Manual of Contract Documents for Highway Works

Control & Communications Technology
Contract preparation

TP 131 Instructions for specifiers for TC 131 Roadside technology and communications

(formerly)

Version NI/LIVE_2025-01-16

The 'SUMMARY' field is missing from the Document Information. Please populate this field before publication.

This document incorporates specific requirements for the Department for Infrastructure Northern Ireland. Alternative versions of this document are available for other Overseeing Organisations.

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Contents

Latest release notes

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change
TP 131	NI/ LIVE_2025-01-16	Not available	Core document	Change to policy, major revision, new document development
TP 131 replaces and updates Series NG 1500. This full document has been re-written in accordance with the new drafting rules.				

Previous versions

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change

Foreword

This document provides specifier instructions for the production of the works specific requirements for TC 131 Roadside technology and communications.

This document does not form part of the works specification.

The works specification is made up of both the Specification for Highway Works and the works specific requirements completed by the Specifier.

This document is applicable for contracts throughout the UK, complemented by the additional specification requirements and contractual changes of each Overseeing Organisation.

Users are responsible for applying all appropriate documents applicable to their contract.

Users are responsible for archiving contract documentation in accordance with the user's quality management system.

1. General requirements for roadside technology and communications

Location of assets for roadside technology and communications

1.1 Tolerances for the locations in the schedules for roadside technology and communications shall be as specified in TC 131/WSR/001.

Tolerances for the locations in the schedules for roadside technology and communications		
Tolerance of chainage	**Tolerance of marker post**	**Tolerance of Global Positioning System (GPS) coordinates**
(a)	(b)	(c)

a) Enter text, to specify the tolerance of the chainage in metres.

b) Enter text, to specify the tolerance of the marker post distances in metres.

c) Enter text, to specify the tolerance of GPS coordinates in metres.

NI/1.2 Coordinates shall be to Ordnance Survey National Grid and Ordnance Datum Belfast via OSTN15 and OSGM15.

1.3 Roadside technology equipment shall be labelled and recorded in the asset management system in accordance with PO 1148 [Ref 46.N].

Scope of works for roadside technology and communications

1.4 The scheme design for the installation of roadside technology and communications equipment shall be as described in TC 131/WSR/001.

The scheme design for the installation of roadside technology and communications equipment		
Drawing, model or document reference	**Drawing title**	**Version**
(a)	(b)	(c)

a) Enter text, to identify drawing, model or document reference detailing the design.

b) Enter text, to identify the drawing title for the document, drawing or model reference title detailing the design.

c) Enter text, to identify the version of the document, drawing or model reference version detailing the design.

1.5 The supply of roadside technology and communications equipment for the scheme shall be as described in TC 131/WSR/001.

The supply of roadside technology and communications equipment for the scheme	
Asset type	**To be supplied by**
(a)	(b)

a) Enter text, to identify the asset type.

b) Enter a value, from options Overseeing Organisation, Telecommunications Service Provider (TSP), not supplied, to identify if the asset will be supplied to the scheme by others.

1.6 The Telecommunications Services Provider (TSP) shall be the provider of 'service capability' for conveying voice, video and data.

1.7 The TSP for the scheme's telecommunications services shall be as stated in TC 131/WSR/001.

SI.1.7 The TSP of the scheme's telecommunications services shall be [enter free text].

Metal theft for roadside technology and communications

1.8 The requirements to mitigate against metal theft for roadside technology and communications equipment shall be as stated in TC 131/WSR/001.

SI.1.8 The requirements to mitigate against metal theft for roadside technology and communications equipment are [enter free text].

Hardstanding maintenance working areas for roadside technology equipment sites

1.9 The form of construction and layout of the hardstanding maintenance working areas for roadside technology equipment sites shall be as described in TC 131/WSR/001.

The form of construction and layout of the hardstanding maintenance working areas for roadside technology equipment sites			
Site identifier	**Layout version**	**Drawing, model or document reference**	**Form of construction**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to specify the site identifier for the hardstanding maintenance working area.

b) Enter text, to identify the layout version used for the hardstanding maintenance working area at the site.

c) Enter text, to identify the scheme drawing, model or document reference that applies to the hardstanding maintenance working area at the site.

d) Enter text, to describe the form of construction for the hardstanding maintenance working area at the site which is defined in CC 207 [Ref 18.N].

1.10 The requirements of hardstanding maintenance working areas for roadside technology equipment sites shall comply with the requirements of "Modular paving" in Section 6 of CC 207 [Ref 18.N].

Foundations for roadside technology equipment

1.11 Foundations for roadside technology equipment such as cabinets, cameras, emergency roadside telephones, other pole mounted technologies and signal posts shall make allowance for cables to enter the roadside technology equipment from beneath.

Inspection and testing for roadside technology equipment

1.12 An inspection and test plan shall be prepared for each roadside technology equipment installed, in accordance with BS ISO 10005 [Ref 52.N], detailing the checks and inspections to be undertaken to provide evidence of conformity with the specification.

1.13 Verification shall be undertaken for each roadside technology and communications equipment asset by undertaking the checks and inspections detailed in the inspection and test plan for that asset, with the results recorded in the inspection and test plan for that asset.

1.14 The frequency of the check and inspection, as detailed in the inspection and test plan, for each roadside technology and communications equipment asset shall be as detailed in the inspection and test plan.

1.15 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the check and inspection, as detailed in the inspection and test plan, for each roadside technology and communications equipment asset.

1.16 The following Documentation shall be submitted for each roadside technology and communications equipment asset prior to the commencement of handover into maintenance: inspection and test plan.

1.17 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the inspection and test plan for each roadside technology and communications equipment asset.

Commissioning and handover of roadside technology equipment

1.18 The process for commissioning and handover of roadside technology equipment shall be in accordance with GG 182 [Ref 31.N].

1.19 The technology and systems commissioning plan for roadside technology equipment shall be prepared in accordance with GG 182 [Ref 31.N], unless otherwise stated in TC 131/WSR/001.

SI.1.19 The scheme document reference of the technology and systems commissioning plan for roadside technology equipment to be updated in accordance with GG 182 [Ref 31.N] shall be [enter free text].

1.20 The handover schedule for roadside technology equipment shall be prepared in accordance with GG 182 [Ref 31.N], unless otherwise stated in TC 131/WSR/001.

SI.1.20 The scheme document reference of the handover schedule for roadside technology equipment to be updated in accordance with GG 182 [Ref 31.N] shall be [enter free text].

Documentation requirements for commissioning and handover of roadside technology equipment

1.21 The following Documentation shall be submitted for all roadside technology equipment prior to the commencement of installation of the permanent technology systems on site: the technology and systems commissioning plan.

1.22 The following Documentation shall be submitted for all roadside technology equipment prior to the commencement of installation of the permanent technology systems on site: the handover schedule.

1.23 The following Documentation shall be submitted for all roadside technology equipment prior to the commencement of acceptance of the roadside technology equipment into maintenance: handover certificate in accordance with GG 182 [Ref 31.N].

1.24 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the handover certificate for all roadside technology equipment.

1.25 The following Documentation shall be submitted for all roadside technology equipment prior to the commencement of closure of the project: scheme maintenance handover documentation in accordance with GG 182 [Ref 31.N].

1.26 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the scheme maintenance handover documentation for all roadside technology equipment.

Site records for roadside technology and communications

1.27 The production and issuing of as-built record drawings for roadside technology and communications equipment, upon completion of the works, shall be in accordance with MCH 1652 [Ref 6.N].

1.28 The type and location of existing roadside technology equipment identified shall be recorded on the as-built record drawings.

1.29 The type and location of ancillary infrastructure at existing unmodified sites shall be recorded on the as-built record drawings.

1.30 The following information shall be recorded on the as-built record drawings for installed and modified roadside technology and communications equipment within the area of the works:

1. duct locations, including offset from kerbs, edge of carriageway or fence lines measured at least every 20 m,
2. quantities, size and arrangement of ducts;
3. cable chamber locations including type of chamber;
4. cabinet positions, cabinet type, equipment housed within each along with the Service Delivery Point (SDP) interfaces with the TSP;
5. cable routes and types of cable;
6. signals location, type (e.g. MS4), version and variant (e.g. enforcement) of each signal;
7. CCTV location and type;
8. detector location and type;

9. telephones;

10. other roadside technology assets location and type; and

11. sheath repair and cable joint positions.

1.31 The items of additional information to be recorded on the as-built record drawings for roadside technology and communications equipment shall be as stated in TC 131/WSR/001.

SI.1.31 The items of additional information to be recorded on the as-built record drawings for roadside technology and communications equipment shall be [enter free text].

1.32 The location of roadside technology and communications equipment assets for the as-built drawings shall be determined using the GPS coordinates of the central point of the asset.

1.33 The interval, accuracy and method of data recording shall be stated on the as-built record drawings for roadside technology and communications equipment.

1.34 The following information shall be recorded and included as part of the as-built information pack for installed and modified roadside technology and communications equipment within the area of the works:

1. the number, size and type of cables allocated to each duct and the length of each cable within a ducted network, other than those installed by the TSP;

2. power supply installations detailing what assets are being powered from each DNO power cabinet;

3. all roadside technology on gantries that have been subject to a technology departure (including departure reference);

4. cable chamber references, locations including type, depth, incoming and outgoing ducts including their depth, sub-ducts, type of chamber cover, drainage arrangement and details of cable joints within;

5. coverage drawings for CCTV and stopped vehicle detection systems.

Documentation requirements for site records for roadside technology and communications

1.35 The following Documentation for recording the works that have been installed in a working shift shall be submitted as continuous records: at

the end of the next working day: redline drawings showing alterations from the design.

1.36 The requirements of "Records" in Section 3 of GC 101 [Ref 21.N] shall apply to redline drawings showing alterations from the design.

