

**SERIES 1500
HIGHWAY COMMUNICATIONS**

Contents

Clause	Title	Page	Clause	Title	Page
1501	(02/17) Introduction	2	1527	(02/17) Cable Installation at Transmission Stations	20
1502	(02/17) General Requirements	3	1528	(02/17) Modifications to Equipment and Circuitry associated with Existing Cabinets	20
1503	(02/17) Materials Equipment and Workmanship	4	1529	(02/17) Temporary Emergency Telephones	21
1504	(02/17) Site Records	4	1530	(02/17) Cable Ducts General	22
1505	(02/17) Provision of Cabinets, Cables and Ancillary Items	6	1531	(02/17) Installation of Ducts General	24
1506	(02/17) Cables	6	1532	(02/17) Chambers for Highway Communications Cables	26
1507	(02/17) Cable Installation	6	1533	(02/17) Proving and Testing of Ducts	29
1508	(02/17) Installation of Cabinets and Signal Posts	9	1534	(02/17) Closed Circuit Television	29
1509	(02/17) Gantries for Motorway Signals	10	1535	(02/17) Provision of the Telecommunications Services	29
1510	(02/17) Installation of Telephones	11	1536	(02/17) Electricity Connections	30
1511	(02/17) Marker Tape	11			
1512	(02/17) Installation of Ancillary Items	12			
1513	(02/17) Jointing and Termination of Multi-pair Communications Cables	12			
1514	(02/17) Cable Connectors	13			
1515	(02/17) Termination of Optical Fibre Communication Cables	14			
1516	(02/17) Termination and Jointing of Power Supply Cables for Communications	14			
1517	(02/17) Earthing, Bonding and Lightning Protection	15			
1518	(02/17) Cable Testing	15			
1519	(02/17) Labelling and Numbering	16			
1520	(02/17) Not Used				
1521	(02/17) Removal and Re-siting of Existing Equipment	17			
1522	(02/17) Enforcement and Other Systems	18			
1523	(02/17) Detector Systems	18			
1524	(02/17) Trial Pits	18			
1525	(02/17) Safeguarding the Existing Highway Communications Network	19			
1526	(02/17) The Inspection and Testing of Electrical Installations	20			

**NATIONAL ALTERATIONS OF THE
OVERSEEING ORGANISATIONS OF
SCOTLAND, WALES AND NORTHERN
IRELAND**

Contract specific Additional Requirements (A) and Substitute Requirements (S) may be included for contracts where the Overseeing Organisation is not Highways England (or its successor). Where required, these will be issued by:

Scotland

Transport Scotland, 8th Floor, Buchanan House, 58 Port Dundas Road, Glasgow, G4 0HF.

Wales

The Welsh Government, Transport Department, Cathays Park, Cardiff, CF10 3NQ.

Northern Ireland

Director of Engineering, The Department for Infrastructure, Clarence Court, 10 – 18 Adelaide Street, Belfast BT2 8GB.

The Overseeing Organisation may also issue an initial list of Alternative Requirements/Departures.

HIGHWAY COMMUNICATIONS

1501 (02/17) Introduction

1 (02/17) Where this document contains specification requirements, it must be read in conjunction with the general requirements in Series 000 and 100 and with all other Series relevant to the specification for the particular works to be undertaken.

Where this document contains design requirements, it must be read in conjunction with the general requirements in GD 01 (DMRB 0.0.2), GD 02 (DMRB 0.2.1) and GD 04 (DMRB 0.2.4) and with all other DMRB documents relevant to the design for the particular works to be undertaken.

Where this document contains technology requirements that fall within the scope of the TSS Plans Registry, it must be read in conjunction with the general requirements in TR 1000, TR 1100 and TR 2130, and with all other TSSR Documents relevant to the particular works to be undertaken.

2 (02/17) Where there is a requirement in this document for compliance with any part of a “British Standard”, technical specification or quality mark, that requirement may be met by compliance with GD 01.

Where there is a requirement in this document for compliance with any part of a “British Standard”, technical specification or quality mark, that requirement may be met by compliance with Series 100 of the specification.

Where there is a requirement in this document for compliance with any part of a “British Standard”, technical specification or quality mark, that requirement may be met by compliance with TR 1000.

3 (02/17) A safety risk assessment shall be carried out in accordance with GD 04.

4 (02/17) Where the design falls within the scope of the Equality Act, an equality impact assessment shall be carried out by the designer.

5 (02/17) Where a product falls within the scope of a harmonised standard, the contractor shall provide the declaration of performance and manufacturer’s installation instructions for the product as part of the safety file.

6 (02/17) Series 1500 applies to the Strategic Road Network i.e. both to all purpose trunk roads and motorways.

7 (02/17) Unless otherwise stated in contract specific Appendix 15/1 a Telecommunications Services Provider is responsible for the highway communications transmission network from a Service Delivery Point (SDP) where roadside technology interface with that network to the SDP in the Overseeing Organisation’s central facilities such as the Regional Control Centres.

Where the Contractor is responsible for the highway communications transmission network the requirements placed on the Contractor shall be as set out within amended or substitute Clauses to this 1500 Series with detail of the works contained in contract specific Appendices 15/1 and 15/2.

The Contractor is responsible for all cabling, termination and linking downstream or otherwise termed beyond the SDP where such cabling is required by the installation but not directly linked to the SDP.

The Contractor shall install all communications infrastructure, comprising but not limited to ducts, chambers, hard-standings, transmission station bases, cabinet bases (including any cast-in frames that may be provided by the Telecommunications Services Provider) access infrastructure and protection infrastructure as stated in contract specific Appendix 15/1.

With exception of cables and equipment provided by the Telecommunications Services Provider the Contractor shall supply and install all cables, cable terminations and equipment as stated in contract specific Appendix 15/1. This shall include all power cabling and local communications cables that are installed beyond the SDP and any other local cables required by the installed equipment and systems.

8 (02/17) The telecommunications services and all related equipment necessary to provide the telecommunications services shall be as scheduled in contract specific Appendix 15/1. These shall be installed by the Telecommunications Services Provider into infrastructure constructed by the Contractor unless the contract specific Appendix 15/1 defines otherwise.

1502 (02/17) General Requirements

1 (02/17) The Contractor is responsible for the supply of all equipment except that scheduled in contract specific Appendix 15/1 as to be supplied by the Overseeing Organisation.

The procurement responsibilities in respect of the telecommunications services to be provided by the Telecommunications Services Provider shall be as set out within the contract. Details of the telecommunications services to be provided by the Telecommunications Services Provider and any specific instructions relating to the provision of the telecommunications services shall be as stated in contract specific Appendix 15/1. The Contractor shall comply with the requirements of the Telecommunications Services Provider as stated in contract specific Appendix 15/3.

The Contractor shall confirm and amend as appropriate with the Telecommunications Services Provider details of the telecommunications services contained in the contract specific Appendix 15/1.

The Contractor shall establish and maintain a programme of interfacing, liaison, planning and co-ordination with the Telecommunications Services Provider, taking account of the requirements within contract specific Appendix 15/3, throughout the period of performing the works as necessary to permit the Telecommunication Services Provider to provide the telecommunications services.

2 (02/17) In response to requirements set out in contract specific Appendix 15/3, the Contractor shall contribute to and provide support to the Telecommunications Services Provider in the establishment, joint periodic review and update of an interface agreement, comprising a memorandum of understanding between the Contractor and the Telecommunications Services Provider. This interface agreement covering the period of the works shall as a minimum capture the joint requirements in respect of:

- (i) the scope and geographic coverage of the interface agreement;
- (ii) a description of the contractual and operational interfaces including current and future plans;
- (iii) contacts and roles/responsibilities, including fault reporting, handling and escalation;
- (iv) requirements in respect of meetings and written and electronic communications;
- (v) requirements in respect of authorisations and the provision of notices;
- (vi) specific access boundaries and access protocols;
- (vii) definition of responsibilities for maintenance, including any shared maintenance responsibilities;
- (viii) the booking and provision of temporary traffic management;
- (ix) a schedule and details of special requirements including references to site-specific special requirements such as site health and safety requirements and permits to work;
- (x) any additional requirements within contract specific Appendix 15/3.

3 (02/17) The Contractor shall organise all operations and works so that the highways communications installation, the provision of services by the Telecommunications Services Provider is completed, tested and the test results accepted by the Overseeing Organisation or in accordance with contract specific Appendix 15/3 by the date or dates specified in contract specific Appendix 1/13. The Contractor shall allow time in the programme for any remedial works, repairs and retesting which may be required to be completed satisfactorily before the date or dates specified in contract specific Appendix 1/13.

The Contractor shall include within the programme key dates, as appropriate to the work relating to the Telecommunications Services Provider's activities including any sectional completion. This programme shall include dates for:

- (i) installation and removal of telecommunications bypasses;
- (ii) de-activation and re-activation of existing telecommunications services;
- (iii) removal of existing telecommunications equipment and infrastructure;

- (iv) setting out of telecommunications infrastructure at site prior to the start of construction activities;
- (v) completion of telecommunications infrastructure, including periods for inspection and acceptance;
- (vi) the availability of cabinets for the installation of cabling or equipment;
- (vii) installation of the Contractor's cables;
- (viii) installation of the Telecommunications Services Provider's cabinets, cables and equipment, based on information provided by the Telecommunications Services Provider;
- (ix) activation of new telecommunications services;
- (x) provision of temporary traffic management by the Contractor for the Telecommunications Services Provider;
- (xi) dates for any additional activity types including notice and mobilisation periods and constraints regarding the Telecommunications Services Provider's activities contained within contract specific Appendix 15/3.

4 (02/17) The location of existing buried services and infrastructure shall be detected, confirmed, marked on the ground and protected in accordance with the relevant special requirements contained in the contract documents and any additional requirements detailed in contract specific Appendix 15/1 and contract specific Appendix 15/3 in the case of buried services and infrastructure owned, operated or maintained by the Telecommunications Services Provider.

In respect of buried services and infrastructure owned, operated or maintained by the Telecommunications Services Provider, the Contractor shall arrange for the location and marking of buried services and infrastructure and shall subsequently comply with the requirements for excavation in the proximity of such buried services and infrastructure in accordance with contract specific Appendix 15/3.

The location of buried cables shall be detected, confirmed and protected in accordance with the relevant "special requirements of (name of statutory undertaker)" or similar notice or instruction issued by a statutory undertaker and any additional requirements determined by the Telecommunications Services Provider in accordance with contract specific Appendix 15/3.

5 (02/17) Prior to the start of telecommunications infrastructure construction activities, the Contractor shall comply with any requirements of the Telecommunications Services Provider contained in contract specific Appendix 15/3, in respect of the setting out of communications infrastructure that will be handed over upon the completion of the works for the Telecommunications Services Provider to maintain.

6 (02/17) Mitigation methods to prevent metal theft shall be contained in contract specific Appendix 15/1 as agreed with the Overseeing Organisation.

1503 (02/17) Materials Equipment and Workmanship

1 (02/17) All Electrical works shall comply with BS 7671 'Requirements for Electrical Installations, IET wiring Regulations' and the rules and regulations of the electricity Distribution Network Operator (DNO).

1504 (02/17) Site Records

1 (02/17) The Contractor shall keep a record, on drawings or as specified in contract specific Appendix 15/1, of all work carried out as it proceeds. Copies shall be kept available for the use of the Overseeing Organisation and during the Contract at intervals shown in the programme.

The compilation of records, drawings and other information specified in contract specific Appendix 15/1 including timing of submissions shall be co-ordinated with and reflect the requirements of the Telecommunications Services Provider as specified in contract specific Appendix 15/3.

Upon completion of the works, the Contractor shall produce record drawings in accordance with MCH1652 and contract specific Appendix 15/3 which shall be issued to the Overseeing Organisation and the Telecommunications Services Provider for record purposes. The following information shall be recorded on the drawings:

- (i) Duct locations including depth, number and size of ducts and duct material.
- (ii) Cable chamber locations including type, depth, incoming and outgoing ducts, sub-ducts, type of chamber cover and details of cable joints within.
- (iii) Cabinet positions and type.
- (iv) Cabinet, cabinet function and cable chamber references.
- (v) Other than those cables installed by the Telecommunications Services Provider the cable routes including cable lengths. Additionally, within a ducted network, the number and type of cable allocated to each duct and the length of each cable, unless the Telecommunication Services Provider is to provide the cable route.
- (vi) Other than those cables installed by the Telecommunications Services Provider, the cable size, type and drum number.
- (vii) Power supply installations.
- (viii) SDP interfaces with Telecommunications Services Provider.
- (ix) Signals.
- (x) Telephones.
- (xi) Sheath repair and cable joint positions.
- (xii) Any additional requirements stated in contract specific Appendix 15/1 and contract specific Appendix 15/3.

