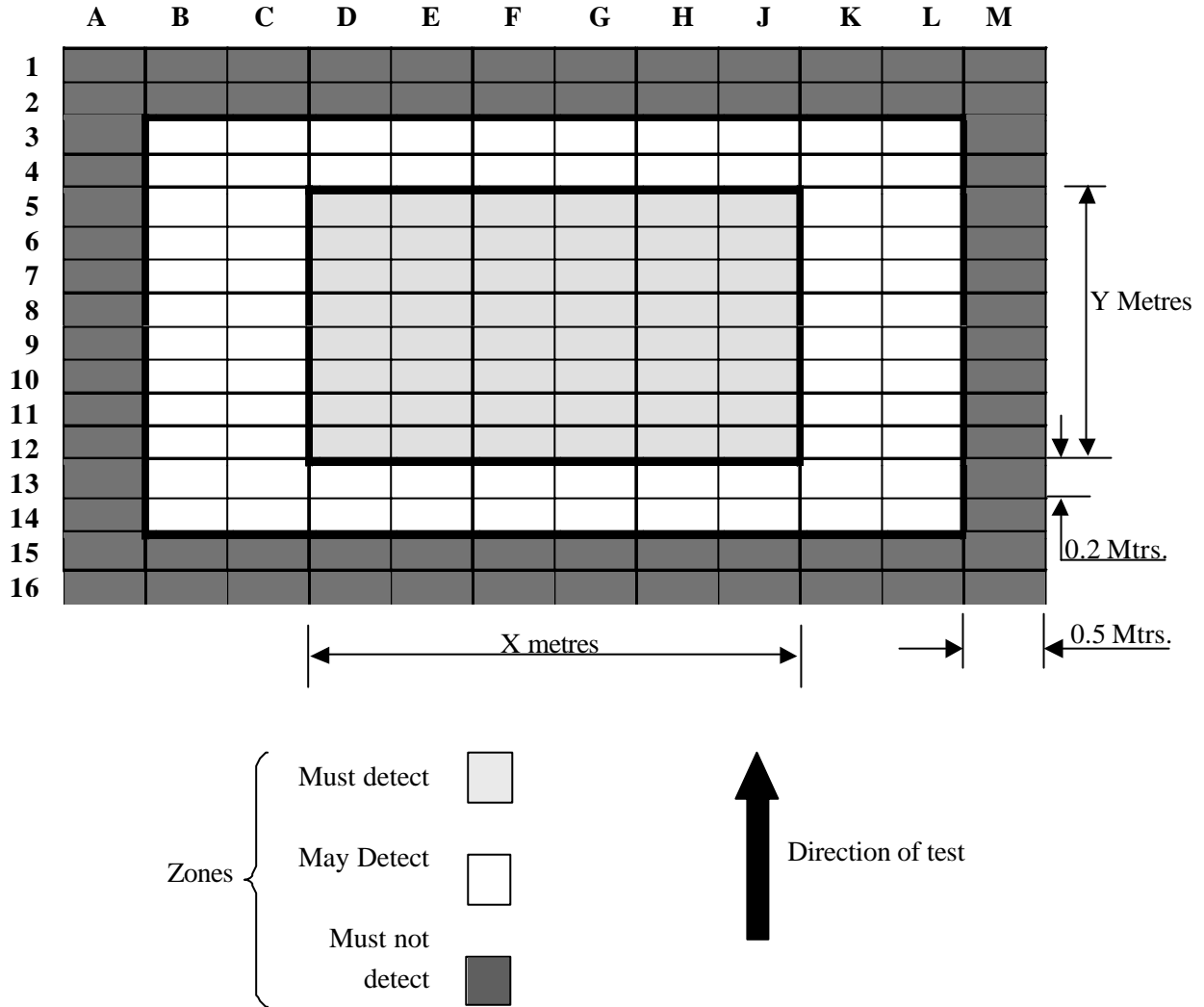
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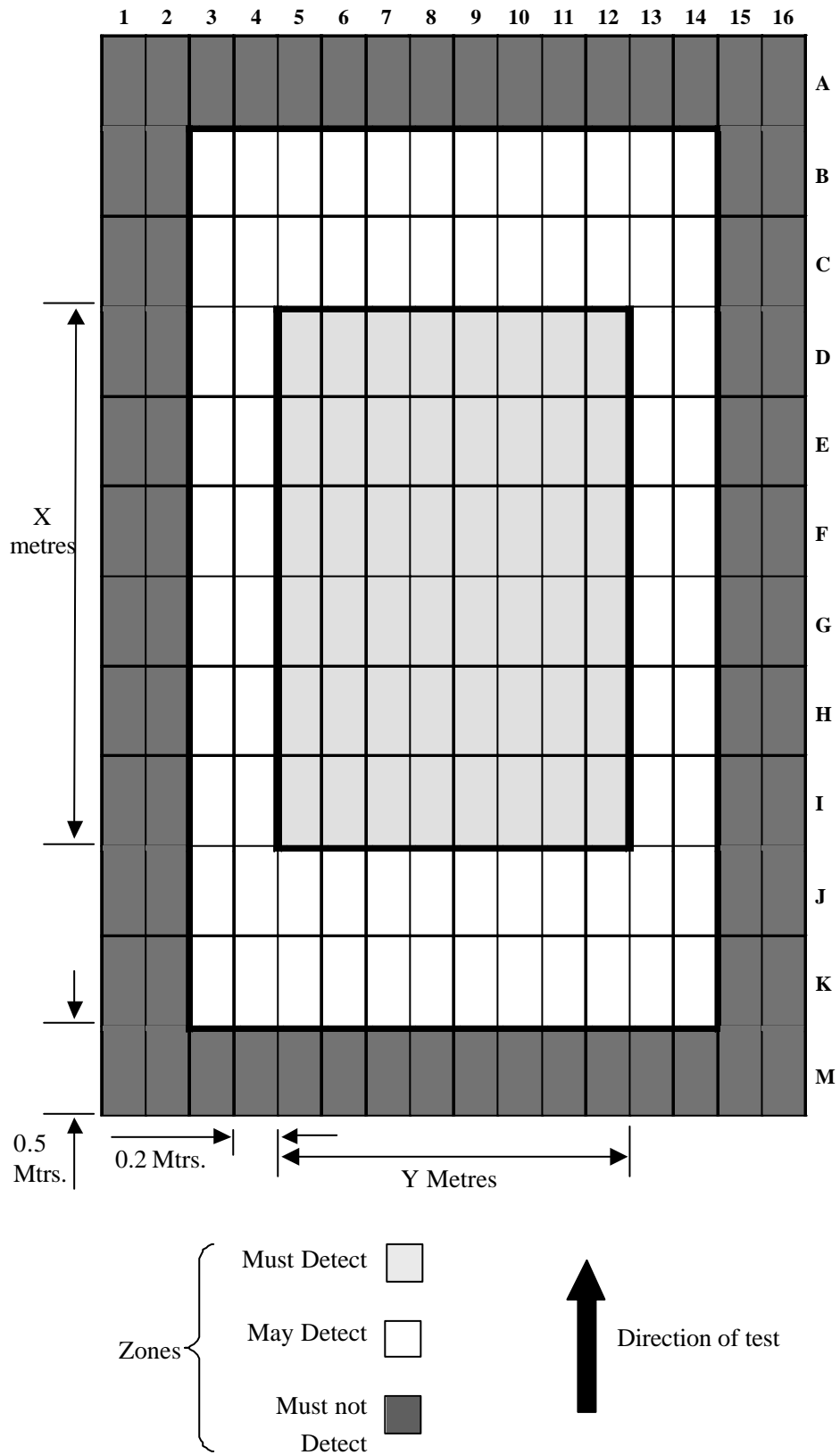
M.J. SMITH
Team Manager
Traffic Control Systems & Lighting

APPENDIX A ABOVE GROUND DETECTION SYSTEM - TEST GRID AREAS

A1 Test Grid Area 1



A2 Test Grid Area 2



APPENDIX B SURFACE MOUNTED DETECTION SYSTEM - TEST GRID AREAS