2. Telecommunications services

General requirements for telecommunications services

Interface agreement with the telecommunications services provider (TSP)

2.1 An interface agreement shall be established with the TSP.

NI/2.2 The interface agreement with the TSP shall be in accordance with information supplied by the Department for Infrastructure Roads Traffic Information and Control Centre.

2.3 The interface agreement with the TSP shall include:

1. a description of the scope and geographic coverage of the works;

2. a description of the contractual and operational interfaces including current and known changes during the works;

3. contacts for specific roles/responsibilities, including those needed for fault reporting, handling and escalation;

4. a schedule of meetings (including minutes and time period for distribution) along with format for written and electronic communications;

5. a schedule of requirements for performing disconnections and connections to telecommunications services;

6. a programme of interfacing, liaison, planning and co-ordination throughout the works;

7. processes for authorisations, permits and the provision of notices;

8. specific access boundaries and access protocols;

9. a process for ensuring continued maintenance of roadside technology and communications equipment during the works;

10. a schedule and details of special arrangements including references to site-specific items such as health and safety information and permits to work;

11. access arrangements to facilitate the installation, maintenance, repair and removal of operational equipment and telecommunications bypasses;

12. access arrangements for attendance at site for works to be undertaken within 1.5 m of TSP buried services;

13. procedures to be implemented in the event of damage incurred to the network bypass cable;

14. the design, protection and programming of temporary cabling, the connections required, lengths involved and duration of the temporary cabling; and

15. operating protocols to be followed for the termination of cables into existing cabinets including contacting operational centres and safety aspects of the works.

2.4 The additional requirements of the TSP interface agreement shall be as stated in TC 131/WSR/002.

SI.2.4 The additional requirements of the TSP interface agreement shall be [enter free text].

2.5 The following Documentation shall be submitted for the interfaces with the TSP prior to the commencement of the works: interface agreement.

2.6 Documentation for the interface agreement shall be submitted 4 weeks before the commencement of the works.

Notice Periods for roadside technology works

2.7 During roadside technology works, the notice periods shall be as stated in Table 2.7, unless otherwise stated in TC 131/WSR/002.

Table 2.7 TSP and Overseeing Organisation notice periods

Item	Description	Notice period	To be submitted to
1	TSP mobilisation and implementation to install bypass cables	3 weeks minimum from the date of completion of the detailed design for the bypass cables	TSP
2	Issue of planned interruption notice for bypass cables to TSP	2 weeks before the works commence	TSP
3	Marking out of TSP buried assets	2 weeks	TSP
4	Notification for TSP to attend site for works being carried out within 1.5 m of TSP buried equipment	2 weeks	TSP
5	Notification for TSP to attend site for works being carried out within	2 weeks	TSP

Table 2.7 TSP and Overseeing Organisation notice periods			
Item	**Description**	**Notice period**	**To be submitted to**
	cabinets which are the responsibility of the TSP		
6	Notification for Overseeing Organisation maintainer to attend site for works being carried out within cabinets which are the responsibility of the Overseeing Organisation maintainer	2 weeks	Overseeing Organisation
7	Notification to the TSP for the disruption to existing services	2 weeks	TSP
8	Notification to the Overseeing Organisation for the disruption to existing services	2 weeks	Overseeing Organisation
9	Notification to the TSP for the start of infrastructure inspections	1 week	TSP
10	Notification to the TSP for infrastructure inspections following remedial works undertaken by the scheme	2 working days	TSP
11	Issue of task authorisation to activate a new telecommunications service	Within 4 weeks	TSP
12	Issue of task authorisation to deactivate a telecommunications service	Within 4 weeks	TSP
13	Issue of task authorisation to suspend a telecommunications service	Within 4 weeks	TSP
14	Issue of task authorisation to relocate a telecommunications service	Within 4 weeks	TSP
15	Notification to the TSP for the connection to a telecommunications service	1 week	TSP
16	Notification to the TSP for the disconnection from a telecommunications service	1 week	TSP
17	Notification to the TSP for the implementation of a temporary telecommunications service	2 weeks	TSP

SI.2.7 The variation of the TSP and Overseeing Organisation notice periods and descriptions from Table 2.7 shall be [enter free text].

TSP contact details

2.8 The point of contact name, address, email and telephone details of the TSP for the scheme shall be as stated in TC 131/WSR/002.

SI.2.8 The point of contact name, address, email and telephone details of the TSP for the scheme shall be [enter free text].

Scope of works for installation of telecommunications services

2.9 The scheme document reference that provides the responsibility matrix for construction, testing and commissioning of roadside technology equipment shall be as stated in TC 131/WSR/002.

SI.2.9 The scheme document reference that provides the responsibility matrix for construction, testing and commissioning of roadside technology equipment shall be [enter free text].

2.10 The installation of a Service Delivery Point (SDP) and all roadside technology equipment necessary for the SDP that are not being provided by the TSP, shall be as stated in TC 131/WSR/002.

The installation of a Service Delivery Point (SDP) and all roadside technology equipment necessary for the SDP that are not being provided by the TSP,					
Service Delivery Point (SDP) ID	**Type of SDP**	**Location of SDP**	**Description of SDP equipment**	**Chainage**	**Marker post**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the SDP ID.

b) Enter text, to identify the type of SDP.

c) Enter text, to identify which cabinet or enclosure houses the SDP.

d) Enter text, to describe the SDP equipment and locations within the cabinet or enclosure.

e) Enter text, to identify the chainage location of the SDP.

f) Enter text, to identify the marker post location of the SDP.

The installation of a Service Delivery Point (SDP) and all roadside technology equipment necessary for the SDP that are not being provided by the TSP, (continued)			
Service Delivery Point (SDP) ID	**Carriageway**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**
(a)	(g)	(h)	(i)

a) Enter text, to identify the carriageway location for the SDP installation.

b) Enter a number in units of m, to identify the X (Easting) co-ordinate for the location of the SDP.

c) Enter a number in units of m, to identify the Y (Northing) co-ordinate for the location of the SDP.

2.11 The telecommunications services and associated equipment to be recovered and reinstated at the end of the works shall be as described in TC 131/WSR/002.

The telecommunications services and associated equipment to be recovered and reinstated at the end of the works				
Asset	**Chainage**	**Marker post**	**Carriageway**	**Description of recovery and reinstatement works**
(a)	(b)	(c)	(d)	(e)

a) Enter text, to identify the asset or group of assets to be recovered and reinstated.

b) Enter text, to identify the chainage location of the asset or group of assets to be recovered and reinstated.

c) Enter text, to identify the marker post location of the asset or group of assets to be recovered and reinstated.

d) Enter text, to identify the carriageway location of the asset or group of assets to be recovered and reinstated.

e) Enter text, to describe the recovery and reinstatement works required at the location.

Modifications to the telecommunications services

2.12 The removal of telecommunications services, associated equipment and infrastructure shall be as described in TC 131/WSR/002.

The removal of telecommunications services, associated equipment and infrastructure				
Asset	**Chainage**	**Marker post**	**Carriageway**	**Description of removal works**
(a)	(b)	(c)	(d)	(e)

a) Enter text, to identify the asset or group of assets to be removed.

b) Enter text, to identify the chainage location of the asset or group of assets to be removed.

c) Enter text, to identify the marker post location of the asset or group of assets to be removed.

d) Enter text, to identify the carriageway location where the asset or group of assets to be removed are located.

e) Enter text, to describe the removal works required at the location.

2.13 The telecommunications services and associated equipment to be retained shall be as described in TC 131/WSR/002.

The telecommunications services and associated equipment to be retained				
Asset	**Chainage**	**Marker post**	**Carriage way**	**Description of equipment to be retained**
(a)	(b)	(c)	(d)	(e)

a) Enter text, to identify the asset or group of assets to be retained.

b) Enter text, to identify the chainage location of the asset or group of assets to be retained.

c) Enter text, to identify the marker post location of the asset or group of assets to be retained.

d) Enter text, to identify the carriageway location of the asset or group of assets to be retained.

e) Enter text, to describe the equipment to be retained at the location.

Labelling of the telecommunications services

2.14 The SDP label reference shall be used in all correspondence with the TSP.

2.15 The SDP label reference for each telecommunications service shall be submitted to the TSP in the format x/y/z where:

1. x is the cabinet location comprising motorway/marker post/ carriageway;

2. y is the device or service category; and

3. z is the asset bar code (if the asset is existing).

Existing telecommunications services

2.16 Continuity of telecommunications services through the works shall be maintained at all times.

Maintaining the operation of the telecommunication services

2.17 The maximum period for disruption of the existing telecommunication services shall be as stated in TC 131/WSR/002.

SI.2.17a The maximum period of disruption of the existing telecommunication services shall be [enter a number] .

SI.2.17b The start of any specified time period (day/time) that disruption is allowed shall be [enter free text].

SI.2.17c The end of any specified time period (day/time) that disruption is allowed shall be [enter free text].

2.18 Access to all roadside technology equipment for maintenance shall be provided for representatives of the Overseeing Organisation and the TSP.

2.19 Areas within the works boundary, where the nature of the works performed has a potential impact upon the integrity of the national and local telecommunications services, shall be identified and submitted to the Overseeing Organisation and the TSP.

2.20 The telecommunications services and roadside technology equipment to remain operational during the works shall be as described in TC 131/WSR/002.

The telecommunications services and roadside technology equipment to remain operational during the works				
Asset	**Chainage**	**Marker post**	**Carriageway**	**Description of equipment to remain operational**
(a)	(b)	(c)	(d)	(e)

a) Enter text, to identify the asset or group of assets to remain operational.

b) Enter text, to identify the chainage location of the asset or group of assets to remain operational.

c) Enter text, to identify the marker post location of the asset or group of assets to remain operational.

d) Enter text, to identify the carriageway location of the asset or group of assets to remain operational.

e) Enter text, to describe the assets or group of assets to be kept operational.