The drawings shall be submitted for the approval of the Overseeing Organisation at weekly intervals during the contract.

- 2** (02/17) Position measurements (both horizontal and vertical) shall be taken of the underground equipment to the nearest 100 mm. The interval and method of recording including any datum shall be agreed with the Overseeing Organisation and shall be in accordance with the requirements of contract specific Appendix 15/1.
- 3** (02/17) The Contractor shall keep records of the work in sufficient detail including type and drum number of installed cables to enable site records to be completed. A copy of the records shall be provided by the Contractor for retention and use by the Overseeing Organisation.
- 4** (02/17) The Contractor shall keep record sheets for ducts, sub-ducts and chambers which shall indicate details of all cables installed by the Contractor, ironwork, and plugs or seals installed and tests undertaken.
- 5** (02/17) For all cables installed by the Contractor each drum of cable delivered to the site will have quality inspection certificates attached to each side flange in accordance with the relevant cable specification and shall be CE marked. The Contractor shall ensure that the certificate relates to the cable to which it is attached. The certificate shall be given to the Overseeing Organisation prior to the installation of cable.
- 6** (02/17) The Contractor shall produce handover records in accordance with MCH1349.
- 7** (02/17) Record information shall include details of any test equipment used to produce test results. For each set of results, details of the test equipment manufacturer, model, serial number and confirmation that the test equipment is within its calibration period as recommended by the manufacturer at the time of performing the test.

1505 (02/17) Provision of Cabinets, Cables and Ancillary Items

1 (02/17) Cabinets, cables and ancillary items including cabinet bases, cabinet fittings, equipment mounting posts, and similar items may be supplied by the Overseeing Organisation or the Telecommunications Services Provider to the Contractor. These along with the organisation responsible for delivery, installation and maintenance will be listed in contract specific Appendix 15/1.

2 (02/17) The Contractor shall supply a programme of required delivery dates and other information in accordance with the Overseeing Organisation's requirements given in contract specific Appendix 15/1.

The notice period required for this programme of required equipment and delivery dates is given in contract specific Appendix 15/1.

This programme shall be reviewed and revised by the Contractor to suit the progress of the works and any revised programme and associated schedule of equipment submitted to the Overseeing Organisation in accordance with their requirements given in contract specific Appendix 15/1.

3 (02/17) The Contractor shall provide a dry and heated store to ensure that the equipment is stored in the manner recommended by the manufacturer as described in contract specific Appendix 15/1.

4 (02/17) The Contractor shall be responsible for examining the equipment and cable from the Overseeing Organisation and shall report any defects within five working days to the Overseeing Organisation.

5 (02/17) On completion of the works all unused Overseeing Organisation equipment, cables and cable drums shall be set aside. The ownership status of these items from this point and any instructions for the Contractor to deliver these items to the Overseeing Organisation or make them available for collection by the Overseeing Organisation shall be as set out in contract specific Appendix 15/1.

1506 (02/17) Cables

1 (02/17) Communications cables installed by the Contractor shall meet the requirements of TRH2583 or as detailed in contract specific Appendix 15/1.

2 (02/17) Power cables for communications systems shall meet the requirements of TRH2583 or as detailed in contract specific Appendix 15/1.

3 (02/17) On receipt and at various stages before laying armoured cables the Contractor shall ensure that no damage has been sustained by the cable which will compromise the integrity of the sheath. The Contractor shall also determine that the quantity is sufficient based on the optimum cut lengths and based on the drum quantities and also ensuring minimum wastage. The location in the ground of cable lengths by reference to their drum numbers shall be kept with the daily records.

4 (02/17) The cable end shall be cut/ terminated and the ends sealed to prevent the ingress of water to IPX7.

1507 (02/17) Cable Installation

1 (02/17) The approximate location of roadside technology, cabinets, SDPs, Contractor installed cables, ducts and trenches are described in contract specific Appendix 15/1 and contract specific Appendix 15/2. The Contractor and, as appropriate, the Overseeing Organisation or Telecommunications Services Provider shall agree the exact location of these items before commencement of any associated works, including groundworks.

2 (02/17) Cables shall be stored and laid in accordance with manufacturer's written instructions. Cable occupancy for multiple cables installed in the same duct shall allow for installation and future cable replacement. The cross sectional area of all cables shall not exceed 60% of the inner cross sectional area of the duct or as stated in contract specific Appendix 15/3.

3 (02/17) Sufficient length of cable shall be allowed for its correct termination. When termination does not proceed immediately following the installation of the cable, the cable ends shall be sealed against the ingress of water to IPX7.

4 (02/17) The schedule of existing and new ducts is contained in contract specific Appendix 15/2.

The Contractor shall verify that all ducts are prepared and proven suitable for cable installation in accordance with Clause 1533 prior to the drawing in of cable including where the Telecommunications Services Provider's cables are to be installed by the Telecommunications Services Provider.

Requirements for the preparation and proving of new or existing ducts and sub-ducts for the installation of cables by the Telecommunications Services Provider are specified in contract specific Appendix 15/3.

The requirement for the Contractor to install certain cables prior to the installation of cables by the Telecommunications Services Provider is specified in contract specific Appendix 15/3.

On completion of the cable installation a draw cord in accordance with sub-Clause 1530.11 shall remain secured in each duct.

Where specified in contract specific Appendix 15/2 or as determined by survey, including surveying using CCTV, during construction works, existing ducts may be considered by the Contractor or Telecommunications Services Provider as unsuitable to install new cables. An unsuitable duct in this context shall be determined through the failure of a mandrel test in accordance with Manual of Contract Documents for Highway Works Volume 3 – Highway Construction Details or the presence of visible sharp edges or discontinuities along the length of the duct. In such circumstances the existing duct may be sleeved or sub-ducted with a single High-density polyethylene (HDPE) continuous sub-duct acting as a sleeve for the installation of multiple cables or multiple HDPE continuous sub-ducts in accordance with sub-Clause 1530.3, with one sub-duct for each cable. The diameter of each cable including pulling arrangement shall not exceed 70% of the cross sectional area of the inner diameter of the sub-duct. Sub-ducts shall be retained within the chamber at each end of the continuous run of sub-ducts using a clamping plate or duct plug or other proprietary duct sealing system that can easily be removed (excluding expanding foam) that retains the sub-duct(s) to the outer duct at each chamber.

5 (02/17) No cable shall be left exposed at the end of any work period. Any cable stolen and/or vandalised shall be replaced in its entirety at the Contractor's expense.

6 (02/17) Shall any damage occur to a cable during installation, however slight, the Contractor shall identify and record the damage and report it to the Overseeing Organisation. The damage shall be repaired with cable accessories meeting BS EN 50393 in accordance with the manufacturer's instructions and at the Contractor's expense.

7 (02/17) Every cable shall be temporarily or permanently labelled immediately following its installation. Temporarily labels shall be subsequently replaced with a permanent label prior to the completion of the works.

8 (02/17) Cables shall be handled and installed in accordance with the manufacturer's instructions. The installation of cables shall not damage the cable being installed, existing cables in the duct or the duct itself. Where permitted by the manufacturer, a biodegradable lubricant may be used.

9 (02/17) Unless specifically identified in contract specific Appendix 15/1 and agreed by the owner of the service duct, sharing of individual service ducts for power and data services shall not be permitted.

10 (02/17) Where cables pass through intermediate chambers, the Contractor shall, immediately after installation, label each cable with the destination of the cable (joint chamber or equipment reference as appropriate) 150 mm from the entry and exit points of the chamber.

11 (02/17) The Contractor shall take account of the requirements of the Telecommunications Services Provider as specified in contract specific Appendix 15/3 when determining the order of the installation of cables within ducts and sub-ducts.

12 (02/17) The sections of optical fibre cables that are visible inside chambers shall additionally be marked at intervals of 500 mm along their length inside each chamber. The marking shall be 25 mm wide, yellow PVC adhesive tape or alternative fit for the purpose.

13 (02/17) Cables shall not be bent to an internal radius less than the manufacturer's recommendations, taking account of the tensile load present in the cable during installation.

14 (02/17) Cables shall be secured to the chamber walls using fixings recommended by the manufacturer and kept within the permitted bend radius. Cable management shall be laid such that it maximises the available space, allowing for future cabling of the remaining ducts. The Contractor shall provide cable management fixings to chambers in accordance with the Telecommunications Services Provider as stated in contract specific Appendix 15/3.

15 (02/17) On completion of cabling within chambers, including cabling installed by the Telecommunications Services Provider, the ducts shall be re-sealed with purpose made mechanical duct plugs or other proprietary duct sealing system that can easily be removed (excluding expanding foam) installed in compliance with sub-Clause 1530.14. The locations and responsibility for the provision and installation of duct plugs or duct sealing systems other than by the Contractor shall be as stated in contract specific Appendix 15/2. The cables shall be looped around within the chambers and secured to the cable support steelwork.

16 (02/17) Unless stated otherwise in contract specific Appendix 15/1, all types of cable installed on gantries shall be provided with continuous protection against mechanical damage or vandalism, from ground level to a point a minimum of 3.5 m above the adjacent ground level within a covered cable tray or by other means.

Other means shall be as specified in contract specific Appendix 15/1.

In addition, cables installed on gantries in those areas that are accessible from walkways or ladders, shall be protected from mechanical damage or vandalism by the provision of covered cable tray or other means unless stated otherwise in contract specific Appendix 15/1.

Where specified in contract specific Appendix 15/1, cables shall also be protected against environmental damage e.g. through prolonged exposure to ultraviolet radiation.

Where cables are to be installed across gantries by the Telecommunications Services Provider then the Contractor shall be responsible for the final design and installation of the cable management and cable containment solution to satisfy any requirements in respect of design proving and testing, as specified in contract specific Appendix 15/3.

17 (02/17) The depth of excavation shall be such that directly buried cables laid under verges, footways or open ground shall have a minimum cover of 500 mm and under carriageways of 750 mm, or 300 mm below formation, whichever is the greater depth. Trench detail does not apply to cables laid under carriageways or below formation. For trenches requiring topsoiling, grass seeding and/or turfing shall be as described in Clauses 618 & 3005, and shall be placed in the top 150 mm of the cable trench unless otherwise specified in contract specific Appendix 15/2. With the agreement of the Overseeing Organisation, where minimum cover cannot be achieved, cables can be laid in accordance with contract specific Appendix 15/3.

18 (02/17) Cables laid in trenches shall be both bedded on and covered by a 75 mm thickness of sand complying with sub-Clause 503.3 (ii) Class 1C material complying with Table 6/1 and compacted to those requirements. An additional 100 mm of sand shall be deposited to reach a total cover thickness of 175 mm prior to final backfilling. Cables shall be laid in sand bedding and surround material in accordance with Clause 503 to a depth of 150 mm. Class 1C material in accordance with Clause 602 and Table 6/1 shall be laid on top of the sand to a depth of 175 mm. Class 8 material in accordance with Clause 602 and Table 6/1 shall be laid on top of the Class 1C material to a depth of 150 mm. Where shared ownership of cables applies in the one trench, the requirements of contract specific Appendix 15/3 shall take precedence.

19 (02/17) Backfilling shall be in accordance with Clause 602 with material Class 8 complying with Table 6/1 and compacted to the requirements therein. The material shall be spread and compacted evenly without dislodging, disturbing or damaging cables, ducts or troughs. Vibrating compaction equipment shall not be used within 300 mm of cables, ducts or troughs. For trenches requiring topsoiling, grass seeding and/or turfing shall be as described in Clauses 618 & 3005, and shall be placed in the top 150 mm of the cable trench unless otherwise specified in contract specific Appendix 15/2.

20 (02/17) Cable marker tape complying with Clause 1511 shall be laid in the cable trench. Where several cables are laid in one trench one line of marker tape shall be installed for each 600 mm of trench width.

