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Guidance on Specification for Traffic Control and Communications

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TII Publications



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1. Introduction

A Motorway Communications System (MCS) includes telephones and other devices, and the associated power supplies and control systems. TII should be consulted during the design and preparation of contract documents.

In motorway construction contract the installation of cables, plinths, cabinets, structures, foundations, posts, and telephones will be the responsibility of the Contractor. Drawings for motorway installation work should be included in the Contract as described in CC-GSW-00010 - Notes for Guidance on the Specification for Works Series NG 000 - Introduction.

Normally TII will typically be directly responsible for the installation of the actual devices and the commissioning of the whole system and will arrange this work by means of a separate contract.

The Contractor is responsible for arranging with the electricity supplier for provision of a power supply for the communications system. The Contractor is responsible for negotiating the provision of connections to a telecommunications carrier's network where required. In both cases negotiations must be initiated and the interface cabinets erected or in the case of wireless, services confirmed in sufficient time to ensure that completion of the system is not delayed and power supplies to Cabinets must be available at the time of installation.

TII may appoint Road Undertaking to operate and maintain Motorway Communications equipment. The Employer's Representative [Specialist responsible for the design] should consult any such Road Undertaking during the design and preparation of contract documents.

2. General Requirements

Motorways shall not be opened to traffic unless the telephone system is operational.

It is essential that the communications installation is installed and successfully tested 4-8 weeks before opening to allow adequate time for commissioning.

If a Contract contains Sectional completions it may be necessary to make provision in Appendix 15/1 for the appropriate part or parts of the system to be completed 4 weeks before completion of each Section. Testing in sections may also be required.

3. Site Records

As-built drawings which should include inserts to a larger scale where layouts are complex, should be produced by the Contractor from daily records. The Contractor should maintain record drawings as described in this Section. Should additional information be required on the record drawings this should be described in Appendix 15/1. If considered practical, one set of drawings can be used for recording both motorway communications and road lighting details (see CC-GSW-01400 - Notes for Guidance on the Specification for Road Works Series NG 1400 - Electrical Work for Road Lighting and Traffic Signs).

4. Cables

Cables will typically be supplied by the Contractor as specified in Appendix 15/1. The Employer's Representative's site staff must check the manufacturer's test certificate for each drum of cable before it is installed.

Only those cables specified may be used.

4.1 Non-Armoured Cable

Communications cable (excluding fibre optic cables) lengths should be in the range 500-530 m. The length of cable is the distance between chambers plus 25 m.

4.2 Armoured Cable

Power supply cables for Motorway Communication systems shall be armoured. The use of non-armoured cables is not acceptable unless prior agreement has been reached with the Roads Authority.

Communications cable (excluding fibre optic cables) lengths in excess of 550 m are not permitted and lengths less than 450 m for longitudinal cables should be allowed only on agreement with the Road Authority who will provide the appropriate loading schedule.

The Road Authority must be consulted whenever it is proposed to use any cable not complying with the cable specification.

5. Cable Laying

All communications equipment must be sited within the motorway boundary. Special attention should be paid to the relative positions of cables, drains, environmental/noise barriers and safety fences, tree planting areas, signs and lighting columns during the design to prevent subsequent construction or maintenance operations damaging the cables.

The position of ducts in existing motorways to be used where new schemes overlap should be ascertained and accurately located on the ground and on the Drawings before tenders are invited.

Ducts must be provided in accordance with the TII Standard Construction Details and with CC-SPW-01500 - Specification for Road Works Series 1500 - Traffic Control and Communications. The position of ducts should be adjusted from the standard spacing so that they coincide with the siting of equipment and to keep the length of cabling in verges to a minimum. Additional ducts may be required to meet the specific design being catered for. Draw pits for cables may be necessary in long ducts, (e.g. in viaducts and other lengthy structures).

A length of cable (at least 7.5 m) should be coiled in each jointing chamber as shown on CC-SCD-01520 - Installation Drawing TCC - Cable Management Joint Chamber. This is to enable jointing and testing processes to be carried out within a vehicle or tent.