Bypass cables of telecommunications services

2.21 The scheme document reference for the outline design of bypass cables, including the protection requirements, for the telecommunications services shall be as stated in TC 131/WSR/002.

SI.2.21 The scheme document reference for the outline design of bypass cables, including the protection requirements, for the telecommunications services shall be [enter free text].

2.22 Cable protection for bypass cables and other temporary cables for the telecommunications service shall be of ingress protection (IP) rating IP24 in accordance with BS EN 60529 [Ref 10.N].

Suspension of telecommunications services

2.23 The telecommunications services to be temporarily or permanently decommissioned, or re-located by the TSP shall be as described in TC 131/WSR/002.

The telecommunications services to be temporarily or permanently decommissioned, or re-located by the TSP				
Asset	**Chainage**	**Marker post**	**Carriageway**	**Description of works needed on the equipment by the TSP**
(a)	(b)	(c)	(d)	(e)

a) Enter text, to identify the asset or group of assets to be temporarily or permanently decommissioned, or re-located by the TSP.

b) Enter text, to identify the chainage location of the asset or group of assets to be temporarily or permanently decommissioned, or re-located by the TSP.

c) Enter text, to identify the marker post location of the asset or group of assets to be temporarily or permanently decommissioned, or re-located by the TSP.

d) Enter text, to identify the carriageway location of the asset or group of assets to be temporarily or permanently decommissioned, or re-located by the TSP.

e) Enter text, to describe the works required by the TSP to temporarily or permanently decommission, or re-locate the assets or group of assets.

Underground telecommunications services

2.24 The method of detection, marking and protection of existing underground telecommunications services, power cables and communications infrastructure, owned and operated by the Overseeing Organisation or TSP, shall be as stated in TC 131/WSR/002.

SI.2.24 The method of detection, marking and protection of existing underground telecommunications services, power cables and communications infrastructure, owned and operated by the Overseeing Organisation or TSP, shall be [enter free text].

2.25 The excavation requirements for the underground telecommunications services, power cables and communications infrastructure owned, operated or maintained by the TSP shall be as stated in TC 131/WSR/002.

SI.2.25 The excavation requirements of the underground telecommunications services, power cables and communications infrastructure owned, operated or maintained by the TSP shall be [enter free text].

2.26 The additional requirements determined by the TSP for the location of underground cables for telecommunications services shall be as stated in TC 131/WSR/002.

SI.2.26 The additional requirements determined by the TSP for the location of underground cables for telecommunications services shall be [enter free text].

2.27 The location of underground services owned and operated by a statutory undertaker shall be detected, confirmed and protected in accordance with the relevant special requirements of the statutory undertaker, or similar notice or instruction issued by a statutory undertaker.

Works to be undertaken near buried TSP services

2.28 The following Documentation shall be submitted for construction within 1.5 m of TSP buried services and infrastructure prior to the commencement of construction works within 1.5 m of TSP buried services:

construction method statements to identify the mitigation measures to be taken to prevent damage to the TSP buried services and infrastructure.

2.29 Documentation detailing construction method statements shall be submitted to the TSP prior to the commencement of construction works.

2.30 Construction method statements submitted to the TSP to identify the mitigation measures to be taken to prevent damage to the TSP buried services and infrastructure shall be approved by the TSP before the works commence.

2.31 The location of interface points to the existing communications duct network shall be as stated in TC 131/WSR/002.

SI.2.31 The location of interface points to the existing communications duct network shall be [enter free text].

Modifications to operational roadside technology equipment

2.32 The termination of cables into cabinets containing operational roadside technology equipment shall be as stated in TC 131/WSR/002.

The termination of cables into cabinets containing operational roadside technology equipment	
Cable reference number	**Are either terminations in operational cabinets containing roadside technology equipment**
(a)	(b)

a) Enter a unique reference, to identify the cable.

b) Enter a value, from options Yes, No, to identify if the cable is terminating in a cabinet containing operational roadside technology equipment.

2.33 The operational and future status of cables within a duct route for telecommunications services shall be provided to the TSP prior to the interruption or extension of the duct network.

2.34 The permanent removal or pulling back of cables within a duct route for telecommunications services shall be undertaken through liaison with the TSP to coordinate the works with them.

2.35 No work shall be carried out on existing roadside technology equipment without a permit to work.

NI/2.36 The application for the permit to work shall be made through the NI Direct website.

Documentation requirements for planned works

NI/2.37 The following Documentation shall be submitted for the procedure to work on the existing roadside technology equipment prior to the commencement of telecommunications works on existing roadside technology equipment: a method statement for the works to proceed with SFAIRP risk of electrical injury or equipment damage.

NI/2.38 Documentation defining the procedure to work on the existing roadside technology equipment shall be submitted in writing to the Department for Infrastructure Road Traffic Information and Control Centre at least 15 working days before commencement of the works.

2.39 The following Documentation shall be submitted for planned works on the roadside technology equipment and communications prior to the commencement of planned works: notice of planned activity including the duration.

2.40 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to notifications of planned works and activities on the roadside technology equipment and communications, including the duration.

Documentation requirements for telecommunication services

2.41 The following Documentation shall be submitted for electrical testing and inspection of the works prior to the commencement of acceptance of the works by the TSP: duct installation and proving records, electrical testing to BS 7671 [Ref 53.N] to demonstrate electrical provision is safe, and visual site inspection records.

2.42 Documentation duct installation and proving records, electrical testing and inspection of the works shall be submitted within 7 working days of the testing and inspection.

2.43 The following Documentation shall be submitted for the electrical testing and inspection of the works prior to the commencement of acceptance of the works by the TSP: handover certificate in accordance with GG 182 [Ref 31.N].

2.44 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the handover certificate for the electrical testing and inspection of the works.

3. Electrical installations for roadside technology and communications

Product requirements for electrical installations for roadside technology and communications

3.1 The enclosure for the electrical switch for the isolation of roadside technology equipment mounted on the gantry shall be compliant with BS EN 60529 [Ref 10.N].

3.2 The enclosure for the electrical switch for the isolation of roadside technology equipment mounted on the gantry shall meet the following performance characteristics: minimum IP rating of IP55.

3.3 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 21.N] shall apply to enclosure for the electrical switch for the isolation of roadside technology equipment mounted on the gantry.

Electrical installation requirements for roadside technology and communications

3.4 Electrical installations for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

3.5 Electrical installations for roadside technology and communications shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

3.6 Electrical installations for roadside technology and communications shall be in accordance with BS 7671 [Ref 53.N].

3.7 Structural steelwork that has been exposed during the fitting of electrical equipment for roadside technology and communications shall be re-treated in accordance with "Treatment of damage and local failures of protective systems for protection of steelwork against corrosion" in Section 14 of CC 486 [Ref 51.N].

3.8 Cabinet metalwork that has been exposed during the fitting of electrical equipment for roadside technology and communications shall be repaired with an anti-corrosive treatment in accordance with the manufacturer's instructions.

3.9 Electrical equipment for roadside technology and communications shall be stored in accordance with the manufacturer's instructions.

3.10 Electrical equipment for roadside technology and communications to be installed shall be free from defects.

3.11 Verification shall be undertaken for each item of electrical equipment for roadside technology and communications to be installed to visually inspect for signs of damage, with the results recorded in the inspection and test plan for that equipment.

3.12 The frequency of the visual inspection of the electrical equipment for roadside technology and communications shall be once prior to the installation of the equipment.

3.13 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection of the electrical roadside technology and communications equipment.

3.14 The requirements for all redundant roadside technology equipment, cables and cable drums, including delivery or collection, shall be as described in TC 131/WSR/003.

The requirements for all redundant roadside technology equipment, cables and cable drums, including delivery or collection,		
Asset	**Ownership status on completion of the works**	**Delivery, collection or disposal instructions**
(a)	(b)	(c)

a) Enter text, to identify the redundant roadside technology equipment, cables and cable drums.

b) Enter text, to state the ownership of the redundant asset on completion of the works.

c) Enter text, to specify the delivery, collection or disposal instructions.

3.15 Cable gland plates or boxes on electrical installations for roadside technology and communications shall be prepared to allow for earth continuity between the cable gland plate or box and the cable gland before the cable gland is fitted in accordance with BS 7671 [Ref 53.N] 'Protective conductors'.

3.16 All electrical installations cabling for roadside technology and communications that are connected to any roadside electricity supply during work shall be labelled at the time of connection.

3.17 Hazard warning labels for cabinets, enclosures and distribution equipment containing power shall be installed in accordance with BS 7671 [Ref 53.N] 'Identification and notices'.

3.18 The location of the hazard warning labels for cabinets, enclosures and distribution equipment containing power shall be in accordance with MCX 0164 [Ref 13.N], MCX 0165 [Ref 42.N], and MCX 0170 [Ref 19.N].

3.19 Outgoing circuits of consumer units shall be labelled to detail their rating and downstream service connection.

Electrical load of roadside technology equipment

3.20 The total electrical load of the roadside technology equipment, and details of the equipment types, that connect to each Electrical interface (EI) cabinet shall be as stated in TC 131/WSR/003.

The total electrical load of the roadside technology equipment, and details of the equipment types, that connect to each Electrical interface (EI) cabinet		
Electrical interface (EI) cabinet reference	**Total maximum load**	**Equipment types connected**
(a)	(b)	(c)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter a number in units of A, to identify the the total maximum load placed on electrical connections by roadside technology equipment.

c) Enter text, to identify the roadside technology equipment types connected to the supply.

3.21 The total load information required for both metered and unmetered exit points shall be provided to the Distribution Network Operator (DNO) in TC 131/WSR/003.