- 21** (02/17) Before installing any cables the ducts shall be free from foreign matter and detritus. When cables are required to be laid in ducts the Contractor shall swab through the duct prior to drawing in the cables and a further draw cord. The ducts shall be sealed with a draw cord in place following cabling, and resealed with split plugs, or other proprietary duct sealing system that can easily be removed (excluding expanding foam), to adequately seal the ducts against the ingress of foreign matter.
- 22** (02/17) Where cables are installed in existing troughs they shall either, as defined in contract specific Appendix 15/2, be installed in sub-ducts suitably retaining in position or be covered with sand up to the level underside or seating of the cover, whichever is the lower. The sand shall pass as 2 mm size test sieve as specified in BS EN 933-2.
- 23** (02/17) The Telecommunications Services Provider's use of armoured communications cables shall be limited by design rules where specified in contract specific Appendix 15/3. Unless otherwise stated in contract specific Appendix 15/2, longitudinal armoured cables that are to be installed by the Telecommunications Services Provider shall be installed within sacrificial ducting installed by the Contractor. Longitudinal cables shall generally be run parallel to the fence line or edge of the hardshoulder.
- Transverse cables shall run at right angles to the carriageway. Subject to the approval of the Overseeing Organisation transverse cables installed diagonally with respect to the carriageway may be accepted.
- 24** (02/17) All armoured communications cables exceeding 50 metres in length shall be provided with buried loops to allow for re-termination following a cabinet knockdown. These loops shall be installed at each end of the cable immediately adjacent to the entry and exit ducts at cabinet locations and the location included on the record drawings.
- 25** (02/17) When duct or trough alignments differ from those of the trench the transition from one to the other shall not exceed 1:30 horizontally or vertically.
- 26** (02/17) When more than one cable is laid in a trench they shall be accommodated in one horizontal layer in order to locate them in the future. This applies to both communications and power cables as long as the power cables are associated solely with communications equipment.
- 27** (02/17) The minimum separation between cables shall be such that safety and heat transfer, as defined in BS 7671 or interference, as defined in BS EN 50174-3, from adjacent cables will not affect the cable or the safety and functionality of the equipment the cable is connecting (both communications and power) and as stated in Appendix 15/3. The separation between a cable and the wall of the trench shall be such that the cable shall not be damaged during infill or future ground movement.
- 28** (02/17) Following completion of work unused cable ends shall be sealed according to the manufacturer's written instructions to comply with IPX7.
- 29** (02/17) Installed cables including any cable joints shall have a design life of not less than 30 years unless otherwise stated in contract specific Appendix 15/1.

1508 (02/17) Installation of Cabinets and Signal Posts

1 (02/17) Where described in contract specific Appendix 15/1, the Contractor shall construct hard-standing areas and foundations incorporating plinths for cabinets and signal posts. Plinths shall make allowance for ducts to enter cabinets from beneath.

Hard-standing areas shall be constructed; these shall extend at least 600 mm plus the depth of any raised plinth away from each opening within a face of a cabinet or 900 mm in respect of signal posts, fence line cabinets and gantry cable interfaces to the ducted network requiring access for maintenance. Individual hard-standing areas within groups of cabinets and posts shall be interconnected by paths of minimum 600 mm width. Hard-standing areas shall be continuous between opposing cabinet or post doors where the spacing between the door faces is up to 1.8 m.

Hard-standing areas shall be constructed such that any water drains away from cabinet plinths. Cabinet plinths shall be constructed and cabinets installed such that cabinet doors shall be capable of opening and closing without being fouled by the paved area or each other. The cabinets and signal posts shall be mounted on plinths using the fixings provided. Plinths shall be constructed such that the orientation of the cabinets shall allow the hinged doors to open towards the carriageway unless otherwise required by space or fouling constraints.

The Contractor shall construct hard-standing areas and foundations incorporating plinths for cabinets for use by the Telecommunications Services Provider as described in contract specific Appendix 15/1.

The responsibilities for the provision of cast-in frames, erection of cabinets, labelling, installation of cables and sealing of cabinet bases and ducts shall be as described in contract specific Appendix 15/1.

The orientation, spacing and clearance around cabinets and cabinet doors shall comply with the Telecommunication Services Provider in contract specific Appendix 15/3.

2 (02/17) After the completion of all cable terminations and testing, the cabinet bases and ducts shall be sealed so that the ingress protection (IP) rating of the cabinet, rodent protection and ability to add and replace cables without damage, is maintained following the manufacturer's guidelines.

3 (02/17) The Contractor shall keep the interior of cabinets free from moisture and debris. The Contractor shall ensure, prior to the installation of equipment that for cabinets requiring power for environmental conditioning that power is applied to the cabinets and is subsequently maintained and that the cabinets are clean and dry. Subsequently the Contractor shall ensure that the doors of each cabinet are closed and properly secured after the installation of equipment in the cabinet and after the completion of any other work.

4 (02/17) Entry/exit ducts to cabinets on a ducted network shall be sealed using duct plugs in compliance with sub-Clause 1530.14 or other proprietary duct sealing system that can easily be removed, to prevent the ingress of water and soil, gravel etc. The use of expanding foam is prohibited. The locations and responsibility for the provision and installation of sealing systems other than by the Contractor shall be as stated in contract specific Appendix 15/2.

5 (02/17) Where cabinets are situated in groups they shall be located in a consistent sequence as described in contract specific Appendix 15/1.

6 (02/17) The Contractor shall install additional security measures to deter unauthorised access to cabinets, including cabinets operated and maintained by the Telecommunications Services Provider as detailed in contract specific Appendix 15/1.

7 (02/17) The Contractor shall install secure cabinets for enforcement systems as detailed in contract specific Appendix 15/1.

8 (02/17) When installing a sign in an area where a concrete safety barrier is present it is permissible to install signal posts on top of the concrete safety barrier providing the mounting height as required by the Traffic Signs Regulations and General Directions (TSRGD) is maintained and the access door is accessible as defined in contract specific Appendix 15/1.

9 (02/17) Where power or communications interface cabinets are installed within the Overseeing Organisation's boundary fence line to permit access by a third party to the interface, the cabinet and the associated communications infrastructure shall be wholly contained within the Overseeing Organisation's land.

1509 (02/17) **Gantries for Motorway Signals**

1 (02/17) Details of cables and electrical equipment for traffic signs including variable message signs and matrix signals on gantries are given in contract specific Appendix 15/1.

1510 (02/17) Installation of Telephones

- 1 (02/17) The Contractor shall construct a hard standing area and install the telephone base as described in contract specific Appendix 15/1. Access for disabled users shall be provided.
- 2 (02/17) An area of hard standing shall be provided adjacent to the telephone. It shall be suitable to allow a person in a wheelchair to access the telephone.
- 3 (02/17) A further hard standing, where required, in accordance with Clause 803 of sufficient working area shall be installed behind the telephone to provide a flat level surface for maintenance purposes.
- 4 (02/17) Where not protected by a safety barrier, the telephone holding down arrangements shall pass the requirements of EN 12767:2000 when tested in accordance with speed class 35 and 100, non-energy absorbing structures occupant safety level 3.
- 5 (02/17) Spare cabling as stated in contract specific Appendix 15/1 shall be provided at ERT locations to allow for ERT knockdowns. A cable re-make loop should be retained in the cable pit moulding or nearby underground chamber.

Unless otherwise stated where new cable is being installed, a minimum 5 m length re-make loop of unhindered cable shall be retained in the cable pit moulding.

- 6 (02/17) Each telephone column, instrument module and header module shall be orientated such that:
 - (i) locations where the telephone site is not protected by safety barrier the instrument module door is on the downstream of traffic side of the unit, meaning that the road user is facing oncoming traffic while using the telephone;
 - (ii) locations where a safety barrier is present, that the instrument module door faces the kerb to allow the road user to access the telephone.
- 7 (02/17) Where telephones are installed on existing highways they shall be covered with purpose made "Not in Use" covers until they have been commissioned and are available for use by the public. Where solar panel powered telephones are used the bag used shall ensure that it does not prevent the charging of the telephone.
- 8 (02/17) Telephones shall be aligned within $\pm 1^\circ$ of the vertical.
- 9 (02/17) The Telecommunications Services Provider SDP shall be within the telephone column or instrument module or as agreed by the Overseeing Organisation as defined in the contract specific Appendix 15/1.
- 10 (02/17) An under-plinth duct shall be used for all wired plinth installations. In ducted systems, a suitable proprietary sealed joint shall be used to connect the under-plinth duct to the ducted network. The under-plinth duct shall also be sealed against water ingress, by suitable means, at its junction with the cable pit moulding. Duct to extend minimum of 200 mm beyond edge of plinth (for sites without existing ducts).

1511 (02/17) Marker Tape

- 1 (02/17) All cables and ducts installed underground shall have their position indicated by the use of marker tape in accordance with BS EN 12613 that is detectable from above ground. Marker tape shall be buried in the trench above the cable/duct.
- 2 (02/17) The wording on the marker tape shall read "CAUTION COMMUNICATIONS/ POWER CABLES BELOW". The marker tape shall be compliant to EN 12613.
- 3 (02/17) Marker tape shall be yellow in colour, with wording in black.

1512 (02/17) Installation of Ancillary Items

- 1 (02/17) Unless otherwise specified in contract specific Appendix 15/1, all boxes shall be mounted onto the baseboards or frames of cabinets, the knockouts for cable access removed as necessary and holes bushed or fitted with cable glands. Termination frames shall be fitted within the boxes where appropriate.
- 2 (02/17) Distributors shall be mounted onto the baseboards of posts. Distributors and electrical switches shall be mounted at the gantry or as described in contract specific Appendix 15/1.
- 3 (02/17) Power switchgear and protective devices shall be installed in power supply cabinets and other locations as described in contract specific Appendix 15/1.
- 4 (02/17) The Contractor shall provide and install connectors for the termination of cables as detailed in contract specific Appendix 15/1. All terminations and link cabling from the Telecommunication Services Provider's SDP to the equipment installed within the cabinet shall be the responsibility of the Contractor.
- 5 (02/17) Where the Telecommunications Services Provider's active equipment is installed in a cabinet a minimum of two separately protected circuit ways from the main distribution point within the cabinet shall be provided for the sole use by the Telecommunications Services Provider. Sufficient spare cable terminations and entry points to allow the fitting of 20 mm cable glands or the provision of outlet sockets to IEC 60320 Part 2-2 sheet F shall be provided to permit the Telecommunications Services Provider to make connections to the power supply. Unless stated otherwise in contract specific Appendix 15/1, protection devices on each of the circuit ways shall be 6A, type B miniature circuit breakers that meet the relevant essential requirements for overcurrent protection under the Low Voltage Directive.

1513 (02/17) Jointing and Termination of Multi-pair Communications Cables

- 1 (02/17) Unless described otherwise in contract specific Appendix 15/1, jointing and termination of multi-pair communications cables up to the SDP shall be undertaken by the Telecommunications Services Provider. The Contractor shall be responsible for jointing and termination of multi-pair communications cables beyond the SDP, including detector systems and cables to gantry mounted equipment. The Contractor shall provide space and fixing points to accommodate the Telecommunications Services Provider's terminations, including terminations up to the SDP.
- 2 (02/17) Cable joints provided by the Contractor (except within in-road detector systems) will only be permitted at the locations described in contract specific Appendix 15/1. Where cable joints house a SDP then these joints shall be located and readily accessible as determined by the Contractor's consultation with both the Telecommunications Services Provider and the Overseeing Organisation's Technology Maintenance Services Provider. The responsibility for providing the cable joint that houses an SDP shall be the Telecommunications Services Provider unless otherwise specified in contract specific Appendix 15/1.
- 3 (02/17) Cable joints in road detector systems shall comply with Clause 1218.
- 4 (02/17) All jointing and termination shall be carried out in accordance with manufacturer's instructions. All cable conductors shall be protected from strain prior to their termination. Cables shall be dressed neatly in accordance to the manufacturer's instructions.
- 5 (02/17) The Contractor shall ensure that the lay of the cable is maintained up to the termination position without exerting undue stress on the conductors and terminals. All conductor pairs shall be identified by means of a numbered plastic sleeve, collar or other method as agreed with the Overseeing Organisation.
- 6 (02/17) Termination of cable using insulation displacement connectors shall be undertaken in accordance with the manufacturer's instructions using any specialist tools necessary. The Contractor shall provide the requisite tools.

