

MOTORWAY COMMUNICATIONS

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Motorway Communications

1501 Introduction

- 1 Motorway communications installations shall comply with this Series.

1502 General Requirements

- 1 The Contractor shall:
 - (i) unless otherwise described in Appendix 15/1, supply, deliver, store and install communications cables including fibre optic cables, power cables, detector loop and feeder cables; and
 - (ii) supply, deliver, store and install cabinets and ancillary items as listed in Appendix 15/1, unless otherwise described therein; and
 - (iii) supply, deliver, store and install all associated cable fittings, as described in Appendix 15/1, terminate cables in compliance with Clauses 1515 and 1516 and test the installations in compliance with Clauses 1515 and 1518.
- 2 All operations shall be arranged so that the communications installation is completed, tested and the test results approved by the Engineer at least 8 weeks before the date for completion of the Works and, where required in Appendix 15/1 any Section thereof, in order to allow time for the Engineer to commission the system. The Contractor shall allow sufficient time in his programme for any repairs and retesting which may be required to be completed satisfactorily before the aforementioned 8 week commissioning periods.
- 3 The Contractor shall provide facilities for the electricity supplier for service connections and for the Engineer for commissioning of the system.
- 4 The Contractor shall demonstrate, in advance of commencing cable installation work, competency to undertake the necessary cable termination and testing requirements detailed in Clauses 1511, 1513, 1515, 1516 and 1518, to the satisfaction of the Engineer. The Contractor shall allow sufficient time in his programme to achieve compliance; 14 days notice, in writing, to the Engineer is required. The written consent of the Engineer shall be obtained before cable installation commences.

1503 Materials Equipment and Workmanship

- 1 Materials and equipment supplied by the Contractor and his workmanship shall comply with the National Rules for Electrical Installations published by the Electro-Technical Council of Ireland and the rules and regulations of the electricity supplier.
- 2 All such equipment shall be sufficiently compact for satisfactory installation and operation in the accommodation provided for it.
- 3 The Contractor shall ensure that enclosures, following the drilling cutting or removal of cable entry knockouts, maintain the manufacturer's quoted IP Classification ratings and are cleaned of all waste and surplus material prior to any further work being undertaken.

1504 Site Records

- 1 The Contractor shall keep a daily record in duplicate in a clear and legible form, on drawings, of all work carried out as it proceeds. One copy shall be kept available for the use of the Engineer during the Contract and shall, at completion certificate stage of the contract, be handed to the Engineer for record purposes. (Handover during maintenance period is not acceptable). The following information shall be recorded on the drawings:
 - (i) Cable routes, including cable lengths;
 - (ii) Cable size, type and drum number;
 - (iii) Cabinet positions and type;
 - (iv) Power supply interfaces;
 - (v) Telecom and other interfaces;
 - (vi) Transmission stations;
 - (vii) Signals;
 - (viii) Telephones;
 - (ix) Joint and sheath repair positions;
 - (x) Duct locations including depth, number of ducts, duct material and the number and type of cable in each duct;
 - (xi) Cabinet references;
 - (xii) Any additional requirements stated in Appendix 15/1.

The drawings shall be subject to the approval of the Engineer at weekly intervals during the Contract.

- 2 Locational measurements shall be taken of the underground equipment to the nearest 100 mm from the nearest edge of the carriageway or fence line. Offsets to the cables shall be recorded at 20 m intervals and at every change of direction along the line of the cable unless otherwise directed by the Engineer. Offsets shall be defined longitudinally by distance from a permanent road feature, a marker post or other point agreed with the Engineer.
- 3 The Contractor shall keep a daily record of the work in sufficient detail including type and drum number of underground cables to enable site records to be completed. A copy of the daily record shall be provided by the Contractor on the next working day for retention and use by the Engineer.