The total load information required for both metered and unmetered exit points		
EI cabinet reference	**Total load (DNO)**	**Type of metering**
(a)	(b)	(c)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter a number in units of kVA, to identify the total load information required for both metered and unmetered exit points to be provided to the DNO.

c) Enter a value, from options Metered, Unmetered, to describe the metering at the EI cabinet.

Installation of lightning protection for roadside technology equipment

3.22 The hazard warning labels for lightning protection components of roadside technology equipment shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

3.23 The equipotential bonding of electrical roadside technology equipment onto gantries, masts and poles as part of the Lightning Protection System (LPS) for the structure shall be compliant with BS EN 62305-3 [Ref 50.N].

3.24 The equipotential bonds shall meet the following performance characteristics: LPS class from I to IV.

3.25 The lightning protection requirements for electrical roadside technology equipment other than gantries shall be as specified in TC 131/WSR/003.

The lightning protection requirements for electrical roadside technology equipment other than gantries		
Asset structure reference	**Asset structure type**	**Lightning protection installation**
(a)	(b)	(c)

a) Enter a unique reference, to identify the structure that needs lightning protection.

b) Enter text, to identify the type of structure that needs lightning protection.

c) Enter text, to describe the installation details and/or drawing reference for the lightning protection system.

3.26 The space and fixing points to accommodate the TSP’s lightning protection components in roadside technology equipment shall be as stated in TC 131/WSR/003.

The space and fixing points to accommodate the TSP’s lightning protection components in roadside technology equipment			
Roadside technology equipment asset type needing the lightning protection component	**Location within the roadside technology equipment asset type to describe where the lightning protection component is to be installed**	**Space allocation**	**Fixing arrangement**
(a)	(b)	(c)	(d)

a) Enter text, to identify the asset type that needs to have the lightning protection components installed.

b) Enter text, to describe the location within the the asset type to describe where the lightning protection component is to be installed.

c) Enter text, to detail the space required in the roadside technology equipment asset type where the lightning protection component is to be installed.

d) Enter text, to detail the fixing arrangement required in the roadside technology equipment asset type to mount the lightning protection component.

3.27 The site-specific lightning protection arrangements required to support the provision of TSP communications services shall be as described in TC 131/WSR/003.

The site-specific lightning protection arrangements required to support the provision of TSP communications services			
Chainage	**Marker post**	**Carriageway**	**Description of site-specific lightning protection arrangements**
(a)	(b)	(c)	(d)

a) Enter text, to identify the chainage location that requires the lightning protection arrangement.

b) Enter text, to identify the marker post location that requires the lightning protection arrangement.

c) Enter text, to identify the carriageway location that requires the lightning protection arrangement.

d) Enter text, to describe the lightning protection arrangements required to support the provision of TSP communications services.

3.28 The installation of hazard warning labels for lightning protection of roadside technology equipment shall be in accordance with BS EN 62305-3 [Ref 50.N].

Installation of earthing components for roadside technology equipment

3.29 The hazard warning labels for the earthing components of roadside technology equipment shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

3.30 All protective conductors of roadside technology equipment shall be compliant with BS 7671 [Ref 53.N] 'Protective conductors'.

3.31 Power supply earthing of roadside technology equipment shall be in accordance with BS 7671 [Ref 53.N] 'Earthing arrangements'.

3.32 Earthing and bonding requirements for electrical roadside technology equipment shall be as specified in TC 131/WSR/003.

Earthing and bonding requirements for electrical roadside technology equipment						
Description of the roadside technology equipment needing earthing and bonding	**Chainage**	**Marker Post**	**Carriage way**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**Earthing and bonding requirements**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter text, to describe the roadside technology equipment that needs to have the earthing and bonding components installed.

b) Enter text, to specify the chainage location(s) the earthing requirement applies to.

c) Enter text, to specify the marker post location(s) the earthing requirement applies to.

d) Enter text, to specify the carriageway location(s) the earthing requirement apply to.

e) Enter a number in units of m, to identify the co-ordinate(s) for the earthing requirements.

f) Enter a number in units of m, to identify the co-ordinate(s) for the earthing requirements.

g) Enter text, to describe the earthing and bonding requirements.

3.33 The installation details of the earthing arrangements for use by the TSP’s lightning protection components shall be as stated in TC 131/WSR/003.

SI.3.33 The installation details of the earthing arrangements for use by the TSP’s lightning protection components shall be [enter free text].

3.34 Labelling for power supply earthing shall be in accordance with BS 7671 [Ref 53.N] 'Identification and notices'.

Installation of electrical protective devices for roadside technology equipment

3.35 The installation of protective devices for roadside technology equipment shall be in accordance with BS 7671 [Ref 53.N] 'Protection against overload current'.

3.36 The locations of electrical protective devices installed in EI and local power cabinets for roadside technology shall be as stated in TC 131/WSR/003.

The locations of electrical protective devices installed in EI and local power cabinets for roadside technology				
EI cabinet reference	**Local power cabinet reference**	**Surge protection device on incoming DNO supply**	**Protective device details**	**Surge protection device on incoming power circuit**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter a unique reference, to identify the local power cabinet.

c) Enter text, to identify the surge protection device on the incoming supply to the EI cabinets.

d) Enter text, to identify protective devices installed in power cabinets and other locations.

e) Enter text, to identify the surge protection device on the incoming power circuit to the cabinet.

3.37 The locations of electrical switchgear for roadside technology equipment shall be as stated in TC 131/WSR/003.

The locations of electrical switchgear for roadside technology equipment					
Electrical switchgear reference	**Electrical switchgear description**	**Location of switchgear**	**Chainage**	**Marker post**	**Carriage way**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the electrical switchgear.

b) Enter text, to describe the electrical switchgear installed.

c) Enter text, to identify where the electrical switchgear is located.

d) Enter text, to identify the chainage location where the electrical switchgear is installed.

e) Enter text, to identify the marker post location where the electrical switchgear is installed.

f) Enter text, to identify the carriageway location where the electrical switchgear is installed.

The locations of electrical switchgear for roadside technology equipment (continued)			
Electrical switchgear reference	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**New/Existing/ Modified**
(a)	(g)	(h)	(i)

g) Enter a number in units of m, to identify the co-ordinate where the electrical switchgear is installed.

h) Enter a number in units of m, to identify the co-ordinate where the electrical switchgear is installed.

i) Enter a value, from options New, Existing, Modified, to identify whether the electrical switchgear installation is new, existing or modified.

Installation of electrical distribution devices for roadside technology equipment

3.38 The electrical distribution devices for roadside technology equipment shall be located and mounted as stated in TC 131/WSR/003.

The electrical distribution devices for roadside technology equipment					
Electrical distribution device reference	**Electrical distribution device description**	**Asset type**	**Asset reference**	**Chainage**	**Marker post**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the electrical distribution device.

b) Enter text, to describe the electrical distribution device.

c) Enter text, to identify the type of asset that the electrical distribution device is to be installed into.

d) Enter a unique reference, to identify the asset that the electrical distribution device shall be installed into.

e) Enter text, to identify the chainage location of the asset that the electrical distribution device shall be installed into.

f) Enter text, to identify the marker post location of the asset that the electrical distribution device shall be installed into.

The electrical distribution devices for roadside technology equipment (continued)				
Electrical distribution device reference	**Carriage way**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**Method of mounting**
(a)	(g)	(h)	(i)	(j)

g) Enter text, to identify the carriageway location of the asset that the electrical distribution device shall be installed into.

h) Enter a number in units of m, to identify the X (Easting) co-ordinate of the asset that the electrical distribution device shall be installed into.

i) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the asset that the electrical distribution device shall be installed into.

j) Enter text, to describe the method of mounting the electrical distribution device into the asset.

Installation of electrical switches for technology equipment mounted on a gantry

3.39 Electrical switches for the isolation of technology equipment that are not mounted at the gantry in an enclosure shall be as stated in TC 131/WSR/003.

Electrical switches for the isolation of technology equipment that are not mounted at the gantry in an enclosure					
Electrical switch reference	**Electrical switch type**	**Asset type**	**Asset reference**	**Chainage**	**Marker post**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the electrical switch to be installed.

b) Enter text, to identify the type of electrical switch to be installed.

c) Enter text, to identify the asset type that the electrical switch is to be installed into.

d) Enter a unique reference, to identify the asset that the electrical switch is to be installed into.

e) Enter text, to identify the chainage location of the asset that the electrical switch shall be installed into.

f) Enter text, to identify the marker post location of the asset that the electrical switch shall be installed into.

Electrical switches for the isolation of technology equipment that are not mounted at the gantry in an enclosure (continued)				
Electrical switch reference	**Carriageway**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**Method of mounting**
(a)	(g)	(h)	(i)	(j)

g) Enter text, to identify the carriageway location of the asset that the electrical switch shall be installed into.

h) Enter a number in units of m, to identify the X (Easting) co-ordinate of the asset that the electrical switch shall be installed into.

i) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the asset that the electrical switch shall be installed into.

j) Enter text, to describe the method of mounting the electrical switch into the asset.

3.40 The enclosure for the electrical switch for the isolation of technology equipment mounted on the gantry shall be lockable.

3.41 Two sets of keys for each type of enclosure used for electrical switches for the isolation of technology equipment mounted on the gantries on the scheme shall be provided.

3.42 The enclosure for the electrical switch for the isolation of technology equipment mounted on the gantry shall be ultra-violet (UV) stable.

Modification to existing electrical installations for roadside technology and communications

3.43 The maximum period of disruption due to the installation or modification of power supplies for roadside technology and communications shall be as stated in TC 131/WSR/003.

SI.3.43a The maximum period of disruption due to the installation or modification of power supplies for roadside technology and communications shall be [enter a number] .