- 7 (02/17) Within cabinets, links shall be terminated in terminal blocks complying with sub-Clause 1514.2. The conductors shall be secured in terminals in accordance with the manufacturer's written instructions. Links shall be tied and supported and of sufficient length to facilitate routine maintenance and allow for subsequent re-terminations. The correct pairing shall be maintained at all times. The Contractor shall clearly identify links by using collets at either end.
- 8 (02/17) Where the Contractor is required as scheduled in contract specific Appendix 15/1 to terminate cables into cabinets containing operational circuitry, the Contractor shall give two weeks' notice (or as specified in contract specific Appendix 15/3, whichever is the longer) to allow the opportunity for a representative of the Overseeing Organisation's Technology Maintenance Services Provider to attend each site to oversee all work within the cabinet for which the Contractor is responsible.
- (i) The Contractor shall also comply with the Telecommunications Services Provider's requirements for notification and attendance by the Telecommunications Services Provider where necessary in accordance with the requirements specified in contract specific Appendix 15/3. This work shall not compromise operational system(s).
- 9 (02/17) For cable joints installed by the Contractor, Cable Joint Enclosures (CJE) shall be installed in chambers and Above Ground Joints (AGJ) or other cable joint type in cabinets, as described in contract specific Appendix 15/1. If cable joints are to be located in the same chamber as a Telecommunications Services Provider's cable joints then the accommodation requirements shall be as per contract specific Appendix 15/3.
- 10 (02/17) At rural post mounted signal sites or other locations where the accommodation of a suitable SDP connection is not possible or readily accessible within the equipment housing, the Contractor shall provide sufficient space within a segregated compartment for the Telecommunications Services Provider to install a CJE to house an SDP and to facilitate the isolation and testing of RS485 and other communication circuits.
- 11 (02/17) Cable continuity kits to ensure the integrity of protective and screening conductors shall be installed on every cable except in the case of screening conductors where specified otherwise in contract specific Appendix 15/1.
- 12 (02/17) Links shall be installed and connected within cabinets and connection boxes with jumper leads installed between connection boxes wherever two are installed within one cabinet; using as appropriate the insulated conductors of multi-pair cable with its outer sheath, armour and inner sheath removed. The leads shall be of sufficient length to facilitate routine maintenance and allow for several subsequent re-terminations and shall not obstruct any accessory in the connection box. The Contractor shall maintain multi-pair colour coding so that colour code duplication does not occur. The correct pairing shall be maintained at all times.

1514 (02/17) Cable Connectors

- 1 (02/17) Where shown on the contract specific drawings, cables shall be terminated using insulation displacement connectors that are designed to accommodate the conductor and outer insulation sizes of the cables being terminated and the number of conductors terminated into a single terminal.
- 2 (02/17) Unless otherwise shown on the contract specific drawings the Contractor shall use terminal blocks that meet the relevant essential requirements for copper conductors under the Low Voltage Directive with an impulse withstand voltage rating of at least 6kV. Terminals shall employ either screw-type or screw-less-type clamping arrangements to retain individual conductors without any direct screw to conductor contact. Terminal blocks shall be compatible with the stranding and size of conductors being terminated and shall incorporate or be fitted with indelible identification labels to uniquely identify each terminal way.
- 3 (02/17) The requirements for ethernet and optical patch cords shall be as detailed in contract specific Appendix 15/1.

1515 (02/17) Termination of Optical Fibre Communication Cables

- 1 (02/17) Unless otherwise stated in contract specific Appendix 15/1, the Telecommunications Services Provider shall be responsible for the termination of optical fibre cables up to the SDP and the Contractor shall be responsible for the termination of optical fibre cables beyond the SDP. Sub-Clauses 1515.2 to 4 give the requirements where the Contractor is required to execute optical fibre cable jointing.
- 2 (02/17) The Contractor shall be responsible for the safe disposal of any optical fibre cable waste created by the Contractor.
- 3 (02/17) Cables shall be terminated in such a way to prevent damage due to the occurrence of moisture to IPX7. The fibres shall be fusion spliced and protected from mechanical strain.
- 4 (02/17) Copper conductors in composite optical fibre cables shall be secured in terminals in accordance with the manufacturer's recommendations.

1516 (02/17) Termination and Jointing of Power Supply Cables for Communications

- 1 (02/17) The method and responsibility of the termination of power supply cables for communications shall be described in contract specific Appendix 15/1.
- 2 (02/17) Cable joints in power cables shall be made where described in contract specific Appendix 15/1. Additional joints shall not be permitted to overcome inaccuracies in measurement, or cable damage. Cable joints shall not be situated in a duct or trough. Heat-shrink or cold-shrink type joints shall not be used.
- 3 (02/17) Cables greater in size than 25 mm² shall not be terminated within cabinets, unless the cabinet is specifically designed to terminate a large sized cable as identified in contract specific Appendix 15/1.
As specified in contract specific Appendix 15/1 or on the cable schematic contract specific drawings the cable shall be jointed to a length of 10 mm² or 25 mm² cable manufactured to specification TRH 2583 part 3. The 10 mm² or 25 mm² cable shall be terminated within the cabinet. An underground cable reduction joint shall be installed at the change in cable size. Within a ducted cable network the cable joint shall be made in the adjacent chamber or for a direct buried network near to the cabinet cable entry duct. The type of chamber shall be as shown on the contract specific drawings. Details of the reduction joint shall be displayed within the cabinet where the jointed cable is terminated.
- 4 (02/17) Power supply cable joints including reduction joints for cables of cross section greater than 50 mm² are not permitted within chambers containing longitudinal below ground cable joints. Power supply cable joints for cables of cross section greater than 50 mm² shall be housed in separate chambers as shown on the contract specific drawings. Details of the locations of chambers that will contain power supply cable joints are provided in contract specific Appendix 15/2.

Power cables shall be supported and routed in a manner that does not impede access to the telecommunications infrastructure nor create a hazard when using the access steps where present.

- 5 (02/17) Joints shall be made using a suitable jointing system in which all components are mutually compatible and adequate for the type of cables to be jointed. Joints shall be installed in accordance with the manufacturer's written instructions.
- 6 (02/17) Jointing shall only be carried out when all the materials used in the joint are free from visible signs of moisture. Joints shall be protected from water, frost, direct sunlight and extremes of temperature during the curing period for the joint materials in accordance with the manufacturer's instructions. Joints shall be adequately supported at all times. Backfilling shall comply with this specification and shall not take place until the joint is completely cured and able to withstand any stresses which may be imposed on it.
- 7 (02/17) Where a new power supply is being provided to existing equipment or an existing power supply is modified which will result in a disruption to or the loss of existing facilities (signals, CCTV etc.) written authority shall be obtained by the Contractor from the Overseeing Organisation and Telecommunications Services Provider (as appropriate), who will advise their individual stakeholders of the anticipated duration, so that the effects of the

power supply disruption can be assessed. The Contractor shall provide at least two weeks' notice in writing of all planned disruptions to the Overseeing Organisation and take into account any other notice periods that are in place as stated in contract specific Appendix 15/1. The Contractor shall undertake all necessary preparatory work to ensure that the period of disruption is minimised.

8 (02/17) Where described in contract specific Appendix 15/1 at each existing gantry the Contractor shall carry out tests to confirm that the lighting supply and the communications power supply are fed from the same phase. Where tests show the two supplies are not in phase the Contractor shall isolate the lighting power supply, at the power isolation cabinet, from the mains supply and carry out the remedial works necessary to bring both supplies into the same phase as agreed with the Overseeing Organisation.

9 (02/17) Cable joint markers complying with the requirements of duct end markers, sub-Clause 501.8, but with the letters 'CJ' replacing the letter 'D', shall be provided and installed to indicate the position of below ground joints. Alternatively, the letters 'CJ' can be added to the chamber label described in sub-Clause 1532.15. Temporary markers shall be provided if necessary to ensure the accurate positioning of permanent markers, alternatively an active marker may be provided.

1517 (02/17) Earthing, Bonding and Lightning Protection

1 (02/17) Lightning protection and power supply earthing, and the labelling of such earthing arrangements, shall be provided for all metalwork including gantries and cantilever structures in accordance with BS EN 62305, BS 7430 and BS 7671. Specific lightning protection and earthing requirements are defined in contract specific Appendix 15/1.

2 (02/17) The area of gland plates or boxes which will come in contact with a cable gland shall be cleaned of all paint and corrosion before a cable gland is fitted. Once the gland is fitted, exposed metalwork of gland plates or boxes shall be suitably treated to protect against corrosion.

3 (02/17) All connections to bolted fixtures shall be made through crimped type lugs.

4 (02/17) Adjacent cabinets less than two metres distant shall be effectively equipotentially bonded together in accordance with BS 7671.

5 (02/17) Lightning protection for gantries and other structures, such as camera masts, shall be provided as described in contract specific Appendix 15/1. Gantry lightning protection system components shall comply with BS EN 62561.

6 (02/17) Unless otherwise stated in contract specific Appendix 15/1, the Telecommunications Services Provider shall provide lightning protection components to protect the telecommunications services delivered to the SDP.

7 (02/17) The Contractor shall provide space and fixing points to accommodate the Telecommunications Services Provider's lightning protection components.

8 (02/17) The Contractor shall provide suitable earthing point or earthing arrangements in accordance with contract specific Appendix 15/3 for use by the Telecommunications Services Provider to provide earthing for the Telecommunications Services Provider's lightning protection components.

1518 (02/17) Cable Testing

1 (02/17) The Contractor shall undertake tests on cables as detailed in contract specific Appendix 1/5. The Telecommunications Services Provider shall undertake tests on all cables installed by the Telecommunications Services Provider.

2 (02/17) All cables shall be tested by the Contractor post installation in accordance with specification MCG 1022 (for armoured or non-armoured copper cables), or to the manufacturer's specifications for continuity and insulation, as appropriate. The cable sections and scope of tests shall be as described in contract specific Appendix 15/1.

- 3 (02/17) Three copies of all cable test results shall be supplied to the Overseeing Organisation on the completion of each test.
- 4 (02/17) All test instruments requiring calibration shall have a current calibration certificate, copies of which shall be available at the time of testing.
- 5 (02/17) The Contractor shall give at least two weeks' advance notice, in writing, to the Overseeing Organisation of any cable testing.
- 6 (02/17) In the event of the Contractor opening up a trench or drawing further cables through a duct after cables have been installed and tested, then all cables in the trench or duct shall be retested. Any damage identified by this test shall be rectified by the Contractor and the cables then re-tested.
- 7 (02/17) After testing, the Contractor shall locate and expose any damaged outer sheath and shall report all such damage to the Overseeing Organisation. The Overseeing Organisation shall be informed prior to the commencement of any operation to expose damaged cable and shall be allowed to be in attendance during the operation. The Contractor will be informed by the Overseeing Organisation whether a sheath repair shall be permitted. For cables installed on behalf of the Telecommunications Services Provider the criteria to determine whether a cable sheath repair is permitted or other action required shall be as defined in contract specific Appendix 15/3. Should sheath repairs be permitted the Contractor shall provide and install cable joint markers complying with sub-Clause 1516.9.
- 8 (02/17) No tests shall be carried out until the cable trench has been backfilled and the ground above the cable reinstated and the cable ends have been installed, unterminated, in the respective termination cabinets.