1505 Cabinets and Ancillary Items

- 1 Cabinets and ancillary items include cabinet bases, cabinet fittings, equipment mounting posts, and other similar items.
- 2 The Contractor shall be responsible for safe storage of the equipment including the provision of a dry heated store as described in Appendix 15/1. All equipment shall be secured by means of master keys, of which 2 originals of each shall be supplied to the Engineer on the completion of the Works.
- 3 The Contractor shall maintain an up to date record of all equipment, including cable. The record shall include details of the number and type of equipment and serial numbers (drum numbers for cable).

1506 Cables

- 1 Communications cable shall consist of one or more of the following as required in Appendix 15/1:
 - (i) armoured multi-pair cable to the Specification given in Appendix 15/1;
 - (ii) fibre optic single mode cable to the Specification given in Appendix 15/1.
- 2 Power supply cable for communication systems shall be armoured split concentric made to the Specification given in Appendix 15/1 and laid

as described therein. Where installations require power cables incorporating larger conductors than 25 mm² then XLPE/SWA/PVC cables to BS 5467 shall be provided and installed by the Contractor.

- 3 The approximate positions of cables to be installed and their terminating cabinets are described in Appendix 15/1. The exact location shall be agreed with the Engineer before the commencement of any associated ground work. At this time the Contractor shall also provide the Engineer with a schedule of cable lengths and their locations, after checking the lengths of cable routes on the Site.
- 4 Each drum of cable delivered to the Site shall be accompanied by duplicate copies of test certificates bearing the cable description and the name of the manufacturer. No cable length shall be laid until its manufacturer's test certificate has been accepted by the Engineer and the Contractor has tested and accepted the integrity of the sheath in accordance with the cable test specification. The results of the Contractor's tests shall be notified to the Engineer. The location in the ground of cable lengths by reference to their drum numbers shall be kept with the daily records.
- 5 The location of buried cables shall be detected, confirmed and protected in accordance with the Conditions of Contract, "Special Requirements in Relation to Motorway Communications Systems" and any additional requirements determined by the design.
- 6 The Contractor is responsible for the safe and secure storage of all cable. The Contractor shall keep and maintain a register of all cable drums; the register shall for each cable drum include the cable drum number, cable size and length(s) of cable removed. Both ends of each cable are to be sealed as protection from the ingress of moisture.

1507 Cable Laying

- 1 Service ducts shall comply with Clause 501 and Appendix 5/2 and be installed in accordance with Clauses 502, 503, 504, 505, 509 and 512.
- 2 Cable covers for protection of underground cables shall comply with BS 2484 and shall be installed as described in Appendix 15/1. When cable covers are installed marker tapes are not required.
- 3 Cable trenches shall be excavated to the lines described in Appendix 15/1 and in accordance