SI.3.43b The start of any specified time period (day/time) that disruption is allowed shall be [enter free text].

SI.3.43c The end of any specified time period (day/time) that disruption is allowed shall be [enter free text].

3.44 When disconnecting existing electrical roadside technology equipment, cables shall be disconnected from the energising end first.

3.45 Terminal screws and cable glands shall be re-tightened after disconnecting electrical roadside technology cables..

3.46 Roadside technology cabinets to be re-sited shall be un-bolted from their plinths or supports, together with their holding-down bolts.

3.47 Roadside technology cabinets to be stored for re-siting shall be stored with their holding-down bolts.

3.48 When removing existing roadside technology cabinets that are not to be re-sited, plinths and concrete foundations shall be broken out and disposed of in compliance with "Site clearance" in Section 1 of GC 109 [Ref 58.N].

3.49 When removing existing roadside technology cabinets, plinths and cable trenches the reinstatement shall be level with the surrounding ground, unless otherwise stated in TC 131/WSR/003.

SI.3.49 The requirements of the reinstatement when removing existing roadside technology cabinets, plinths and cable trenches, if not level with the surrounding ground, shall be [enter free text].

3.50 When removing existing roadside equipment, any resulting waste shall be disposed of.

Testing and commissioning of electrical installations for roadside technology and communications

3.51 The responsibility for the inspection and testing of electrical installations for roadside technology and communications, when the supply becomes for the sole use of the TSP shall be with the TSP, unless otherwise stated in TC 131/WSR/003.

SI.3.51 The responsibility for the inspection and testing of electrical installations for roadside technology and communications, when the supply becomes for the sole use of the TSP shall be [enter free text].

3.52 Verification shall be undertaken for each electrical installations for roadside technology and communications by inspection and testing in accordance with BS 7671 [Ref 53.N] 'Inspection and Testing', with the results recorded in the electrical installation certificate.

3.53 The frequency of the electrical inspection and testing shall be once upon completion of the installation of each electrical installation for roadside technology and communications.

3.54 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the electrical inspection and testing.

3.55 Verification shall be undertaken for the protective equipotential bonding of technology equipment onto each gantry, mast and pole by visual inspection and testing in accordance with BS EN 62305-3 [Ref 50.N] 'Maintenance and inspection of an LPS', with the results recorded in the LPS inspection report as detailed in BS EN 62305-3 [Ref 50.N] Annex E.

3.56 The frequency of the visual inspection and testing of the protective equipotential bonding of technology equipment onto each gantry, mast and pole shall be once upon completion of the installation of the lightning protection system and technology equipment.

3.57 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection and testing of the protective equipotential bonding of technology equipment onto each gantry, mast and pole.

3.58 Verification shall be undertaken for the protection of each roadside technology equipment from internal damage from lightning current and its associated magnetic field by visual inspection and measurement in accordance with BS EN 62305-4 [Ref 49.N] 'Inspection procedure, with the results recorded in the inspection report as detailed in BS EN 62305-4 [Ref 49.N].

3.59 The frequency of the visual inspection and measurement of the protection of each roadside technology equipment from internal damage from lightning current shall be once upon completion of the installation of the lightning protection system and technology equipment.

3.60 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection and measurement of the protection of each roadside technology equipment from internal damage from lightning current.

Documentation requirements for electrical installations for roadside technology and communications

3.61 The following Documentation shall be submitted for electrical inspection and testing of the electrical provision for roadside technology and communications prior to the commencement of further works: electrical installation certificate in accordance with BS 7671 [Ref 53.N].

3.62 Documentation for electrical inspection and testing shall be submitted to the Overseeing Organisation and the TSP within 10 working days.

3.63 The following Documentation shall be submitted for the equipotential bonding of roadside technology equipment onto each gantry, mast and pole prior to the commencement of project closure: LPS inspection report.

3.64 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the LPS inspection report.

3.65 The following Documentation shall be submitted for the protection of each roadside technology equipment from internal damage from lightning current and its associated magnetic field prior to the commencement of prior to the project closure: inspection report.

3.66 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the inspection report.

3.67 The Documentation for recording electrical installations that are connected or disconnected from the roadside electricity supply during the works shall be recorded as shown in Table 3.67 and be submitted within 4 weeks of the connection or disconnection or as stated in TC 131/WSR/003.

Table 3.67 Connection/disconnection record

Asset identifier	Asset location	Power Cabinet disconnected from	Connection date	Disconnection date

SI.3.67 The number of weeks to submit a record of the connection or disconnection of electrical installations for roadside technology and communications from the roadside electricity supply during work when this is not 4 shall be [enter a number] .

3.68 The following Documentation shall be submitted for non-compliant electrical installations for roadside technology and communications prior to the commencement of any further works: details of the non-compliance with BS 7671 [Ref 53.N] in the form of an electrical installation condition report in accordance with BS 7671 [Ref 53.N].

3.69 Documentation for non-compliant electrical installations for roadside technology and communications shall be submitted within 1 day.

4. General requirements for cabinets for roadside technology and communications

Product requirements for roadside technology and communications cabinets

4.1 Type 610 plinth skirt and frame of cabinets for roadside technology and communications shall be compliant with MCE 1175 [Ref 39.N].

4.2 The 6 mm pea gravel for use in the base of cabinets for roadside technology and communications shall be compliant with BS EN 12620 [Ref 1.N].

4.3 The 6 mm pea gravel shall meet the following performance characteristics: all in aggregate designation 0/6.3 mm as per Table 1 in BS EN 12620 [Ref 1.N], no other requirements are specified.

4.4 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 21.N] shall apply to 6 mm pea gravel for use in the base of cabinets for roadside technology and communications.

Scope of works for electrical interface (EI) cabinet installations

4.5 The installation of EI cabinets shall be as stated in TC 131/WSR/004.

The installation of EI cabinets					
EI cabinet reference	**EI cabinet type**	**EI cabinet variant**	**EI cabinet foundation type**	**Model reference ID (optional)**	**Chainage**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter text, to identify the type of EI cabinet, for example Type 609N.

c) Enter text, to identify the EI cabinet variant, for example Aluminium – DNO Interface or Steel – Rural Power.

d) Enter text, to identify the foundation type for the EI cabinet.

e) Enter text, to identify the 3D model reference of the EI cabinet.

f) Enter text, to identify the chainage location of EI cabinet.

The installation of EI cabinets (continued)						
EI cabinet reference	**Marker post**	**Carriage way**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**Site arrangement drawing**	**New/Existing/ Modified**
(a)	(g)	(h)	(i)	(j)	(k)	(l)

g) Enter text, to identify the marker post location of EI cabinet.

h) Enter text, to identify the carriageway location of the EI cabinet.

i) Enter a number in units of m, to identify the X (Easting) co-ordinate of EI cabinet.

j) Enter a number in units of m, to identify the Y (Northing) co-ordinate of EI cabinet.

k) Enter text, to identify the site arrangement drawing for the EI cabinet.

l) Enter a value, from options New, Existing, Modified, to identify whether the EI cabinet to be installed is new, existing or modified.

4.6 The modification of existing EI cabinet installations shall be as stated in TC 131/WSR/004.

The modification of existing EI cabinet installations							
EI cabinet reference	**Remove and re-install cabinet duct seals and base pea gravel**	**Remove and re-lay hardstanding maintenance working area**	**Excavate to expose cable, re-termination loop and excavate cable routes**	**Re-route cable to gain sufficient lengths**	**Reinstate cable trenches**	**Break open and re-seal resin filled base**	**Other cabinet modifications required**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter a value, from options Yes, No, to identify the modification to remove and re-install the cabinet duct seals and base pea gravel installations.

c) Enter a value, from options Yes, No, to identify the modification to remove and re-lay the cabinet hardstanding maintenance working area.

d) Enter a value, from options Yes, No, to identify the modification to expose cable, re-termination loop and excavate cable routes on direct buried cable routes.

e) Enter a value, from options Yes, No, to identify the modification to re-route cable to gain sufficient lengths.

f) Enter a value, from options Yes, No, to identify the modification to reinstate cable trench installations.

g) Enter a value, from options Yes, No, to identify the modification to break open and re-seal resin filled base installations for armoured cable routes.

h) Enter text, to identify other cabinet modifications.

Scope of works for local power cabinets and communications cabinets for roadside technology equipment installations

4.7 The installation of local power cabinets and communications cabinets for roadside technology equipment shall be as stated in TC 131/WSR/004.

The installation of local power cabinets and communications cabinets for roadside technology equipment					
Local power cabinet or communications cabinet reference	**Cabinet type**	**Cabinet variant**	**Cabinet adaption kits**	**Communications cabinet termination frame**	**Local power cabinet internal configuration**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the local power cabinet or communications cabinet for the roadside technology equipment.

b) Enter text, to identify the cabinet type of the local power cabinet or communications cabinet for roadside technology equipment, for example 600 or 640.

c) Enter text, to identify the cabinet variant for the local power cabinet or communications cabinet for roadside technology equipment, for example rural or local.

d) Enter one or more values, from options None, AMI kit 1, AMI kit 2, ADSL, HADECS, ADS Lighting, to identify which optional adaption kits are to be installed.

e) Enter text, to identify the type of termination frame to be installed into the communications cabinet or box within the cabinet.

f) Enter text, to identify the drawing reference showing the internal fit out of the local power cabinet for roadside technology equipment.