Where practicable, provision should be made for an additional length of the main longitudinal cable at the site of each terminal cabinet to allow for future re-terminations.

As an alternative to laying cables in trench the Contractor may, subject to the Employer's Representative's approval use a purpose-built cable laying machine. It should be of a type approved by the Employer's Representative and capable of forming a slit in the soil before guiding and laying the cable and marker tape without strain. A sand surround to the cable need not be provided if this method of laying is used.

If alternative methods of laying cables in trenches are offered and approved the Contractor may elect to use multi-passes of the purpose built cable laying machine in order to lay several parallel cables instead of laying all the cables in one operation. Care must be taken in such cases to ensure that cables already laid are not damaged by subsequent passes of the machine.

Minor sheath repairs to communications cable may be permitted in accordance with the cable specification, where approved by the Employer's Representative.

A draw rope attached to a cable and pulled through a duct with the cable is likely to twist around the cable prejudicing future cable pulling operations. Alternative installation methods that leave a draw rope free within the duct should be used. Rods must not be used to install draw ropes.

6. Installation of Cabinets and Signal Posts

Cabinets are generally expected to be sited near the boundary fences. However, some locations, e.g. cut/fill lines may put them in a position where they are particularly vulnerable to damage from vehicles leaving the carriageway. In such cases they should be protected by means of safety fencing or the extension of an existing safety fence. It is recommended that a safety fence should always be provided when equipment is located near the hardshoulder. Signal posts should be protected in accordance with the current requirements for the provision of safety fences.

Power supplies may be provided from a supply point which is either near to or remote from a group of communications cabinets. Where the supply point is greater than 100 metres away from a group or across a main carriageway then an additional power cabinet should be provided in the group.

Paved areas are required to form platforms adjoining cabinets and gantry bases for maintenance purposes. Easy access must be available to the cabinets as heavy testing equipment needs to be carried to them in all weather conditions. Slopes exceeding 1 in 3 should be provided with steps, and crossings should be provided over ditches, where appropriate. In some cases it may be necessary to site cabinets on a slope thus involving the construction of suitable platforms. All such details should be included in Appendix 15/1.

For maintenance and safety purposes, it is essential that a consistent layout of cabinets in groups is adopted. The layout to be adopted should be detailed in Appendix 15/1 and, where necessary, on the Drawings.

7. Installation of Telephone Posts and Housings

Telephone housings should be installed so that the rear of the housing faces on-coming traffic except that when located next to safety fencing the housing should be turned through 90° to allow access to the device from the traffic side of the safety fence (CC-SCD-01562 - Installation Drawing TCC - Detail of Telephone Installation Behind Safety Barrier).

In the interests of safety it is imperative that telephones which have not been commissioned and are, therefore, not available for use are covered with "Not in Use" bags.

8. Cable Joints

Joints in any cables are most undesirable and are only permitted in power cable when prior written approval for the jointing of the cable has been given by the Road Authority. Cable joints are not permitted within cable ducts.

In power supply cables for communications, approval will not be given for more than one joint in any one cable between terminations, or where the combined length of the 2 cables to be jointed is less than 70 metres.

Shortage of cable through incorrect measurement, wilful damage, cable faults, cable damage or such other causes will not be accepted as a justification for cable joints. Such circumstances must be overcome by the Contractor installing a completely new length of cable.

Where joints are permitted, joint markers must be provided and these must be accurately recorded on the record drawings.

Minor sheath repairs to communications cable may be permitted in accordance with the cable specification, where approved by the Employer's Representative.

9. Installation of Ancillary Items

Distributive and protective devices must be specified in Appendix 15/1 and may include fused cut-outs, power distribution units, surge protection devices, MCB's and/or residual current devices (RCD's) of a suitable rating.

Where required, post mounted entry stop signals, which comprise a 1 metre square target board on a post must be positioned on site to ensure that they are clearly visible before entering on to the motorway and will not be obscured by signs or other street furniture.