- with Clause 602. The depth of excavation shall be such that cables laid under verges, footways or open ground shall have a minimum cover of 600 mm and under carriageways of 750 mm, or 300 mm below formation, whichever is the greater depth.
- 4 Where agreed by the Engineer cable may be installed using a purpose built cable laying machine.
 - 5 Cables shall be laid without sharp bends and kinks and in accordance with any particular requirements in Appendix 15/1. If required, additional protection and support shall be provided as described in Appendix 15/1 or as directed by the Engineer. Communication cables shall be installed without mechanical pulling.
 - 6 Where cables are laid across or within 500 mm of filter drains they shall be contained within a duct. The ducts shall be surrounded with 150 mm of mix ST2 concrete in compliance with Clause 2602. In the event that a cable route coincides with the line of a filter drain the Contractor shall inform the Engineer prior to continuing the trenching operation; an alternative trench line shall be agreed. Any damage caused by the Contractor to any drain shall be repaired and reinstated to the satisfaction of the Engineer at no cost to the Employer.
 - 7 Communications cables following the same route shall, unless otherwise described in Appendix 15/1, occupy the same trench with a clearance of 50 mm between the outer sheaths of the cables. Communication cables shall have a clearance of 150 mm between them and the outer sheath of associated power cables. Non associated power cables and other services shall be given a clearance of 300 mm, unless otherwise described in Appendix 15/1.
 - 8 Cables shall only be laid when the ambient temperature is above 0°C, and the cable has been stored at a temperature greater than 0°C for the previous 24 hours.
 - 9 Cables shall not be bent to an internal radius of less than 12 times the external diameter of the cable or less than the radius recommended by the manufacturer, whichever is greater.
 - 10 Sufficient length of cable shall be allowed for its correct termination. When termination does not proceed immediately following the installation of the cable, its end shall be sealed against the ingress of moisture. An additional loop of cable shall be allowed for at cabinet sites to enable future re-termination to be carried out.
 - 11 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.
 - 12 Unless otherwise directed by the Engineer, cables laid in trenches shall be both bedded on and covered by a 75 mm thickness of sand passing a 2 mm sieve to BS 410. Class 1C material complying with Table 6/1 and compacted to the requirements therein shall be deposited to a thickness of 175 mm prior to further backfilling to comply with sub-Clause 15 of this Clause.
 - 13 A green self-coloured PVC or polythene plastic tape for cable marking not less than 0.1 mm thick and 150 mm wide with the wording "Caution Telephone Cables" printed along the full length so as to occupy not less than 75% of its available length and occurring at least at 1 m intervals, shall be laid approximately 250 mm above any communication cable. Where several cables are laid in one trench, only one line of marker tape need be installed, unless otherwise directed by the Engineer. The wording on the tape shall be "Electricity Cables" where power supply cables and communication cables are laid in one trench, and the tape shall be yellow.
 - 14 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 rope. On completion of cabling and prior to backfilling, ducts shall be left with a draw rope in place and then re-sealed with split plugs, or suitable alternative material, to adequately seal the ducts against the ingress of foreign matter. Where cables are laid in troughs they shall be covered with sand passing a 2 mm sieve to BS 410 or equivalent material up to the level of the cover.
 - 15 Backfilling to trenches shall not take place until they have been inspected and approved by the Engineer. Backfilling shall be in accordance with Clause 602 with material Class 1 or 2 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. Power hammers shall not be used within 300 mm of cables, ducts or troughs. The surface shall be reinstated as described in Appendix 15/1.
 - 16 As unburied or exposed cable is liable to theft and/or vandalism, no cable is to be left exposed at the end of any work period. Any cable stolen and/or vandalised as a result of the Contractor's non-compliance with this

requirement shall be replaced by a length equal to the original unbroken total length of cable involved (i.e. through joint(s) will not be accepted), at the Contractor's own cost which also includes the cost of the replacement cable.

- 17 Where directed by the Engineer any cable trenches, or excavations left open overnight or between the finish of one work period and the start of the next work period are to be covered by steel plates. The steel plates are to be strong enough to withstand the passage of any vehicles permitted to drive on the roadway, without the possibility of collapse or dislodgement.
- 18 Between adjacent, longitudinal cabinets a drum length of cable shall be laid in one operation, unless otherwise directed by the Engineer.
- 19 Longitudinal cables shall generally be run parallel to the fence line or edge of the hard shoulder. Transverse cables shall run at right angles to the carriageway. Transverse cables installed diagonally with respect to the carriageway shall not be accepted unless being laid in existing ducts.
- 20 The Contractor shall remove and replace over its full length any damaged cable or cable which proves unsatisfactory
- 21 All longitudinal fibre-optic and 30-pair cables and those fibre-optic, 20-pair and 2-pair transverse cables exceeding 50 metres in length shall be provided with buried loops. These loops shall be installed at each end of the cable immediately adjacent to the entry and exit ducts at cabinet locations. The loop shall be made of a minimum of 3 metres of cable.
- 22 In the event of any protective insulation or armouring being stripped or damaged whilst cables are being installed, the whole of the particular length of cable concerned shall be replaced and re-connected at the Contractor's expense prior to the handover date.
- 23 Immediately on completion of laying, cables shall be temporarily marked to ensure their unambiguous identification

1508 Installation of Cabinets and Signal Posts

- 1 The Contractor shall construct paved areas and foundations incorporating plinths for cabinets and signal posts as described in Appendix 15/1.