The installation of local power cabinets and communications cabinets for roadside technology equipment (continued)					
Local power cabinet or communications cabinet reference	**Communications cabinet termination frame wiring**	**Wiring diagram for communications bay**	**Environmental options**	**Cabinet foundation type**	**Model reference ID (optional)**
(a)	(g)	(h)	(i)	(j)	(k)

g) Enter text, to identify the drawing reference to describe the wiring diagram, including the termination blocks, for the termination frame to be installed into the communications cabinet for roadside technology equipment.

h) Enter text, to identify the drawing reference to describe the wiring diagram for the communications bay in the communications cabinet for roadside technology equipment.

i) Enter one or more values, from options None, Heater, Cooling, to identify the options required to be installed to maintain the temperature of the cabinet for roadside technology equipment.

j) Enter text, to identify the foundation type for the cabinet for roadside technology equipment.

k) Enter text, to identify the 3D model reference of the local power cabinet or communications cabinet for roadside technology equipment.

The installation of local power cabinets and communications cabinets for roadside technology equipment (continued)						
Local power cabinet or communications cabinet reference	**Chainage**	**Marker post**	**Carriageway**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**New/Existing/ Modified**
(a)	(l)	(m)	(n)	(o)	(p)	(q)

l) Enter text, to identify the chainage location of the local power cabinet or communications cabinet for roadside technology equipment.

m) Enter text, to identify the marker post location of the local power cabinet or communications cabinet for roadside technology equipment.

n) Enter text, to identify the carriageway location of the local power cabinet and communications cabinet for roadside technology equipment.

o) Enter a number in units of m, to identify the X (Easting) co-ordinates of the local power cabinet or communications cabinet for roadside technology equipment.

p) Enter a number in units of m, to identify the Y (Northing) co-ordinates of the local power cabinet or communications cabinet for roadside technology equipment.

q) Enter a value, from options New, Existing, Modified, to identify whether the cabinet installation for roadside technology equipment is new, existing or modified.

4.8 The modification of existing cabinet installations for roadside technology and communications shall be as stated in TC 131/WSR/004.

The modification of existing cabinet installations for roadside technology and communications							
Local power cabinet or communications cabinet reference	**Remove and re-install cabinet duct seals and base pea gravel**	**Remove and re-lay hardstanding maintenance working area**	**Excavate to expose cable, re-termination loop and excavate cable routes**	**Re-route cable to gain sufficient lengths**	**Reinstate cable trenches**	**Break open and re-seal resin filled base**	**Other cabinet modifications required**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference, to identify the local power cabinet or communications cabinet for roadside technology equipment.

b) Enter a value, from options Yes, No, to identify the modification to remove and re-install the cabinet duct seals and base pea gravel installations for existing cabinet installations.

c) Enter a value, from options Yes, No, to identify the modification to remove and re-lay the cabinet hardstanding maintenance working area for existing cabinet installations.

d) Enter a value, from options Yes, No, to identify the modification to expose cable, re-termination loop and excavate cable routes on direct buried cable routes for existing cabinet installations.

e) Enter a value, from options Yes, No, to identify the modification to re-route cable to gain sufficient lengths for existing cabinet installations.

f) Enter a value, from options Yes, No, to identify the modification to reinstate cable trench installations for existing cabinet installations.

g) Enter a value, from options Yes, No, to identify the modification to break open and re-seal resin filled base installations for armoured cable routes for existing cabinet installations.

h) Enter text, to identify other cabinet modifications for roadside technology and communications.

Installation of cabinets for roadside technology and communications

4.9 The installation of cabinets for roadside technology and communications shall comply with "Telecommunications services" in Section 2 of this document.

4.10 Cables installed within cabinets for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

4.11 The installation of cabinet labels for roadside technology and communication shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

4.12 The interior of cabinets for roadside technology and communications shall be kept free from moisture and debris.

4.13 Cabinets for roadside technology and communications within 2.5 m of a gantry structure shall be bonded to the structure to provide protection by a protective bonding conductor in compliance with BS 7671 [Ref 53.N] 'Additional protection: supplementary protective equipotential bonding'.

4.14 Cabinets for roadside technology and communications, separated by less than 2.5 m, shall be bonded together to provide protection by a protective bonding conductor in compliance with BS 7671 [Ref 53.N] 'Additional protection: supplementary protective equipotential bonding'.

4.15 The number of 6 A ways within the consumer unit to be provided in each roadside technology equipment cabinet for the TSP's use when not limited to one shall be as described in TC 131/WSR/004.

The number of 6 A ways within the consumer unit to be provided in each roadside technology equipment cabinet for the TSP's use when not limited to one				
Local power cabinet or communications cabinet reference	**Chainage**	**Marker post**	**Carriageway**	**Number of 6 A ways**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the local power cabinet or communications cabinet for roadside technology equipment.

b) Enter text, to identify the chainage location of the local power cabinet or communications cabinet for roadside technology equipment.

c) Enter text, to identify the marker post location of the local power cabinet or communications cabinet for roadside technology equipment.

d) Enter text, to identify the carriageway location of the local power cabinet or communications cabinet for roadside technology equipment.

e) Enter a number, to specify the number of 6 A ways to be installed for the TSP's use when it is not limited to one.

4.16 The items that need to be installed in addition to the standard cabinet specification for roadside technology and communications shall be as stated in TC 131/WSR/004.

SI.4.16 The details of the items to be installed in addition to the standard cabinet specification for roadside technology and communications shall be [enter free text].

4.17 Cabinets for roadside technology and communications shall be mounted on its foundation in accordance with the manufacturer’s instructions.

4.18 The locations where the external clearance from non-accessible faces of cabinets for roadside technology and communications is less than 250 mm shall be as specified in TC 131/WSR/004.

The locations where the external clearance from non-accessible faces of cabinets for roadside technology and communications is less than 250 mm				
EI cabinet reference	**Local power cabinet or communications cabinet reference**	**Cabinet geographic address**	**Clearance dimension**	**Featu re**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the EI cabinet with the constrained clearance.

b) Enter a unique reference, to identify the local power cabinet or communications cabinet for roadside technology equipment with the constrained clearance.

c) Enter text, to identify the geographic address for the location of cabinet with the constrained clearance.

d) Enter a number in units of mm, to specify the minimum clearance between the cabinet and the other feature when it is less than 250 mm.

e) Enter text, to describe the feature next to the cabinet with the constrained clearance.

NI/4.19 Security straps on cabinets for roadside technology and communications shall be fitted as specified.

4.20 Security straps on cabinets for roadside technology and communications shall be as specified in TC 131/WSR/005.

Security straps on cabinets for roadside technology and communications			
EI cabinet reference	**Local power cabinet reference**	**Communications cabinet**	**Security strap to be fitted**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter a unique reference, to identify the local power cabinet.

c) Enter a unique reference, to identify the communications cabinet.

d) Enter a value, from options Yes, No, to identify which cabinets need a security strap fitting.

Installation of fan trays in cabinets for roadside technology and communications

4.21 The installation of a fan tray within cabinets for roadside technology and communications shall be as stated in TC 131/WSR/004.

The installation of a fan tray within cabinets for roadside technology and communications		
Local power cabinet or communications cabinet reference	**Fan tray**	**Fan tray location**
(a)	(b)	(c)

a) Enter a unique reference, to identify the local power cabinet or communications cabinet for roadside technology equipment.

b) Enter a value, from options Yes, No, to identify if a fan tray is to be installed in the cabinet for roadside technology and communications.

c) Enter text, to identify where a fan tray is to be installed in the cabinet for roadside technology and communications.

4.22 Fan trays installed in cabinets for roadside technology and communications shall not be powered from the TSP's power distribution unit (PDU) strip.

Installation of internal wiring within a cabinet for roadside technology and communications

4.23 The adaption kits for cabinets for roadside technology and communications shall be installed in accordance with the manufacturer's instructions.

4.24 All cable routes within a cabinet for roadside technology and communications shall follow the cabinet frame to leave the body of the frame clear for further equipment to be installed later.

4.25 All internal wiring looms within a cabinet for roadside technology and communications shall either be:

1. supported and terminated, or;

2. bound together and tied back.

4.26 All internal wiring looms within a cabinet for roadside technology and communications shall be installed using a cable compatible with the connector with a minimum conductor diameter of 0.5 mm.

4.27 Termination blocks and insulation displacement connectors (IDCs) shall be provided to terminate the cables within a cabinet for roadside technology and communications.

Installation of external wiring to cabinets for roadside technology and communications

4.28 Each incoming and outgoing cable from a cabinet for roadside technology and communications shall be securely fixed into the cabinet using cable glands or restraining methods whilst preserving the IP rating of the cabinet.

4.29 Non-armoured incoming and outgoing cables from a cabinet for roadside technology and communications shall be clamped in accordance with Figure 4.29a-b.

Figure 4.29a Clamping arrangement for incoming and outgoing non-armoured cables from a cabinet for roadside technology and communications.