1519 (02/17) Labelling and Numbering

- 1 (02/17) Gantries, Cable Joint Enclosures (CJE), Above Ground Joints (AGJ), cable chambers, cabinets, signal posts and telephones shall be numbered and cables shall be labelled, in accordance with the details described in contract specific Appendix 15/1.
- 2 (02/17) Labels shall be as specified in contract specific Appendix 15/1. Labels shall be fitted so as not to compromise the IP rating of the cabinet or enclosure. The label material and fixing method shall be capable of lasting the design life of the equipment it is fitted to.
- 3 (02/17) The Contractor shall reference individual telecommunications services in correspondence and site records using the telecommunications service and SDP labelling information as provided and installed by the Telecommunications Services Provider and as stated in contract specific Appendix 15/3.
- 4 (02/17) Cables shall not be left unlabelled at any time, temporary labelling may be applied to facilitate testing and termination prior to the implementation of permanent labelling.
- 5 (02/17) All cabinets and enclosures containing power distribution and control equipment shall be labelled to indicate the source of supply, destination and user where this is a third party (e.g. Telecommunications Services Provider), circuit arrangements and test details in accordance with regulations. Refer to contract specific Appendix 15/1 for examples of such labels.
- 6 (02/17) Where the Contractor carries out modification work to existing cabinets, new labels shall be fitted in accordance with contract specific Appendix 15/1.
- 7 (02/17) The Contractor shall submit to the Overseeing Organisation for acceptance proposals for cabinet labels. The Contractor shall allow seven working days for acceptance of the proposals.
- 8 (02/17) Cabinets, enclosures and distribution equipment containing power shall be fitted with warning labels, as per the requirements in BS 7671.
- 9 (02/17) The Contractor shall refer to TSRGD for proportions and forms of numbers and letters for all external labels. External cabinet identification labels shall contain details of marker post number, carriageway designation letter and internal equipment, or cabinet function identification. Cabinet identification references shall be consistent across a scheme and with references used within record information and drawings. Text shall be upper case

and readable when standing adjacent to the cabinet. Cabinet labels shall be installed on the side of the cabinets facing the carriageway. At Electrical Interface (EI) locations, the label shall be fitted on each cabinet door due to orientation of the cabinet in the fence line.

10 (02/17) External labels for post 75 signal posts and target boards shall have numbers and upper case letters. The label shall be fitted as near to the bottom of the post as possible and viewed from the carriageway. The label can be fitted to the door if the signal obscures the bottom of the post e.g. when an Advanced Motorway Indicator (AMI) is fitted.

11 (02/17) External labels for gantries shall be fitted to each gantry leg facing traffic 2 m above road level.

12 (02/17) For telephone installations although the door may face the carriageway or downstream of the traffic direction, depending on installation, the header module shall always be oriented so that external labels face upstream and downstream.

13 (02/17) All cables shall be clearly and unambiguously marked to show details of cable destinations. At CJE's the cable shall be marked immediately adjacent to the CJE. At AGJ's the cable shall be marked immediately prior to the glanding of the cable before its entry into the terminal housing.

14 (02/17) Where the Overseeing Organisation's cables are terminated into cabinets or locations for which the Telecommunications Services Provider is solely responsible for maintaining then the Contractor shall identify the Overseeing Organisation's cables in accordance with the requirements in contract specific Appendix 15/3.

1520 (02/17) Not Used

1521 (02/17) Removal and Re-siting of Existing Equipment

1 (02/17) Existing communications equipment and infrastructure shall be removed or re-sited where required in the works, as detailed in contract specific Appendix 15/1. No equipment shall be removed or cables disconnected or cut until agreed by either the Overseeing Organisation or Telecommunications Services Provider (as appropriate).

The Contractor shall co-ordinate and schedule the deactivation of telecommunications services, re-siting of equipment, re-activation of telecommunications services and removal of telecommunications services and associated equipment and infrastructure as identified in contract specific Appendix 15/1 in accordance with a programme agreed with the Telecommunications Services Provider as and in compliance with the requirements of contract specific Appendix 15/3.

2 (02/17) Existing highway communications equipment, as detailed in contract specific Appendix 15/1, shall be removed in a manner that would enable its reuse and stored by the Contractor as directed by the Overseeing Organisation.

Existing equipment operated by the Telecommunications Services Provider shall be removed by the Telecommunications Services Provider. Cables and other infrastructure maintained by the Telecommunications Services Provider shall, as scheduled in contract specific Appendix 15/1, be removed or broken out and disposed of by the Contractor in compliance with Clause 201.

3 (02/17) Where the Telecommunications Services Provider is required to attend site and remove equipment no longer required or that requires re-siting, the notice period set out in contract specific Appendix 15/3 shall be given by the Contractor to the Telecommunications Services Provider.

4 (02/17) Conductors shall be disconnected from the equipment in which they are terminated, the terminal screws and glands re-tightened and the cable withdrawn clear of the equipment.

5 (02/17) Items of equipment to be re-sited shall be unbolted from their plinths or supports together with their holding down bolts, stored, and re-sited as described in contract specific Appendix 15/1. Plinths and concrete foundations shall be broken out and disposed of in compliance with Clause 201.

6 (02/17) Cables, including those to be removed, shall be located and marked at ground level by the Telecommunications Services Provider where these are maintained by the Telecommunications Services Provider or the Contractor in respect of other cables throughout their routes. The marking shall clearly distinguish the cables to be removed from other cables. The Contractor or Telecommunications Services Provider (as appropriate) shall also excavate trial holes to expose these cables at the pre-determined locations detailed in contract specific Appendix 15/2 together with the method of cable removal.

Where described in contract specific Appendix 15/2 the Contractor or Telecommunications Services Provider (as appropriate) shall excavate that part of the cable route carefully by hand. Where the cable to be removed is sharing a trench with other existing cables, on completion of removal, all stones and contaminated material shall be removed from the cable trench, clean sand and warning tape shall be provided and installed and the cable trench shall then be reinstated in compliance with Clause 1507; the Contractor or Telecommunications Services Provider (as appropriate) shall then remove and dispose of all unsuitable and surplus material in compliance with Clause 201.

Cable in ducts shall be carefully withdrawn. The Contractor or Telecommunications Services Provider (as appropriate) shall also fulfil the requirements for removal of duct seal, re-sealing and re-ropeing. Cables in troughs shall be carefully segregated and lifted out. The Contractor or Telecommunications Services Provider (as appropriate) shall also remove all trough lids, all debris from troughs and all sand from troughs. On completion the Contractor or Telecommunications Services Provider (as appropriate) shall provide and install clean sand, reinstate all trough lids, and provide and install new trough lids to replace any breakages caused during the preceding operation.

7 (02/17) The sites of cabinets, plinths and cable trenches shall be reinstated to the level of the surrounding ground unless otherwise described in contract specific Appendix 15/2.

8 (02/17) The disposal of any waste shall be in accordance to the Contractor's waste management plan.

1522 (02/17) Enforcement and Other Systems

1 (02/17) Secure equipment cabinets required for enforcement systems shall be installed in accordance with Clause 1508.

2 (02/17) The Contractor shall construct foundations for enforcement system camera masts as described in contract specific Appendix 15/1.

3 (02/17) Mountings, cable tray and other ancillary items for enforcement system equipment shall be installed as described in contract specific Appendix 15/1.

1523 (02/17) Detector Systems

1 (02/17) The installation of detector systems shall comply with the requirements of contract specific Appendix 15/1.

2 (02/17) Where detector loops are specified, detector loop installation and testing shall comply with Clause 1218. Other detection systems shall comply with the installation requirements detailed in contract specific Appendix 15/1.

3 (02/17) Any cabinet equipped for detector system use shall be installed in accordance with Clause 1508.

4 (02/17) Loop feeder cables shall be terminated as described in contract specific Appendix 15/1. The loop feeders shall be terminated in terminals complying with Clause 1514, secured to the equipment frame. Each feeder shall have 500 mm of cable coiled in the bottom of the cabinet to allow subsequent re-terminations. Each feeder shall be individually identified by means of a label.

1524 (02/17) Trial Pits

1 (02/17) Trial pits shall be excavated as described in contract specific Appendix 15/1.

1525 (02/17) Safeguarding the Existing Highway Communications Network

1 (02/17) The highway communications network forms part of the national network operated by the Telecommunications Services Provider and consequently any damage to equipment or infrastructure within the works area, including power supplies to the Telecommunications Services Provider's equipment cabinets, can have severe consequences to the system as a whole. The Contractor shall co-ordinate with the Telecommunications Services Provider a programme of works that supports the installation by the Telecommunications Services Provider of measures to maintain service continuity throughout the affected area (there may be more than one affected areas within the works boundary) and to implement temporary communications arrangements that allow the Contract to complete each phase of the works whilst minimising the disruption to the national communications network and local communications services. The requirements for implementing measures to maintain service continuity and for giving notice to the Telecommunications Services Provider to implement these measures and other temporary communications services are specified in contract specific Appendix 15/3. Any provisional agreements in respect of network bypass cables shall be scheduled in contract specific Appendix 15/1.

2 (02/17) Telecommunications services to be suspended (de-activated pending activation at a later date), re-located or removed by the Telecommunications Services Provider shall be as scheduled against location and equipment type in contract specific Appendix 15/1. Telecommunications services to be maintained using temporary arrangements are to be implemented by the Telecommunications Services Provider. In each case the Contractor shall give notice for service suspension, re-location, service removal and the implementation of temporary communications arrangements in accordance with contract specific Appendix 15/3.

3 (02/17) The Contractor shall give at least three weeks' written notice of the proposed change to the network, which shall have been identified in advance in the Contractor's programme. Any such proposal shall be subject to the agreement of the Overseeing Organisation and the Telecommunications Services Provider.

4 (02/17) The Contractor shall allow representatives of the Overseeing Organisation and the Telecommunications Services Provider access to all equipment within the works which has been identified as operational. The Contractor shall comply with the Telecommunications Services Provider's requirements for access to install, maintain and remove operational equipment and telecommunications bypasses as specified in contract specific Appendix 15/3.

5 (02/17) The Contractor shall recognise the importance of the need for the Telecommunications Services Provider to gain access for the maintenance and repair of temporary communications arrangements, particularly those that support the national communications network. The Contractor shall accommodate and prioritise requests made by the Telecommunications Services Provider to enable the repair of temporary communications arrangements to restore the Telecommunications Services Provider's services.

6 (02/17) Areas within the works boundary where the nature of the works performed has a potential impact upon the integrity of the national communications network and local telecommunications services shall be jointly identified and agreed between the Contractor, the Overseeing Organisation and the Telecommunications Services Provider. Measures to maintain service continuity throughout the affected areas, including any routes for the implementation of network bypass cables and to implement temporary communications arrangements shall be agreed between the Contractor, the Overseeing Organisation and the Telecommunications Services Provider.

7 (02/17) The Contractor shall be responsible for the provision of cable protection for network bypass cables and other temporary communications cables. The requirements for protection shall be as detailed in contract specific Appendix 15/3. The locations for the installation of cable protection and the measures to be applied over the entire length of network bypass cables shall be agreed with the Telecommunications Services Provider, taking account of the following.

- (i) The risk of damage due to construction work activities, including plant crossings.
- (ii) The risk of damage due to vandalism or theft, e.g. close exposure to public footpaths or known areas of vandal damage/theft.

- (iii) The close proximity to running traffic lanes and where the cables can only be located at a low level where they directly face running traffic, e.g. close proximity to running traffic with cables installed near to ground level – risk of damage by stones or other debris.
- (iv) The installation of protection infrastructure at carriageway crossings on over-bridges or gantries where this enables cable installation without the need to implement significant lane closures.

All of the above requirements shall apply to the full extent of network bypass cables and other temporary cabling including where they extend beyond the works boundary.

8 (02/17) Where, in accordance with criteria set out within contract specific Appendix 15/3, construction works are to be performed in close proximity to the Telecommunications Services Provider's buried services and infrastructure, then the Contractor shall provide notice to the Telecommunications Services Provider to attend site during periods of relevant construction work. The Contractor shall provide construction method statements and a programme of these works to the Telecommunications Services Provider. No construction works in close proximity to the Telecommunications Services Provider's buried services and infrastructure shall be performed by the Contractor without either:

- (i) the attendance at site by the Telecommunications Services Provider; or
- (ii) the written consent of the Telecommunications Services Provider.

1526 (02/17) The Inspection and Testing of Electrical Installations

1 (02/17) The Contractor shall carry out the inspection and testing of electrical installations in accordance with BS 7671. The Contractor shall provide inspection and completion certificates to the Overseeing Organisation in accordance with BS 7671 and to notice periods determined in contract specific Appendix 15/3.

2 (02/17) Where the inspection/ tests show that an existing electrical installation or earthing arrangement is not determined as safe in accordance with the requirements of BS 7671, the Contractor shall immediately notify the Overseeing Organisation giving full details of non-compliance. The Contractor shall not undertake any work on such an installation until written instructions have been issued by the Overseeing Organisation.