10. Termination of Power Supply Cables for Communications

The requirements for termination of power supply cables must be fully detailed on the Drawings, cross-referenced in Appendix 15/1.

It is not physically possible to terminate cables larger than 25 mm² within cabinets; it is therefore necessary to terminate the cable within an isolation device in an adjacent dedicated mini-pillar. A cable, of suitable termination cross sectional area, connects the mini-pillar to the cabinet power distribution unit.

Joints are only permitted in power cable when prior written approval for the jointing of the cable has been given by the Road Authority.

In power supply cables for communications, approval will not be given for more than one joint in any one cable between terminations, or where the combined length of the 2 cables to be jointed is less than 70 metres.

Shortage of cable through incorrect measurement, wilful damage, cable faults, cable damage or such other cases will not be accepted as a justification for cable joints. Such circumstances must be overcome by the Contractor installing a completely new length of cable at their own expense.

Where joints are permitted, joint markers must be provided and these must be accurately recorded on the record drawings.

11. Earthing and Bonding

The provisions of Section 11 are to cover the internal earthing and bonding of the system. In some areas the requirements of the electricity supplier or the results of testing may require additional earth(s) to be provided and these requirements must be incorporated in the design. Specific requirements for earthing and bonding are to be detailed in Appendix 15/1 and the system should be compliant with relevant European standards and with the requirements of ET101.

12. Cable Testing

The Road Authority should be consulted about testing requirements.

Details of cable tests, frequency, reporting etc. are to be detailed in Appendix 15/1

The cable sections upon which tests are to be carried out must be stated in Appendix 15/1. They are best shown on the loading schedule or on a cable drawing. Sections to be tested may comprise the complete length of longitudinal cable in the Contract or such shorter lengths as circumstances may demand. In some cases tests may also be called for on lengths of cable which include lengths previously laid under another contract. If faults are revealed, the Engineer should seek advice immediately from the Road Authority

Cable tests such as those described below, should be detailed in Appendix 15/1 to prove installation compliance with relevant standards and with the requirements of ET101:

- An insulation resistance test to measure the insulation resistance between each conductor and the remaining conductors and between each conductor and the metallic sheath (if any) and armouring.
- A voltage / pressure test.
- An earth continuity test to verify that the cable armouring and metal sheath, if any, have been properly bonded to earth.
- Phase-rotation and phase-correspondence tests to prove that the cables have been correctly connected.

13. Labelling and Numbering

The importance of labelling cannot be overstressed and compliance with the Specification is essential to future maintenance operations. Where alternatives are proposed, the prior approval of the Road Authority should be obtained for such proposals.

14. Loading

In certain special situations, and wherever a cable length is less than 450 metres it becomes necessary to build out the circuits with appropriate capacitors inserted into the terminators and a loading drawing/ schedule agreed with the Road Authority shall be provided in Appendix 15/1 as part of the Contract. Where significant changes are made in the lengths of longitudinal cables the Road Authority must be advised without delay.

15. Removal and Resiting of Existing Equipment

It may be necessary to make provision for the removal and re-siting of existing communications equipment, particularly at a new motorway interchange with an existing motorway where re-routing of cables is required.

Boxes and cabinets and their contents are worth recovery for re-use, but plinths and cables are not. If any equipment is not immediately required it can be stored for future use by the Road Authority. The location of the store should be described in Appendix 2/3.

Existing cables which are no longer required should be removed where to do so will not result in consequential damage to the existing in-service cables in order to prevent interference with the operation of the communications system.

Clear instructions should be given in Appendix 15/1 as to the removal and disposal of equipment.

16. Loop Detectors

This Section covers only the installation of the loops and cabinets.

Inductive loops should have a minimum clearance of 50 mm above road reinforcement and slots should be at least 1 m, in the lateral plane from any ferrous objects such as metal reinforcement bars, chamber covers etc.

Also, in concrete roads, slots should not be cut less than 1.5 m from transverse joints between adjacent concrete sections. Where these requirements cannot be met, detailed discussions/tests will be required in order to establish the design of a viable system.