The cabinets and signal posts shall be mounted on the plinths using holding down bolts. Paved areas shall be either constructed level or with a gentle fall away from cabinets as directed by the Engineer; cabinet doors shall be capable of opening and closing without being fouled by the paved area.

- 2 After the completion of terminations and testing, the plinths shall be filled with 6 mm pea gravel and the bases of Cabinets shall be sealed.
- 3 The Contractor shall keep the interior of cabinets free from moisture and dirt. 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 Entry/exit ducts to cabinets shall be sealed using suitable plugs or expanding foam to prevent the ingress of soil, gravel, etc.

1509 Gantries for Motorway Signals

- 1 Sign/signal gantries shall comply with sub-Clause 1219.2. Details of traffic signs including variable message signs and matrix signals on gantries are given in Appendix 12/1. Details of electrical equipment are given in Appendix 14/5.

1510 Installation of Telephone Posts and Housings

- 1 The Contractor shall construct paved areas and set the telephone post vertically in concrete foundations all as described in Appendix 15/1.
- 2 Telephone housings and instruments shall be mounted on the posts and orientated so that the back of the housing faces oncoming traffic unless otherwise described in Appendix 15/1.
- 3 Where telephones are installed on existing motorways they shall be covered until they have been commissioned and are available for use by the public.

1511 Cable Joints

- 1 Cable joints will not be permitted in communication cables.

- 2 Cable joints in power supply cables shall be made where described in Appendix 15/1. The approval of the Engineer is required for the provision of additional joints. Approval will not be given for cable joints situated in a duct or trough. Heat-shrink type joints shall not be used.
- 3 Cable joints in detector loop systems shall comply with Clause 1217.
- 4 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 instructions. Unless agreed by the Engineer, the Contractor shall submit records to the Engineer to enable cable joints to be identified with the joiner responsible for the work.
- 5 The Contractor shall notify the Engineer before jointing commences so that he may have the opportunity of inspecting the whole of the jointing operations. Jointing shall only be carried out when all materials to be used in the jointing are free from visible signs of moisture and joints shall be left protected from the weather during the curing period. Joints shall be adequately supported at all times. Backfilling shall not take place until the completed joint is in a fit condition to withstand any stresses which may be imposed on it and has been approved by the Engineer.
- 6 Where described in Appendix 15/1, a cable joint marker block, consisting of a 300 mm square and 225mm deep precast concrete block or buried active joint marker shall be placed over the cable joint. The block shall have a mark indented into its top surface as described in Appendix 15/1, and shall be recorded on the site records.

1512 Installation of Ancillary Items

- 1 Boxes shall be mounted on to the baseboards of Cabinets, the knockouts for cable access removed as necessary and holes bushed, all as described in Appendix 15/1. Terminators shall be fitted within the Boxes where appropriate.
- 2 Distributors shall be mounted on to the baseboards of Posts and Distributors shall be mounted on gantries as described in Appendix 15/1.
- 3 Distributive and protective devices shall be installed in power supply cabinets as described in Appendix 15/1.

- 4 The Contractor shall supply and install enclosures, termination equipment and all fixings in optical fibre cabinets as described in Appendix 15/1.