3 (02/17) Electrical inspection records, test results and electrical installation certificates shall form part of the records produced in compliance with Clause 1504.

4 (02/17) In the case where the Telecommunications Services provider shares power with the Overseeing Organisation the Telecommunications Services Provider shall, unless specified otherwise within contract specific Appendix 15/1, be responsible for the inspection and testing of the electrical installation from the point that the supply becomes for the sole use of the Telecommunications Services Provider.

1527 (02/17) Cable Installation at Transmission Stations

1 (02/17) Cables shall be installed into and terminated within transmission station buildings and transmission cabinets by the Telecommunications Services Provider.

2 (02/17) Unless detailed otherwise in contract specific Appendix 15/1 work shall not be undertaken in transmission station buildings or transmission cabinets by the Contractor without the approval of the Telecommunications Services Provider. The work shall be identified in the Contractor's programme and agreed with the Telecommunications Services Provider. The Contractor shall comply with the requirements for access to transmission stations and transmission cabinets to perform work as specified in contract specific Appendix 15/3. The Contractor shall ensure that no unplanned disruption occurs to any operational systems.

1528 (02/17) Modifications to Equipment and Circuitry associated with Existing Cabinets

1 (02/17) The Contractor shall carry out modifications to equipment and circuitry associated with existing cabinets as described in contract specific Appendix 15/1.

- 2 (02/17) The Contractor shall, prior to laying any cable to the cabinets, locate (including, as appropriate, scheduling the Telecommunications Services Provider to attend site and to mark buried services and infrastructure) the position of all cabling exposing all cables that are not in ducts by careful hand excavation and identify the type, size and designation of each cable.
- 3 (02/17) Where appropriate the Contractor shall undertake the following:
- (i) remove, retain for re-use, and reinstall the cabinet duct seals and base pea gravel;
 - (ii) remove and re-lay any hard-standing;
 - (iii) excavate to expose cable, remake loop and excavate cable routes;
 - (iv) reroute cable to gain sufficient lengths for the proposed modification;
 - (v) reinstate cable trenches;
 - (vi) break open and re-seal resin filled base;
 - (vii) disconnect and reconnect, undo existing gland and re-gland, including the provision of new ducts seals, gland assemblies and cable termination ancillaries where required;
 - (viii) withdraw and reinstall cables at cabinet base.
- 4 (02/17) Any work required to operational circuitry shall be undertaken by a representative of the Overseeing Organisation or Telecommunications Services Provider (as appropriate). The Contractor shall give at least two weeks' written notice and take into account any other notice periods that are in place as stated in contract specific Appendix 15/1 of the need for such work and shall, in respect of work to be performed by the Telecommunications Services Provider, comply with the requirements stated within contract specific Appendix 15/3.

1529 (02/17) Temporary Emergency Telephones

- 1 (02/17) Where described in contract specific Appendix 15/1, Temporary Emergency Telephones shall be installed for use by the public when it would otherwise be necessary for the public to cross either a live traffic lane or the works to use the nearest working Emergency Roadside Telephone. When not in use Temporary Emergency Telephones shall either be removed or covered up. The direction of Temporary Emergency Telephones shall be indicated in a manner agreed by the Overseeing Organisation at 100 metre intervals. The location and orientation of Temporary Emergency Telephones shall be agreed with the Overseeing Organisation.
- 2 (02/17) When Temporary Emergency Telephones are required they shall be supplied by the Overseeing Organisation or the Contractor as stated and detailed in contract specific Appendix 15/1.
- The use of Global System for Mobile Communications (GSM) or other wirelessly connected Temporary Emergency Telephones may be agreed by the Overseeing Organisation as detailed in contract specific Appendix 15/1.
- 3 (02/17) Locations for cable for Temporary Emergency Telephones shall be identified by the Contractor and the Telecommunications Services Provider. Providing the location of a Temporary Emergency Telephone is within close proximity (within 100 metre and on the same side of the carriageway) of an existing Emergency Roadside Telephone location, the Telecommunications Services Provider shall be responsible for the installation and termination of temporary cables to support local telecommunications services in accordance with the requirements stated in contract specific Appendix 15/3. The Contractor shall be responsible for the additional cost of works performed by the Telecommunications Services Provider where the location of any Temporary Emergency Telephone is not in close proximity of an existing Emergency Roadside Telephone.
- 4 (02/17) The Contractor shall give at least two weeks' written notice of the need for connections and disconnections from the live communications network by the Overseeing Organisation or Telecommunications Services Provider and, shall in respect of work to be performed by the Telecommunications Services Provider, comply with the requirements stated within contract specific Appendix 15/3.

5 (02/17) The Contractor shall install, place in position, maintain, cover up, uncover, reposition, re-cable and remove Temporary Emergency Telephones and associated work as necessitated by the progress of the works, and upon completion of the works return them to the Overseeing Organisation.

6 (02/17) Maintenance of Temporary Emergency Telephones connected onto the network shall only be undertaken by a representative of the Overseeing Organisation or Telecommunications Services Provider (as appropriate). The Contractor shall allow full access arrangements to representatives of the Overseeing Organisation and the Telecommunications Services Provider.

1530 (02/17) Cable Ducts General

1 (02/17) The term cable duct is used in this Series to describe the ducts, sub-ducts or conduits used for installing the highway communications cable network. The ducts shall comply with this Series and any other requirements described in contract specific Appendix 15/2. The Contractor shall be responsible for ensuring that all components used within the duct are compatible with each other and with existing ducts.

2 (02/17) With the exception of the cases listed in this sub-Clause below, cable ducts shall comply with the general essential requirements for cable management systems and for buried conduit systems under the Low Voltage Directive with a type 450N compression and impact resistance rating. The specification of cable ducts for the following cases shall be listed in the contract specific Appendix 15/2 in respect of:

- (i) ducts in transverse crossings installed using trenchless installation techniques;
- (ii) ducts located within or adjacent to filter drains, refer to sub-Clause 1531.13;
- (iii) ducts specified by the Telecommunications Services Provider in accordance of the Telecommunications Services Provider's standards for communications infrastructure ("The Telecommunications Services Provider's Duct Standards"), to meet the Telecommunications Services Provider's requirements in contract specific Appendix 15/3.

3 (02/17) Sub-ducts shall be either:

- (i) continuous HDPE sub-ducts with a Standard Dimension Ratio (SDR) of 11 or less installed between chambers, individual sub-ducts may be joined by low external profile mechanical or welded couplers, welded couplers shall not present an internal bead of sub-duct material that locally reduces the internal diameter of the sub-duct either by more than 3% or has a bead height of greater than 2 mm; or
- (ii) sectional HDPE or uPVC sub-ducts pre-installed into HDPE or uPVC outer main ducts as a modular arrangement using internal spacers and keyed coupler and duct sealing arrangements to prevent misalignment of sub-ducts and to preserve their colour coding between chambers, outer main duct and inner sub-duct seals to provide protection to at least IP47 for the sub-duct; or
- (iii) continuous or sectional HDPE sub-ducts moulded directly within an outer main duct with keyed coupler arrangements and duct sealing to prevent misalignment of sub-ducts, outer main duct and inner sub-duct seals to provide protection to at least IP47 for the sub-duct, individual sub-ducts, where exposed, shall be uniquely identifiable within chambers.

4 (02/17) For cable ducts identified in contract specific Appendix 15/2 to be handed over to the Telecommunications Services Provider upon completion of the works, the Contractor shall be free to elect whether the ducts to be handed over comply with the Overseeing Organisations standards or whether the ducts comply with The Telecommunications Services Provider's duct standards. Whichever duct standards are used the standard shall be applied consistently throughout the works. Chambers shall be positioned at all locations where there is a change to a ducting standard and the ducting systems are not directly compatible by the application of standard duct couplers to achieve a smooth and ridge free internal bore.

Where the Contractor elects to use The Telecommunications Services Provider's duct standards then The Telecommunications Services Provider's duct standards shall in the case of a change or conflict in requirements have precedence over requirements stated in Clauses 1530, 1531, 1532 and 1533, otherwise the requirements of these Clauses remain.

5 (02/17) The internal bore shall be smooth and even throughout the length of the duct and the duct joints to ensure the outer sheath of the cable is not damaged during installation.

6 (02/17) The use of ducts that are designed to be laid to a small bend radius and do not present a smooth bore for the installation of cables shall not be used as ducts for longitudinal cable routes. Use of such ducts shall only be permitted to avoid unforeseen obstacles within local ducts routes. Two sections of such ducts, each up to 3 m in length, separated by at least 6 m shall be permitted in a local duct route.

7 (02/17) With the exception of ducts in transverse crossings installed using trenchless installation techniques and unless otherwise described in contract specific Appendix 15/2 the sizes of the ducts shall be as shown on the contract specific drawings. The internal diameter of standard sized ducts shall be 150 mm, 100 mm or 50 mm. Non-standard sized ducts may be used where a duct is used to sleeve an existing duct or sub-ducts are installed.

8 (02/17) Ducts shall not be bent to internal radius less than the manufacturer's requirements.

The internal radius of installed ducts shall be such that the performance of the cable and duct is safeguarded following cable pulling.

9 (02/17) With the exception of ducts in transverse crossings installed using trenchless techniques and sub-ducts, the external wall of the ducts shall be self-coloured purple in accordance with National Joint Utilities Group publication "Guidelines on the Positioning and Colour Coding of Utilities' Apparatus".

10 (02/17) The materials from which the duct and fittings are made shall be treated so that they are protected from the deleterious effects of short term exposure to ultra violet light and shall be resistant to degradation by acids, alkalis, common chemicals, bacteria, fungi and moulds occurring in soils. The Contractor shall protect the duct and fittings on site in accordance with the manufacturer's written instructions.

11 (02/17) Each duct shall be fitted with a pigmented, rot-proof material draw cord of 5kN breaking load and having a design life of not less than 30 years, the ends of which shall be made fast within the chambers to which the duct is terminated. Draw cords shall be secured within a chamber. Draw cords shall not be knotted within ducts.

12 (02/17) Ducts in transverse crossings installed without a sleeve using directional drilling techniques conforming to the requirements of Series 8000 shall consist of four 100 mm internal diameter Medium Density Polyethylene (PE 80) pipes conforming to BS EN 12201-2 and any other requirements described in contract specific Appendix 15/2.

- (i) Where stated in contract specific Appendix 15/2, the number of ducts may be reduced. The pipe bores shall be smooth and even, and terminated in a chamber at each end.

13 (02/17) The ducts shall be securely bundled together and installed through the crossing with a minimum cover above the top of the combined bundle of eight times the reamed diameter of the bored hole. Each duct shall be tested after installation in accordance with the requirements of Clause 1533.

14 (02/17) The duct network shall be protected against the ingress of water to IPX7, and gases. This shall be achieved by the ducts having suitable joints and plugs or other proprietary duct sealing system that can easily be removed (excluding expanding foam) at the entry to all chambers and cabinets. In addition the Telecommunications Services Provider's requirements for duct plugs, sealing systems and sealing of ducts shall be as stated in contract specific Appendix 15/3.

15 (02/17) The minimum longitudinal duct provision is one communications duct of at least 100 mm diameter fitted with four sub-ducts complying with sub-Clause 1530.3 and of a sub-duct size to accommodate the Telecommunications Services Provider's cables. Ducts for local communications cables may either be incorporated as sub-ducts within a single longitudinal duct or as separate local ducts. Local ducts and separate ducts for power cables installed in the same trench as ducts for longitudinal communications cables need not be continuous throughout the duct network.

16 (02/17) The Contractor shall provide and install in the end of every duct and sub-duct and at every point of entry to chambers re-usable duct plugs or other proprietary duct sealing system that can easily be removed, excluding expanding foam, to achieve ingress protection rating of IP47 on completion of mandrel and air pressure tests. When cable is installed within the ducts, the sealing system will be replaced with a plug pre-formed with the appropriate cable port configuration or other proprietary duct sealing system that can easily be removed, excluding expanding foam, to maintain the ingress protection rating of IP47 after cable installation. The responsibility for the provision and installation of duct plugs or duct sealing systems shall be as stated in contract specific Appendix 15/2.

17 (02/17) After installation ducting shall not cause damage to cables when they are drawn through. Ducts shall be supplied with purpose made spacers and strapping in accordance with the manufacturer's requirements. The strapping shall bind the ducts tightly in the specified formation during installation, backfilling and for the whole life of the duct. Strapping shall be spaced longitudinally to ensure a duct separation of no more than 50 mm.