The Contractor should undertake testing to determine the depth the reinforcement in concrete roads at proposed loop locations. Alternative types of detection should be considered in locations where the minimum clearance of 50mm is not achievable.

Section 16 covers the requirements of the installation of loop detectors and Standard Construction Details CC-SCD-01525 to CC-SCD-01547 may be used as Contract Drawings where appropriate. The Employer's Representative [Specialist responsible for the design] should ensure that the location and type of loop configuration is shown on suitable drawings and that consideration has been given to the effect of any slab reinforcement in the concrete. They should also include sufficient ducts in the Contract to accommodate the number of feeders required at a particular location.

Loop installations should be sited as near as possible to an existing power supply which will usually be taken from a power supply point for the communications system. Failing this an independent supply will have to be provided by negotiation with the local electricity supplier.

The Road Authority will advise on the use of cold poured epoxy resin compounds. Where hot poured sealants are used, it should be noted that to avoid damage to the detector loop insulations, the Contractor may use only those for which the manufacturers recommend pouring temperatures do not exceed 85°C.

17. Trial Pits

The Employer's Representative should describe the method of excavation of trial pits (by hand or other means) and the locations, in Appendix 15/1.

18. Maintaining the Existing Motorway Communications Network

When undertaking works on existing motorways it is essential that the existing motorway communications system is maintained. The main longitudinal cable forms part of the Authority's Communications Network and any disruption to this cable will consequently affect the Authority's Communications Network.

The precise method of maintaining the integrity of the system will be dependent upon the Contractor's programme of works.

Prior written approval must be obtained from the Road Authority to any proposed change.

If any element of motorway communications equipment is to be kept operational, arrangements for its maintenance through the Road Authority's Specialist Maintenance contractor, must be taken into account in the scheme design and specification for the works.

19. Inspection and Testing of Electrical Installations

The importance of Inspection and Testing cannot be over stressed and compliance with ET 101 is essential for Health and Safety reasons.

Where the Contractor encounters existing cabinets or installations which do not meet with the requirements of ET 101, it is essential that the Road Authority is immediately informed and undertakes no work at that site until further instructed.

20. Cable Installation at Buildings

The requirements for cable installation and termination within Buildings including procedures for entry and details of existing buildings must be fully detailed on the Drawings and cross referenced in Appendix 15/1.

Work in Buildings can only be undertaken under the supervision of the building's operator.

The Employer's Representative [Specialist responsible for the design] shall consider the needs of the building's operators and any Design Change processes and procedures that need to be undertaken prior to the Contractor undertaking their works.

21. Modifications to Existing Cabinets

The requirements for modifications to existing cabinets must be fully detailed on the drawings and cross referenced in Appendix 15/1.

22. Temporary Emergency Telephones

The need for Temporary Emergency Telephones will be dictated by the Contractor's programme of works.

The safety implications cannot be over stressed. It is essential that the location of emergency telephones is clear to motorists and that motorists cannot be put into a situation where the nearest visible emergency telephone can only be reached by crossing either live traffic lanes or the works.

The maintenance arrangements for Temporary Emergency Telephones must be considered at the design stage. The works specification must take into account the safe access requirements for the Road Authority's Maintenance Contractor to maintain the telephones.

23. Cable Ducts

The only permitted material for cable ducts is plastic, such as PVC-U (Polyvinyl chloride - Unplasticised), HDPE (High density polyethylene) or MDPE (Medium-density polyethylene).

Ducts should be scheduled in Appendix 15/1.

Mechanical duct plugs should be capable of accepting the combinations of cable types specified.

The strapping/spacer arrangement must be suitable for the purpose.

24. Installation of Ducts

Bedding material should be readily obtainable since a wide grading envelope is permitted including most gradings complying with IS EN 13242. It needs to flow readily and compact uniformly, thus a low coefficient of uniformity is necessary. In order to make savings in coarser granular materials a sand bed may be adopted. Surround to ducts should be in accordance with CC-SCD-01510 - Installation Drawing TCC - Duct Installation Longitudinal Ducts.