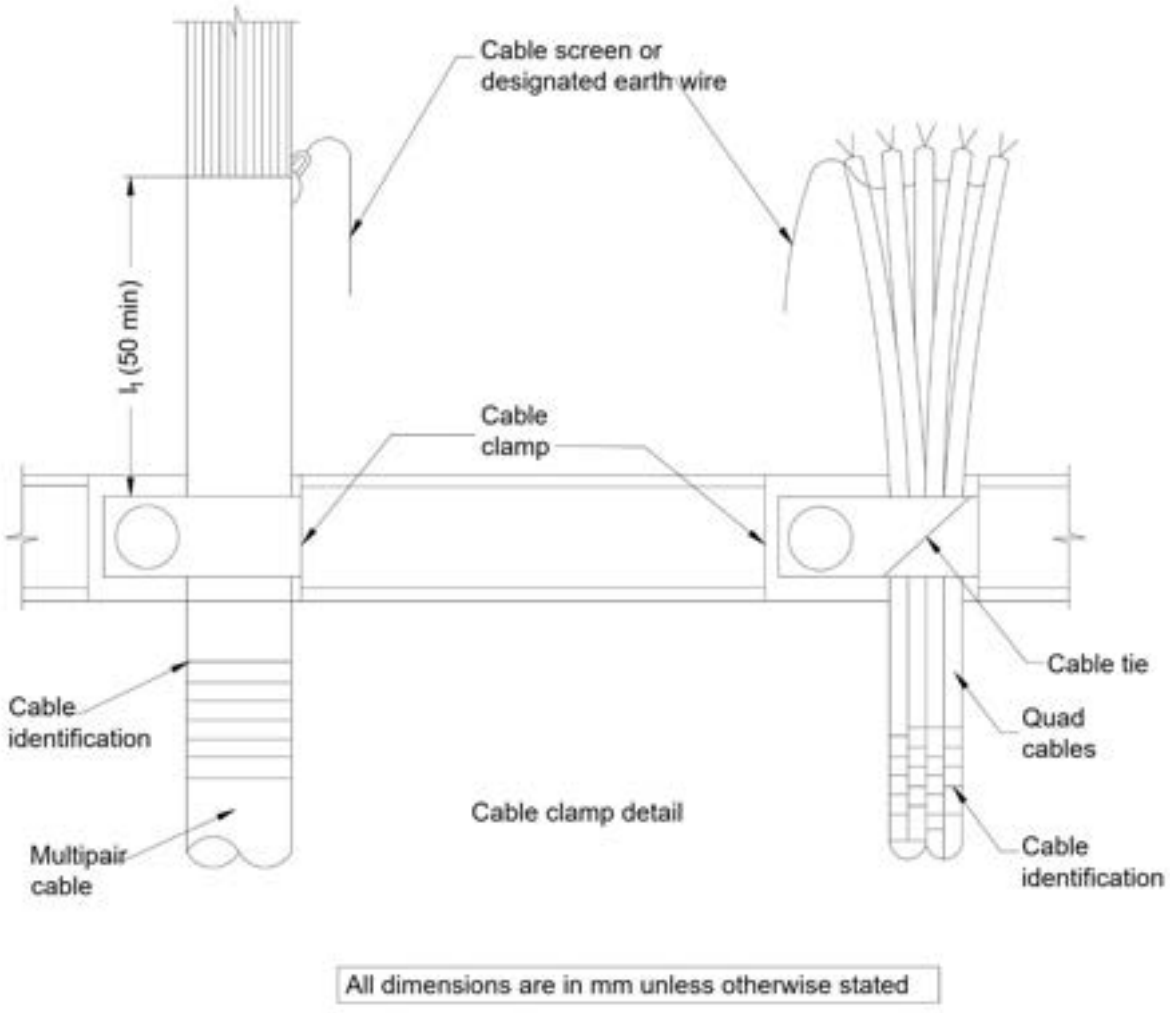
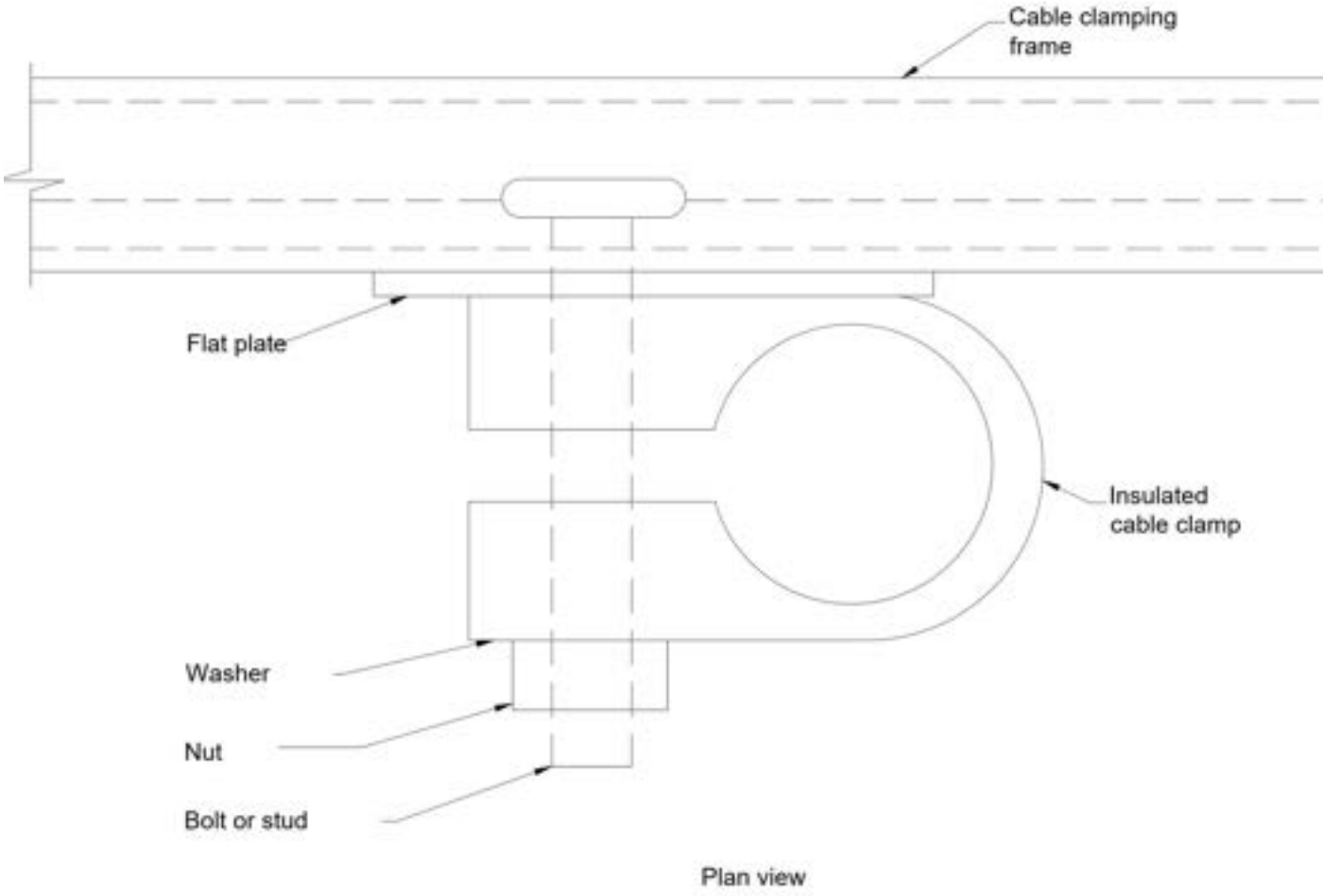


Figure 4.29b Plan view of the clamping arrangement for incoming and outgoing non-armoured cables from a cabinet for roadside technology and

communications.



4.30 Armoured cables installed into cabinets for roadside technology and communications shall be securely earthed to the cabinet clamping frame using a cable gland plate arrangement or a claw cleat.

4.31 Cable screens and designated earth wires in cabinets for roadside technology and communications shall be taken to the cabinet main earth terminal or nearest earth terminal.

Installation of boxes in cabinets for roadside technology and communications

4.32 Boxes installed in cabinets for roadside technology and communications shall be mounted onto the backboard or frame of the cabinet.

4.33 Knockouts shall be removed for the cables entering the box installed into cabinets for roadside technology and communications.

4.34 Boxes installed in cabinets for roadside technology and communications shall have holes bushed or fitted with cable glands.

4.35 Boxes installed in cabinets for roadside technology and communications shall maintain the IP rating of IP56 in accordance with BS EN 60529 [Ref 10.N].

4.36 Metallic boxes in cabinets for roadside technology and communications shall be earthed to the cabinet main earth terminal or nearest earth terminal.

4.37 The additional requirements for boxes installed in cabinets for roadside technology and communications shall be as stated in TC 131/WSR/004.

SI.4.37 The additional requirements of boxes installed in cabinets for roadside technology and communications shall be [enter free text].

Installation requirements for cabinet doors for roadside technology and communications

4.38 Cabinet doors for roadside technology and communications shall be securely closed and locked after the installation.

4.39 The security measures, in addition to door locks, to deter unauthorised access to cabinets for roadside technology and communications shall be as stated in TC 131/WSR/004.

SI.4.39 The details of the security measures, in addition to door locks, to deter unauthorised access to cabinets for roadside technology and communications shall be [enter free text].

4.40 Cabinet doors for roadside technology and communications shall open to their full extent to allow unimpeded access to the cabinet interior.

Installation of foundations and chambered bases of cabinets for roadside technology and communications

4.41 Foundations and chambered bases of cabinets for roadside technology and communications shall be installed to allow the cabinet to stand in an upright vertical position throughout operation.

4.42 In-filling around the foundations and chambered bases of cabinets for roadside technology and communications shall not affect the subsequent installation of a cabinet directly onto the foundation or chambered base.

4.43 The foundations and chambered bases of cabinets for roadside technology and communications shall be installed to the orientation shown in drawings or model.

4.44 The number of ducts entering a cabinet chamber base or plinth for roadside technology and communications shall be as in TC 131/WSR/004.

The number of ducts entering a cabinet chamber base or plinth for roadside technology and communications			
Local power cabinet or communications cabinet reference	**EI cabinet reference**	**Ducts into the local power cabinet or communications cabinet**	**Ducts into EI cabinet**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the local power cabinet or communications cabinet for the roadside technology equipment.

b) Enter a unique reference, to identify the EI cabinet.

c) Enter text, to identify the number and size of ducts into the equipment cabinet.

d) Enter text, to identify the number and size of ducts into the EI cabinet.

Installation of Type 610 plinth for cabinets for roadside technology and communications

4.45 The foundation for the Type 610 plinth for cabinets for roadside technology and communications shall be in accordance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 33.N].

4.46 The locations where RC 20/25 concrete is not to be used for a Type 610 plinth foundation shall be as specified in CC 495/WSR/002.