1531 (02/17) Installation of Ducts General

1 (02/17) Ducts shall be laid at the levels and lines shown on the contract specific drawings and schedules contained in contract specific Appendix 15/2. Longitudinal ducts shall generally be run parallel to the edge of the adjacent carriageway unless otherwise shown on the contract specific drawings. Transverse ducts shall cross at right angles to the carriageway unless otherwise shown on the contract specific drawings. Transverse duct crossings of existing carriageways shall be installed in accordance with the requirements of Series 8000 (MCHW 5.8.2). The exact location of the ducts shall be agreed with the Overseeing Organisation before the commencement of any associated works. Excavations shall comply with Clauses 502 and 602. Immediately following the excavation of the trench, the ducts shall be jointed and laid on the bedding material or prepared trench where the standard of duct installation does not require the duct to be laid on a bedding material. The deviation in level from that specified at any point shall not exceed 50 mm.

2 (02/17) Ducts and fittings shall be examined for damage and the joint surfaces and components shall be cleaned immediately before laying. Measures shall be taken to prevent soil or other material from entering ducts, and to anchor each duct to prevent movement before the work is complete.

3 (02/17) Ducts, other than those in structures using conduits, shall be installed in trenches. The trenches and the fill shall be such that compaction, either during installation or after by use, e.g. a vehicle, shall not crush or damage the ducting; or distort its route such that pulling a cable through will damage the cabling.

The bed and surround for ducts shall be granular material to Clause 503.3. This shall provide a minimum depth of cover to the uppermost duct of 50 mm. The minimum cover depth of overall backfill in non-hardened verges shall be 600 mm in respect of longitudinal ducts and 350 mm in respect of local ducts, the balance comprising of Class 8 material in accordance with Clause 602 and Table 6/1. Alternative installations or where minimum cover cannot be achieved shall be as stated in contract specific Appendix 15/3 subject to agreement with the Overseeing Organisation and Telecommunications Services Provider.

4 (02/17) Transverse crossing ducts shall be installed in granular material to Clause 503.3(i). For shallow transverse crossing ducts with between 750 mm and 1200 mm cover the fill above the ducts shall be replaced with ST2 concrete to Clause 2602, a minimum depth of 150 mm above the ducts. Backfill shall be in accordance with Clause 505.

5 (02/17) For installation of transverse ducts on existing highways, a line and level drainage survey shall be conducted in order to determine the appropriate depths of the ducts to avoid groundwater.

6 (02/17) Duct joints shall have the following characteristics:

- (i) The joint and duct shall be free from burrs and other irregularities that may cause damage to cables when they are drawn through the duct.
- (ii) The joint shall hold and maintain the ducts in axial alignment during installation and afterwards when subjected to foreseeable ground movement in accordance with the manufacturer's written instructions. Requirements for duct joints are defined in contract specific Appendix 15/2.

- (iii) The joint shall not compromise the duct network protection of ingress protection rating IP47.
- 7** (02/17) Cable duct configurations, and any alternative or additional requirements for bedding, haunching, surround, backfilling, surfacing or reinstatement shall be as in contract specific Appendix 15/2.
- 8** (02/17) Backfilling shall be undertaken immediately after the required operations preceding it have been completed.
- 9** (02/17) Trenches for the cable ducts shown shall be backfilled with Class 8 lower trench fill material, as described in sub-Clause 3 of this Clause and sub-Clause 1507.19.
- 10** (02/17) For duct trenches requiring topsoiling, grass seeding and/or turfing shall be as described in Clauses 618 & 3005, and shall be placed in the top 150 mm of the cable duct trench unless otherwise specified in contract specific Appendix 15/2.
- 11** (02/17) In order to prevent damage from other works, all trenched ducts shall have marker tape laid within the trench excavation at a depth of 150 mm or at the Class 8 topsoil interface whichever is the greater depth.
- 12** (02/17) Prior to the interruption or extension of the cable duct network the Contractor shall confirm the operational and future status of cables within the duct route to be interrupted. Where there is a requirement to permanently remove or pull back cables within a duct route the Contractor shall liaise with the Telecommunications Services Provider and co-ordinate the works with them.

The Contractor shall comply with Telecommunications Services Provider's requirements for interruption or extension of the cable duct network as detailed in contract specific Appendix 15/3.

Following the completion of the works necessitating the interruption of a duct route, chambers shall be installed at the interface to the new section of duct. Chambers shall be installed at each end of the new duct route and at any intermediate transition points where any of the following conditions are met:

- (i) the new duct section is routed through a structure; or
- (ii) the new duct section includes a change of direction, horizontal axis and/or a step change in the vertical axis, of the duct route that would otherwise impede the continuous pulling of cables through the completed duct route; or
- (iii) the total length of the new duct section includes more than ten intermediate duct joints or a distance of >50 m whichever is the greater; or
- (iv) where there is a change of ducting standard or duct types that cannot be directly mated to each other.

Where the above criterion is not met then new sections of duct may be mated with existing ducts without installing new chambers.

New sections of duct installed between chambers shall be tested and proved in accordance with Clause 1533. Existing duct mated directly to a section of new ducting shall be cleaned and swabbed prior to the installation of new cables or re-installation of old cables. There shall be no need to air pressure test existing sections of duct.

13 (02/17) Ducts shall be provided for armoured or unarmoured cables that are laid across or within 500 mm of filter drains. The ducts shall be surrounded with 150 mm of ST2 concrete in compliance with Clause 2602. Where a duct crosses the filter drain it may be necessary to provide additional drainage capacity or other measures to compensate for the volume occupied by the duct and associated concrete surround. The Contractor shall provide the Overseeing Organisation with details of the proposed arrangements for additional capacity or other measures for acceptance. This shall be clearly identified in the Contractor's programme of works. In the event that a duct route coincides with the line of a filter drain an alternative duct line shall be determined. Any damage caused by the Contractor to any drain shall be satisfactorily repaired and reinstated at no cost to the Overseeing Organisation. It shall be the responsibility of the Contractor to identify to the Overseeing Organisation any existing damage to drains prior to the commencement of works.

14 (02/17) Where cables are subsequently to be laid by the Telecommunications Services Provider, the Contractor shall lay sacrificial ducting along the cable route leaving cable pulling pits at intermediate locations in accordance with the Telecommunications Services Provider's requirements in contract specific Appendix 15/3. Details of sacrificial duct routes, lengths, number, type and depth of sacrificial ducting, the requirements for reinstatement and locations of intermediate cable pulling pits shall be as specified in contract specific Appendix 15/2.

1532 (02/17) Chambers for Highway Communications Cables

1 (02/17) Chambers shall be constructed of materials of sufficient strength for the purpose. The walls, base and top shall be of sufficient strength to prevent collapse and settlement for the local soil conditions, depth of chamber, number of ducts passing through the wall, weight of cover and frame and any additional force, for example a vehicle, that may be applied to the top of the chamber. In addition to these requirements, plastic chambers shall be installed to manufacturer's requirements.

Chambers shall be as detailed in the schedule in contract specific Appendix 15/2 and the Telecommunications Services Providers requirements in contract specific Appendix 15/3. Chambers may be designated by type (size and usage) by a letter (A to E).

2 (02/17) Chambers shall:

- (i) be used solely for highway communications cables, including power cables used for highway communications;
- (ii) be located at the interface point to duct sections installed through a structure or under a carriageway;
- (iii) be located where a section of duct includes a change of direction, horizontal axis and/or a step change in the vertical axis, of the duct route that would otherwise impede the continuous pulling of cables through the completed duct route.

3 (02/17) The exact location, size and usage of these chambers shall be agreed with the Overseeing Organisation and the Telecommunications Services Provider (as appropriate) on site prior to the commencement of any associated works.

4 (02/17) Brickwork chambers shall comply with the Series 2400 and be built with mortar designation in English bond. The joints of brickwork where exposed shall be finished as specified for un-pointed joints in Clause 2412. The ends of all ducts shall be neatly built into the brickwork and finished flush with mortar designation to prevent the ingress of water. The walls of the chambers shall be 225 mm in thickness and shall be treated with waterproofing material to prevent the ingress of moisture.

5 (02/17) Precast concrete chambers shall comply with BS 5911-3 Concrete Pipes and Ancillary Concrete Products – Specification for Unreinforced and Reinforced Concrete Manholes and Soak-a-ways and BS EN 1917 Concrete Manholes and Inspection Chambers, Unreinforced, Steel Fibre and Reinforced. Cast in situ chambers shall be constructed of ST4 concrete complying with Clause 2602 unless otherwise described in contract specific Appendix 15/2.

6 (02/17) Chambers may be constructed from plastic units that comply with the requirements of BS 5834-4. Where plastic chambers are comprised of multiple sections, all sections shall be sealed in accordance with the manufacturer's requirements to prevent the ingress of water throughout the intended design life of the chamber. The foundation and backfill for plastic chambers is location specific and shall be as described in Appendix 15/2.

7 (02/17) The design of the chamber shall allow sufficient access for a person to enter and exit the chamber, access to the ducting, and provide a safe working environment appropriate to the needs and purpose of the chamber that would allow industry standard interchangeability. The design of the chamber shall take into account all hazards that could occur as a result of a confined space.

Where steps are required for entry and exit from the chamber these shall conform to BS EN 13101. Hinged covers shall allow safe access without the cover unintentionally closing. Access shall be possible by a single person.

The dimensions for chamber cover openings and chamber length and breadth shall be described in Appendix 15/2.

Where the depth of chambers exceeds 900 mm below the finished surface of the carriageway or the adjacent ground, manhole steps complying with BS EN 13101 shall be included.

8 (02/17) Chamber covers, gratings and frames shall be as described in contract specific Appendix 15/2 and shall comply with BS EN 124:1994. Chambers containing a joint shall be equipped with 2 x 100 mm access ports to chambers for the installation of network bypass (interrupter) cables. Reinforced concrete cover slabs shall be installed at the top of the chamber on all sides to provide suitable support for the chamber covers to be installed.

Where access ports are required for temporary interrupter cables these shall be agreed by the Telecommunications Services Provider as stated in contract specific Appendix 15/2.

9 (02/17) Where required by contract specific Appendix 15/2, lockable chamber covers or other measures to deter unauthorised access to chambers shall be provided. Where the telecommunications infrastructure is provided for the operation and maintenance of the Telecommunications Services Provider lockable covers shall also meet requirements in contract specific Appendix 15/3. The Contractor shall supply four sets of keys for each type of locking system to the Overseeing Organisation and four sets of keys for each type of locking system to the Telecommunications Services Provider.

10 (02/17) Four sets of chamber cover lifting keys as described in contract specific Appendix 15/2 shall be delivered to the Overseeing Organisation and to the Telecommunications Services Provider for each type of cover supplied.

- (i) Additionally, a suitable cover lifter shall be delivered for each type of cover to the Overseeing Organisation or Telecommunications Services Provider, as appropriate, where the mass of an individual cover exceeds manual handling regulations or as stated in contract specific Appendix 15/2.
- (ii) The quantities of cover lifters, required for compliance with manual handling regulations, shall be as stated in contract specific Appendix 15/2.

11 (02/17) Frames for chamber covers gratings shall be set in cement mortar complying with Clause 2404 or a suitable proprietary quick setting mortar of equivalent strength.

12 (02/17) The chamber shall contain a sump to allow water to collect and drain away such that no water shall collect in the bottom of the chamber. The size of the sump and position shall not affect the integrity of the structure or be too large to prevent a person to be able to stand and work from the bottom of the chamber.

The sump shall feed to a soakaway or highway drainage system that shall allow water entering the chamber to collect and drain away. The sump and soakaway capacity, or sump and drainage system shall be based on the location of the site including its varying water table throughout the year.

The sump shall be of sufficient size to fit a pump and shall be as agreed with the Telecommunication Services Provider and stated in contract specific Appendix 15/3.

Details of the drainage system shall be shown in contract specific Appendix 15/2.

13 (02/17) Chambers shall be clearly identified by the legend "HIGHWAY COMMUNICATIONS", on each cover. Where covers have a concrete infill, a non-corrodible plate showing the above information shall be cast into the concrete flush with the concrete surface.