A distinction is to be made between the requirements of bedding, haunching and surrounding and those of backfilling. The former comprise all operations of trench fill up to a level 300 mm above the top of the barrel of the pipe. Backfilling constitutes the remaining operations up to ground level in verges and open ground and up to formation or sub-formation level under carriageways. Work above formation level constitutes construction or reinstatement of the pavement (see CC-GSW-00700 - Notes for Guidance on the Specification for Road Works Series NG 700 - Road Pavements - General).

Concrete surround should be used exceptionally, e.g. for protection of ducts against mechanical damage from subsequent operations after construction of the pipeline and where remedial measures due to over excavation are required. Protection of existing ducts where necessary may take the form of concrete arch or slab above the pipe.

Where ducts are to be installed beneath heavily trafficked existing ground, where it is undesirable that the existing ground surface should be disturbed, consideration should always be given to the possibility of inserting the pipe by suitable thrustboring or jacking processes.

25. Chambers for Motorway Communications Cables

Concrete chambers, precast or cast in situ against forms, do not require strengthening with additional concrete surround. Brick chambers do not need a concrete surround for strengthening. It may, however, be necessary to backfill with concrete where a space is insufficient to permit compaction of one of the earthwork's acceptable materials. The types of brick to be used for brick chambers, and beneath chamber frames, in normal circumstances are specified in CC-SPW-02400 - Specification for Road Works Series 2400 - Brickwork, Blockwork and Stonework. Where a different type of brick is required this should be described in Appendix 24/1. Any brickwork upon which chamber frames are seated should be properly constructed.

Chamber covers should have a minimum opening of 600 mm diameter where personnel may be required to enter completely. In carriageways and hardshoulders where frequent heavy vehicles may be expected, chamber covers and frames should be Grade D400. Reference should be made to IS EN 124 regarding locations where other Grades of covers, gratings and frames will be acceptable. In determining the Grade, regard should also be paid to whether the chamber is located behind safety barriers or protected by revetment walls. Special duty covers can be considered including those with a higher skid resistance. Advice may be obtained from the Road Authority.

The requirement for cover lifters should be determined by the Employer's Representative [Specialist responsible for the design] in accordance with the Safety Health and Welfare at Work Regulations. The chamber cover lifter should be safe and fit for use. Regard should be paid to the available hardstanding area around the chamber.

26. Proving and Testing of Ducts

The air test should be carried out on complete duct lengths i.e. from chamber to chamber

27. Poles for Lightweight Equipment

The performance specifications of detection equipment may vary between manufacturers and should be considered when identifying pole locations. The off-set between the pole and the detection zone may affect the accuracy of the detection equipment and the final position of the pole and detection equipment should be in accordance with the manufacturer's recommendations.

Detection equipment should be sited on straight sections of road where possible and should be located away from on- and off-ramps as far as possible.

The poles for motorway signals should be positioned to allow unrestricted access to the maintenance panels to the rear of the signals once mounted.

The minimum mounting height for cameras used for traffic monitoring and vehicle detection is to reduce vandalism. Poles with these types of equipment should be positioned away from parapets and street furniture to limit access by unauthorised persons.

Work at height should be undertaken from Mobile Elevated Work Platforms (MEWP) as far as possible. MEWP access should be provided to the equipment behind the safety barrier, where possible. In locations with continuous safety barrier, consideration should be given to temporarily removing safety barrier sections to provide access to the MEWP. Irrespective of MEWP access, the plinth for pole installations without cabinets and ancillary items should include sufficient area for a ladder for installation and short-term maintenance.

CC-SPW-01500 - Specification for Traffic Control and Communications Table 15/1 provides typical pole sizes only. Design checks should be carried out to verify the suitability of a pole size at each individual site location taking cognisance of site investigation information and local wind pressure. Pole sizes not included in Table 15/1 should be designed from first principles to suit the requirements of the equipment and the site specific conditions.