1513 Termination of Armoured Multi-pair Communication Cables

- 1 The armour and sheaths shall be removed from the ends of the communication cable to reveal the pairs of insulated conductors. All surplus jelly shall be removed by the use of a clean dry cloth taking care not to stretch the insulation, and any fluid substance to aid the cleaning process shall have had the prior approval of the cable manufacturer and the Engineer. Such approval will not be unreasonably withheld provided that the substance has been shown to have no detrimental effect on the cable or, if applicable, the jointing system. Heat shall not be applied to any part of the cable. The cable crutch shall be fitted with a sleeve and the cable ends shall be glanded or cleated and sleeved. Glands, cleats and earth tags shall be of aluminium.
- 2 The pairs of insulated conductors shall be twisted together and laced neatly to form a loom passing from the cable gland position to the termination position. All conductors shall be long enough for several subsequent terminations and each pair of conductors shall be identified by means of a numbered plastic sleeve or collar. 30-pair looms are not to be laced together in a common loom but are to be physically separate and installed individually.
- 3 Unless otherwise described in Appendix 15/1, communication cables shall be terminated in terminal blocks complying with Clause 1514. The conductors shall be secured by tightening the screws with a torque screwdriver to within the range 0.4 to 0.6 Nm.
- 4 Links shall be installed and connected within Cabinets and Boxes and jumper leads installed between Boxes wherever two are installed within one Cabinet; using as appropriate the insulated conductors of multi-pair/0.9 mm 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 box. The Contractor shall maintain multi-pair colour coding so that colour code duplication does not occur. Care shall be taken at all times to maintain correct pairing. In the 'mainside' box the links shall be tied back and left unconnected.

- 5 In adverse weather conditions, terminations shall be carried out beneath a purpose made tent.
- 6 Where the Contractor is required to terminate cables into cabinet equipment containing operational circuitry; the Contractor shall notify the Engineer sufficiently in advance so that he may arrange for Specialists to attend the site to supervise or undertake all work within the cabinet for which the Contractor is responsible. This must not compromise the operational system(s).

1514 Terminal Block Connectors

- 1 The Manufacturer of terminal blocks proposed by the Contractor shall be subject to approval by the Engineer. Approval will not be unreasonably withheld provided the Contractor can demonstrate that his adopted terminal block is in all respects physically compatible with the design and that it has satisfactory electrical performance characteristics.

1515 Termination of Fibre Optic Communication Cables

- 1 Cables shall be terminated in an approved hermetically sealed box containing silica gel to prevent damage due to the occurrence of moisture. The fibres shall be fusion spliced and protected from mechanical strain.
- 2 Copper conductors shall be secured by tightening the screws with a torque screwdriver to within the range 0.4 to 0.6 Nm.

1516 Termination of Power Supply Cables for Communications

- 1 Power supply cables for communications shall be terminated in compliance with Clause 1423 and as described in Appendix 15/1.

1517 Earthing and Bonding

- 1 The earthing and bonding of the whole installation shall comply with the recommendations contained in the National Rules for Electrical Installations published by the Electro-Technical Council of Ireland and as specified in Appendix 15/1.

- 2 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.

1518 Cable Testing

- 1 The Contractor shall undertake tests on cables as detailed in Appendix 1/5.
- 2 Cables shall be tested at the manufacturer's works to ensure compliance with the specifications and the tests shall be witnessed by the Engineer.
- 3 When installed, cables shall be tested by the Contractor in accordance with the Specifications and the Engineer shall arrange for the tests to be witnessed by a specialist if he so requires. The cable sections for Stage 2 tests shall be as described in Appendix 15/1.
- 4 Three copies of all cable test results shall be supplied to the Engineer on the completion of each test.
- 5 The Contractor shall, after testing, locate and expose any damaged outer sheath whether caused by himself or not and shall report all such damage to the Engineer. The Engineer 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.
- 6 The Contractor shall provide and display warning notices, barriers etc. when testing cables.
- 7 All test instruments requiring calibration shall have a current calibration certificate, the Contractor shall provide the Engineer with copies of all such certificates prior to the commencement of testing.
- 8 The Contractor shall give at least two weeks notice, in writing, to the Engineer of his intention to test any cable.
- 9 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 Labelling and Numbering