14 (02/17) All chambers shall be referenced to their longitudinal position along the carriageway with an accuracy of ± 1 m. The measurement point for each chamber will be the centre of the chamber cover. The longitudinal position of the chamber, and where used the chamber reference number, shall be clearly displayed on the chamber apron or on a concrete block placed immediately adjacent to the cover. The longitudinal position shall be in the form of an address comprising the marker post reference, offset to the marker post, carriageway identification and chamber reference.

15 Where required in contract specific Appendix 15/3 Technology Performance Management Services (TPMS) barcode label mounting plates shall be provided.

- 16 (02/17) Where detailed in contract specific Appendix 15/2, stub ducts shall be incorporated into the chamber construction. Ducts shall be as described in Clause 1530 and are either to be plugged in accordance with sub-Clause 1530.14 or proprietary inserts or other proprietary duct sealing system that can easily be removed, excluding expanding foam. Details of sealing system shall be supplied by the Contractor for acceptance of the Telecommunications Services Provider as defined in the Contractors programme of works.
- 17 (02/17) Where a Chamber, installed as part of a cross carriageway duct crossing, does not lie on the line of the longitudinal network, a second chamber shall be constructed on the line of the longitudinal network under and connected to the cross carriageway duct crossing chamber by means of a 4-way duct.
- 18 (02/17) Where the water table is within 2 m of the ground surface, or the ground is poorly drained, the chambers shall be surrounded by a minimum thickness of 150 mm ST4 concrete to reduce the potential for water ingress, detrimental deformity or movement. Specific requirements will be defined in contract specific Appendix 15/2.
- 19 (02/17) To accommodate the form of construction used for the chamber the spacing between local ducts entering the chamber shall be within 100 mm of one another.
- 20 (02/17) Chambers shall be constructed so that their covers are raised 50 mm above the level of the adjacent ground and the in-situ concrete hard-standing area surrounding chambers laid to falls to the adjacent ground level to prevent ponding of water over and adjacent to the chambers. The fall shall be formed of a 150 mm minimum deep layer of ST4 concrete to Clause 2602 with a U2 surface finish. In order to maintain long term stability reinforcement shall be applied. The raised covers shall not cause a trip hazard.
- 21 (02/17) Where type A chambers are required for telecommunications cable joints, cable joint bearer systems will be installed within the chamber. The cable brackets shall be equipped with two CJE cable bearers, but shall be capable of supporting an additional bracket for a third CJE if required. Where more than three CJEs are required, an additional type A chamber shall be provided. Where power cables enter a chamber equipped for CJEs, these cables shall be installed in such a way that the extraction of the CJE from the chamber for maintenance is not impeded by the power cables. Specific requirements for cable bearers will be defined in contract specific Appendix 15/2.
- 22 (02/17) All ducts shall enter the chamber wall perpendicularly such that the drawing of cables through the ducts shall not cause any damage to the cables, and shall be sealed to prevent the ingress of water unless otherwise stated in contract specific Appendix 15/3.
- 23 (02/17) Type B chambers shall not be used for the housing of CJEs, where power cable reduction joints are required, or where power cable size exceeds 70 mm².
- 24 (02/17) For type A chambers, longitudinal sub-duct ducts may be continuous through the chamber where no access to the cables within is required.
- 25 (02/17) For type B chambers, longitudinal ducts may be continuous through the chamber where no access to the cables within is required.
- 26 (02/17) The maximum depth of type B chambers shall be 1300 mm, measured from the underside of the chamber cover and the base of the chamber. Where the depth of transverse ducts dictates a greater depth than 1300 mm, the use of a more suitable chamber, such as a type A chamber shall be considered.
- 27 (02/17) Type C chambers shall not be used for the housing of CJEs, where power cable reduction joints are required, where power cable size exceeds 25 mm² or as an interface to equipment cabinets.
- 28 (02/17) The chamber size shall be selected to ensure that cable minimum bend radii and maximum cable tension parameters during installation according to TRH 2583 or the cable manufacturer's written specification are not exceeded.
- 29 (02/17) The chamber shall have a design life of not less than 30 years unless otherwise stated in contract specific Appendix 15/2.
- 30 (02/17) The chamber shall have an area of hard-standing around it to allow for safe working and lifting of covers. It shall be flush with the finished ground level. The hardstanding, cover and frame shall be sufficient for the loading that might be placed on it including any vehicles, and have life span of a minimum of 30 years unless otherwise stated in contract specific Appendix 15/2.

1533 (02/17) Proving and Testing of Ducts

- 1 (02/17) Longitudinal and cross carriageway cable ducts shall be proved by drawing a mandrel of 150 mm length through each as the ducts are laid. Local ducts from chambers to cabinets shall be proved by drawing through each completed length of duct a spherical mandrel. The mandrel will have a diameter of 10% less than the internal bore of the duct. On the successful completion of each mandrel test the Contractor shall certify compliance of the duct and immediately seal the duct in accordance with sub-Clause 1530.14.
- 2 (02/17) Longitudinal and cross carriageway cable ducts within a ducted non-armoured cable network shall be tested in chamber-to-chamber sections by means of the air test described in sub-Clause 1533.3. On the successful completion of each test the Contractor shall certify compliance of the duct and immediately seal the duct in accordance with sub-Clause 1530.14.
- 3 (02/17) To undertake the test, air shall be pumped in by suitable means until a stable pressure of 100 mm head of water is indicated in a U-tube connected to the system. The air pressure shall not fall to less than 75 mm head of water during a period of five minutes without further pumping, after an initial period to allow for stabilization.
- 4 (02/17) Continuous sections of ducts and sub-ducts, including sub-ducts jointed as part of a modular inner and outer duct arrangement, shall be tested and proven by blowing a close fitting foam plug or similar arrangement that tests the integrity of the duct in respect of diameter and air-tightness in a single operation. There is no requirement to additionally test the outer main duct that houses a sub-duct. The design and dimension of the foam plug shall inhibit the progression of the foam plug within the duct where the diameter of the duct has suffered deformity or presents a discontinuity in size that is outside of the duct manufacturer's written specifications.
- 5 (02/17) No testing and proving of sacrificial ducts shall be required prior to the installation of armoured cables. The Contractor shall satisfy themselves that the sacrificial duct is fit for purpose and the Telecommunications Services Provider (where applicable) will be able to correctly install the armoured cable.
- 6 (02/17) The Contractor shall comply with any additional or amended requirements in respect of the proving and testing of ducts as contained within contract specific Appendix 15/3.
- 7 (02/17) A register of mandrel and air test certificates shall be maintained by the Contractor as appropriate and handed to the Overseeing Organisation and Telecommunications Services Provider on the successful completion of the ducting work.

1534 (02/17) Closed Circuit Television

- 1 (02/17) Unless specified otherwise in contract specific Appendix 15/1 the camera and outstation equipment for closed circuit television (CCTV) shall be provided by the Contractor in accordance with specifications MCE2135, Pan tilt zoom cameras, MCE2241, fixed cameras, and MCE2536.
- 2 (02/17) The provision of cabinets and ancillary items for CCTV shall be as described in contract specific Appendix 15/1.
- 3 (02/17) The Contractor shall install and commission CCTV equipment in accordance with the requirements detailed in contract specific Appendix 15/1.
- 4 (02/17) The provision of masts shall be as scheduled in Series 1300 contract specific Appendices.

1535 (02/17) Provision of the Telecommunications Services

- 1 (02/17) In the case where the Contractor provides the telecommunications services, the requirements in respect of the telecommunications services shall be contained in contract specific Appendix 15/1.
- 2 (02/17) In the case where the Telecommunications Services Provider provides the communications infrastructure, the requirements in respect of communications infrastructure to support the provision of the telecommunications services shall be contained in contract specific Appendices 15/1, 15/2 and 15/3.

3 (02/17) In the case where the Telecommunications Services Provider provides the telecommunications services the Contractor, in addition to the requirements specified elsewhere in this 1500 Series, shall comply with the Telecommunications Services Provider's requirements detailed in contract specific Appendix 15/3 in respect of the following.

- (i) Designs for Telecommunications Services including authorised changes to designs and departures from the Telecommunication Services Provider's standards.
- (ii) The confirmation of accommodation requirements for the installation of the Telecommunications Services Provider's equipment within the Overseeing Organisation's cabinets including the allocation of space and power supply load allocation, total power dissipation, and power supply distribution arrangements within the Overseeing Organisation's cabinets.
- (iii) Changes or additions to the telecommunications services contained in contract specific Appendix 15/1 and the processes relating to any changes or additions to the telecommunications services including any associated change control, design, ordering and notification periods.
- (iv) The provision and updating of service configuration information related to the telecommunications services, including geographic, IP, URL or other electronic address information as appropriate to the telecommunications service and/or the roadside and central control system technologies.
- (v) The Telecommunications Services Provider's process related to the activation and deactivation of telecommunications services, including methods of notification offered by the Telecommunications Services Provider and associated notification periods as part of any request for the activation and deactivation of telecommunications services.
- (vi) The inspection, witnessing and acceptance criteria with respect to the installation of communications infrastructure and cabinets provided by the Contractor and associated pre-installation requirements of the Telecommunications Services Provider.
- (vii) The processes, including notification, reporting and periods for remedial actions associated with any defects and remedial works that result from the Telecommunications Services Provider's inspection, witnessing and acceptance activities with respect to the installation of communications infrastructure and cabinets.
- (viii) The provision of copies of electrical test certificates prior to the Telecommunications Services Provider's connection to the Contractor's or Overseeing Organisation's power supplies.

1536 (02/17) Electricity Connections

1 (02/17) The type of electricity connection, whether an exit point with standard Distribution Network Operator (DNO) single or a more secure dual feed (i.e. incoming feeds from two primary sub stations) shall be agreed with the Overseeing Organisation and shall be as stated in contract specific Appendix 15/1.

2 (02/17) The Contractor shall record all equipment that is connected and disconnected from the roadside electricity supply during the works with a date and time of the connection/disconnection. They shall provide this information to the Overseeing Organisation within five working days of the connection/disconnection or as agreed by the Overseeing Organisation.

3 (02/17) The Contractor shall provide infrastructure for the electricity DNO for electricity connections to roadside technology and infrastructure.

4 (02/17) The Contractor shall provide the required total load requirements and equipment types to the DNO. The information shall be sufficient for the DNO to provide the correct supply capacity and phase, single and multiple, at an exit point.

5 (02/17) The Contractor shall provide the DNO the information required for both metered and unmetered exit points. Equipment to be connected to unmetered exit points must possess an Unmetered Supplies User Group (UMSUG) charge code.

- 6 (02/17) For any equipment without charge codes, the Contractor shall request one from UMSUG at Elexon.
- 7 (02/17) The Contractor shall agree with the DNO and Overseeing Organisation access requirements for meter reading and maintenance.
- 8 (02/17) The electricity supplier shall fit the supply meter. This shall remain in their ownership.
- 9 (02/17) In the case of a DNO offer for a three phase supply capacity at an exit point being slightly above the DNO single phase limit, then discussions shall be started with the DNO to ascertain whether a single phase supply could be offered.
- 10 (02/17) Where the provision of three phase supply is the only viable means of obtaining an exit point, the Contractor shall:
- (i) clarify the responsibility for balancing the load with the DNO;
 - (ii) comply with any DNO requirements for balancing the load across the three phases;
 - (iii) in the case of double span gantries that require equipment to be fed from separate phases the Contractor shall ensure the risk of receiving shock at 400V is eliminated;
 - (iv) in areas where equipment fed from separate phases are within reach of each other, clear warning labelling shall be provided to BS7671 section 514.10.1;
 - (v) the Contractor shall ensure a switch is available to isolate both sides of a double span gantry.
- 11 (02/17) The Contractor shall ensure electricity connections provided by the DNO to be a Protective Multiple Earthing (PME) termination (TN-C-S) including the provision of a customer earth terminal.

In the case where the DNO will not provide a PME terra terra (TT) termination the Contractor shall ensure that additional protective equipment is installed.

If a PME (TN-C-S) is not offered in the proposed location, the DNO may agree to a PME termination in the following circumstances:

- (i) the 609 EI cab is installed in an enclosed area fenced off from public access;
- (ii) installation a Class II 609 EI cabinet.