28. References

28.1 TII Publications (Standards) References

CC-SPW-01500 - Specification for Traffic Control and Communications

CC-SPW-02400 - Specification for Road Works Series 2400 - Brickwork, Blockwork and Stonework

CC-GSW-00010 - Notes for Guidance on the Specification for Works Series NG 000

CC-GSW-01400 - Notes for Guidance on the Specification for Road Works Series NG 1400

CC-GSW-00700 - Notes for Guidance on the Specification for Road Works Series NG 700 - Road Pavements – General

CC-SCD-01510 - Installation Drawing TCC - Duct Installation Longitudinal Ducts

CC-SCD-01520 - Installation Drawing TCC - Cable Management Joint Chamber

CC-SCD-01525 - Installation Drawing TCC - Detector Loop Slot Details Sheet 1

CC-SCD-01547 - Installation Drawing TCC - Loop (Inductive) All - Purpose Road Mova Loops

CC-SCD-01562 - Installation Drawing TCC - Detail of Telephone Installation Behind Safety Barrier

28.2 References to IS/EN/BS Standards

I.S. EN 124 Gully Tops And Manhole Tops For Vehicular And Pedestrian Areas

IS EN 13242 Aggregates for Unbound and Hydraulically Bound Materials for Use in Civil Engineering Work and Road Construction

28.3 Other Miscellaneous References

Electro-Technical Council of Ireland. ET 101 National Rules for Electrical Installation.

SAMPLE APPENDIX 15/1: MOTORWAY COMMUNICATIONS

[Notes to compiler: This should include:]


Appendix 15/1 should be specific to each scheme and provide all the information which a Tenderer requires. Appendix 15/1 should include references to any other specifications and drawings as necessary.

Appendix 15/1 should include the following information as applicable:

- i) any additional information to be provided on records drawings;
- ii) types and specification for communication cable required;
- iii) types and specification for power cable required;
- iv) requirements for surface reinstatement to trench;
- v) termination requirements for power supply cables;
- vi) cable sections for stage 2 testing;
- vii) description of labelling requirements for gantries, signal posts, cabinets and telephones;
- viii) details of electrical loading requirements for communication cable;
- ix) resiting details of equipment [provision for dismantling and storage should be made in Appendix 2/3];
- x) details of trial pit excavation; including number, size, method of excavation and locations;
- xi) requirements for cable installations and terminations within buildings;
- xii) details of modifications to existing cabinets;
- xiii) details of chamber covers (grade and whether square or triangular) and details for special duty covers for use in carriageways;
- xiv) schedule of chambers - location, depths, types etc.;
- xv) schedule of ducts (other than the standard longitudinal ducts);
- xvi) any special requirements for ducts;
- xvii) schedule of duct plugs and inserts;
- xviii) address labels for chambers;
- xix) any special requirements for topsoiling, grass seeding and/or turfing;
- xx) any special requirements for chambers;
- xxi) type of lifting keys;
- xxii) mass of cover that determines requirement for cover lifters;
- xxiii) references to drawings which show approximate positions of cable trenches, cables and their terminating cabinets;
- xxiv) requirements for installation of cable covers;
- xxv) particular requirements for cable laying, additional protection and support;
- xxvi) requirements for cables following the same route if different from the requirements;

- xxvii) references to drawings which show construction of paved areas and foundations incorporating plinths for cabinets and signal posts;
- xxviii) reference to drawings which show construction of paved areas and foundations for telephone posts;
- xxix) requirements for orientation of telephone housing if different from the requirements;
- xxx) reference to drawings which show location of cable joints and cable joint marker blocks and details of indented mark ;
- xxxi) [cross-reference should be made to the TII Standard Construction Details where appropriate]
- xxxii) references to drawings which show installation details for ancillary items;
- xxxiii) requirements for terminating cables if different from the requirements;
- xxxiv) requirements for reinstatement if different from the requirements; and
- xxxv) requirements for completion and testing.



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