- 1 Gantries, cabinets, signal posts and telephones shall be numbered and cables shall be labelled, in accordance with details described in Appendix 15/1.
- 2 With the exception of the cable labels and any earthing labels required in Appendix 15/1 all labels shall be of the engraved colour laminated type. In addition all engraved labels shall be secured into position using stainless steel nuts, bolts and washers or stainless steel screws as appropriate.
- 3 The Contractor shall not leave cables unlabelled at any time and shall provide temporary labelling accordingly to facilitate testing and termination prior to the implementation of permanent labelling.
- 4 All Cabinets containing power distribution and control equipment shall be labelled to indicate the source of supply, destination, circuit arrangements and test details in accordance with Appendix 15/1 and the National Rules for Electrical Installations.
- 5 Where the Contractor carries out modification work to existing cabinets, new labels shall be fitted where appropriate and in accordance with Appendix 15/1.
- 6 The Contractor shall submit to the Engineer for approval his proposals for cabinet labels. The Contractor shall allow the Engineer seven days in which to approve the proposals.

1520 Loading

- 1 The longitudinal communications cable shall be loaded in accordance with Appendix 15/1.

1521 Removal and Resiting of Existing Equipment

- 1 Existing communications equipment shall be removed or resited where required in the Works, as detailed in Appendix 15/1. No equipment shall be removed or cables disconnected or cut until approved by the Engineer.
- 2 Existing redundant cabinets, telephone posts, housing and handsets, signal equipment, etc., as detailed in Appendix 15/1 shall be carefully removed to store. The location of the store shall

be notified by the Engineer at the commencement of the Works.

- 3 Where required in Appendix 15/1 redundant electronic or signalling equipment shall be removed by the Contractor under the supervision of the Engineer. At least 1 weeks notice shall be given by the Contractor to the Engineer of his intention to remove such equipment.
- 4 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 Items of equipment to be resited shall be unbolted from their plinths or supports together with their holding down bolts, stored, and resited as described in Appendix 15/1. Plinths and concrete foundations shall be broken out and disposed of in compliance with Clause 201.
- 6 Buried cables to be removed shall be located and pegged throughout their routes, the Contractor shall also excavate trial holes to expose these cables at the pre-determined locations. Where instructed by the Engineer the Contractor 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 201; the Contractor shall then remove and dispose of all unsuitable and surplus material. Cable in ducts shall be carefully withdrawn, the Contractor must also fulfil the requirements for removal of duct seal, re-sealing and re-roping. Cables in troughs shall be carefully segregated and lifted out, the Contractor shall also remove all trough lids, all debris from troughs and all sand from troughs. On completion the Contractor 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. Redundant cables are to be coiled onto drums at the time of removal and transferred to the site storage area. At a convenient time, to be identified by the Engineer, the Contractor shall remove the redundant cable from the drums and dispose of it.

Cables on signal gantries shall be unclipped and taken down, the Contractor shall also transport these to the site storage area and dispose of these at a time to be advised by the

Engineer. The Contractor shall provide and install new cable clips, where required, for retaining existing cables on the gantry structure and cable tray.

The cables shall be removed in compliance with Clause 201.

- 7 The sites of cabinets, plinths and cable trenches shall be reinstated to the level of the surrounding ground unless otherwise described in Appendix 15/1.

1522 Not Used

1523 Loop Detectors

- 1 Detector loop installation and testing shall comply with Clause 1217.
- 2 Cabinets for loop detector use shall be installed in accordance with Clause 1508, except that it shall not be sealed.
- 3 The power supply cable shall be terminated as described in Appendix 15/1. The loop feeders shall be terminated in terminal blocks complying with Clause 1514, secured to the equipment frame. Terminal screw tightness shall be within the range 0.4 to 0.6 Nm. Each feeder shall have 500mm 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.
- 4 Where loops are to be installed on existing motorways it is the responsibility of the Contractor to devise, obtain approval for and provide the traffic management systems necessary for the safe installation of the loops. Traffic management shall comply with the requirements of Clause 117.

1524 Trial Pits

- 1 Trial pits shall be excavated as described in Appendix 15/1.