The locations where RC 20/25 concrete is not to be used for a Type 610 plinth foundation	
Cabinet reference	**Concrete type**
(a)	(b)

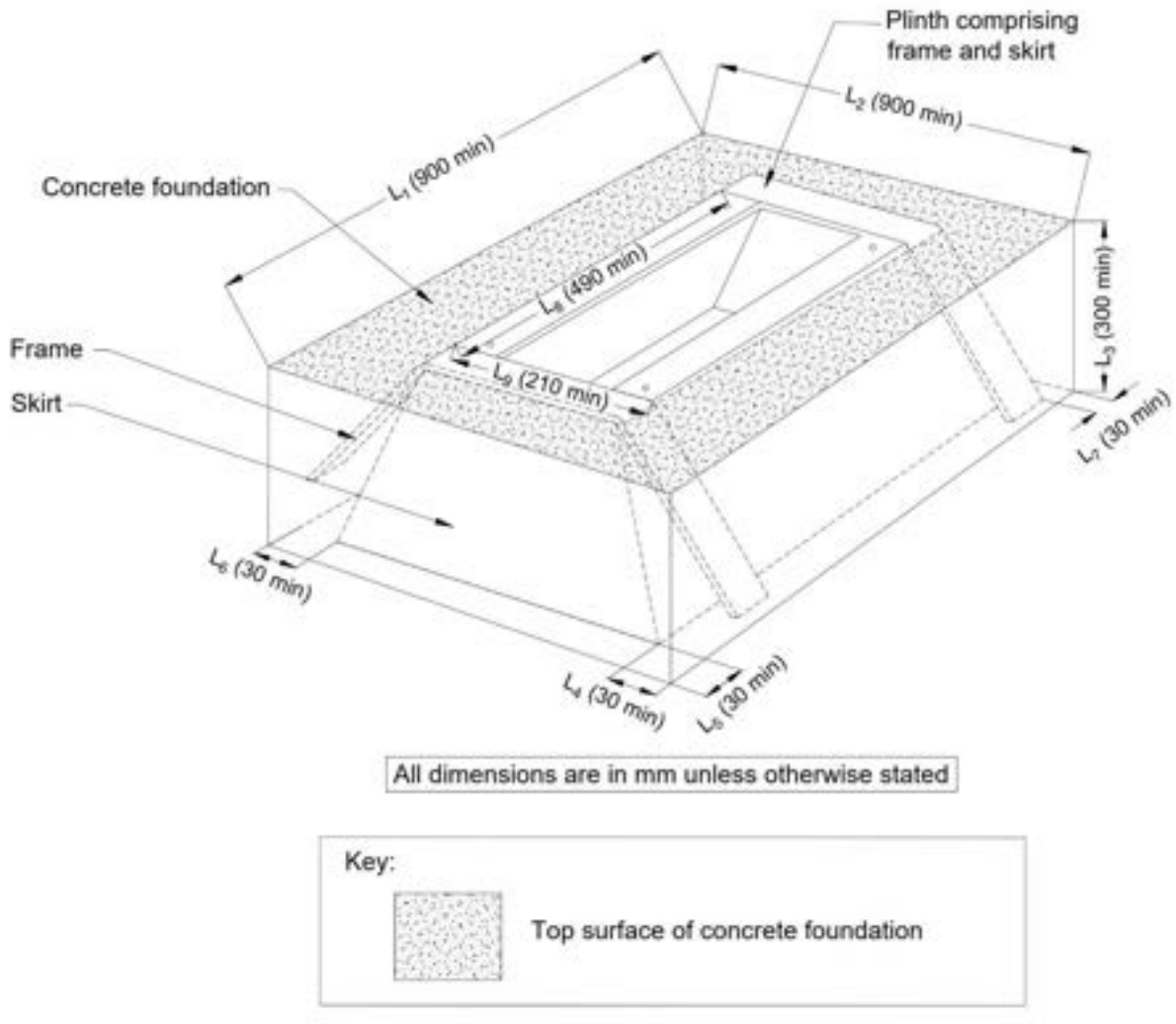
a) Enter a unique reference, to identify the cabinet to be installed on a Type 610 plinth which does not used Type RC 20/25 concrete for the foundation.

b) Enter text, to identify the type of concrete that is to be used for the Type 610 plinth for cabinets for roadside technology and communications.

4.47 The Type 610 plinth skirt shall not be deformed during the placing of the concrete foundation.

4.48 A Type 610 plinth foundation shall be in accordance with Figure 4.48.

Figure 4.48 Type 610 plinth foundation



NI/4.49 Cabinet types 600, 609 and post 75 for roadside technology and communications shall be mounted on Type 610 plinths using the fixings provided with the cabinet or post.

Installation of entry/exit ducts to cabinets for roadside technology and communications

4.50 The entry/exit ducts to cabinets for roadside technology and communications shall comply with the 'Installation of duct plugs or duct sealing for roadside technology and communications' requirements of "Ducts for roadside technology and communications" in Section 15 of this document.

4.51 Entry/exit ducts to cabinets for roadside technology and communications on Type 610 plinths, on a ducted network shall be sealed

to an IP47 rating in accordance with BS EN 60529 [Ref 10.N], with a removable duct sealing system, to prevent the ingress of water, soil, gravel and rodents.

4.52 Modifications to existing cabinets for roadside technology and communications that require the removal of the cabinet duct seals and existing base pea gravel shall be reinstated with cabinet duct seals and 6 mm pea gravel.

Installation of hardstanding maintenance working areas for cabinets for roadside technology and communications

4.53 Hardstanding maintenance working areas for cabinets for roadside technology and communications shall comply with the 'Hardstanding maintenance working areas for roadside technology equipment sites' requirements of "General requirements for roadside technology and communications" in Section 1 of this document.

4.54 The locations where the width of hardstanding maintenance working areas around cabinets for roadside technology and communications are less than 250 mm from the non-opening faces of the cabinet shall be as specified in TC 131/WSR/004.

The locations where the width of hardstanding maintenance working areas around cabinets for roadside technology and communications are less than 250 mm from the non-opening faces of the cabinet	
Cabinet reference	**Width of hardstanding maintenance working area**
(a)	(b)

a) Enter a unique reference, to identify the cabinets for roadside technology and communications.

b) Enter a number in units of mm, to describe the width of the hardstanding maintenance working area in front of the non-opening face of the cabinet when it is less than 250 mm.

Documentation requirements for cabinets for roadside technology and communications

Product compliance documentation for cabinets for roadside technology and communications

4.55 The following Documentation shall be submitted for each Type 610 plinth skirt and frame prior to the commencement of the installation of the plinth skirt and frame: build standard qualification certificate showing that

the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

5. Power cabinets for roadside technology and communications

Product requirements for power cabinets for roadside technology and communications

5.1 Power cabinets for roadside technology and communications shall be in accordance with MCE 1188 [Ref 85.N] or MCE 2650 [Ref 63.N].

5.2 Security straps for Type 609 cabinets for roadside technology and communications shall be in accordance with MCX 0991 [Ref 5.N].

Installation of power cabinets for roadside technology and communications

5.3 Power cabinets for roadside technology and communications shall comply with "General requirements for cabinets for roadside technology and communications" in Section 4 of this document.

5.4 Power cabinets for roadside technology and communications shall comply with "Electrical installations for roadside technology and communications" in Section 3 of this document.

5.5 Power cabinets for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

5.6 The cut out fuses of power supply cabinets for roadside technology and communications shall be as stated in TC 131/WSR/005.

The cut out fuses of power supply cabinets for roadside technology and communications			
EI cabinet reference	**Local power cabinet reference**	**Cabinet geographic address**	**Drawing reference**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter a unique reference, to identify the local power cabinet.

c) Enter text, to identify the geographic address for the location of the cabinet.

d) Enter text, to identify the scheme drawing that specifies the cut out layout to be used.

5.7 Circuit diagram labels installed inside power cabinets for roadside technology and communications shall be provided in accordance with BS 7671 [Ref 53.N] 'Diagrams and documentation'.

5.8 After the completion of cable terminations and testing, the bases and ducts of power cabinets for roadside technology and communications shall be sealed to maintain the following, in accordance with the manufacturer's instructions:

1. IP rating of the cabinet;

2. rodent protection; and

3. the ability to add and replace cables without damage.

5.9 Power for environmental conditioning shall be in place prior to the installation of equipment into power cabinets for roadside technology and communications.

5.10 Power for environmental conditioning shall be maintained after the installation of equipment into cabinets for roadside technology and communications.

Modification of existing power cabinets for roadside technology and communications

5.11 The modification of existing power cabinets for roadside technology and communications shall comply with the requirements for 'Modifications to operational roadside technology equipment' contained in "Telecommunications services" in Section 2 of this document.

5.12 Modifications to power cabinets for roadside technology and communications that need cable glands to be undone shall be re-glanded, including the provision of new ducts seals, cable gland assemblies and cable ancillaries, as stated in TC 131/WSR/005.

Modifications to power cabinets for roadside technology and communications that need cable glands to be undone	
EI cabinet reference	**Local power cabinet reference**
(a)	(b)

a) Enter a unique reference, to identify the EI cabinet that need cable glands to be undone.

b) Enter a unique reference, to identify the local power cabinet that need cable glands to be undone.

5.13 When modifying existing power cabinets for roadside technology and communications, cables at the cabinet base shall be withdrawn and re-installed when the modification to the cabinet cables does not require an increase in cable lengths or a replacement of the cable.

Installation of electricity interface (EI) cabinet installations

5.14 The requirements of the Distribution Network Operator (DNO) for the supply connections shall be as stated in TC 131/WSR/005.

SI.5.14 The requirements of the DNO for the supply connections shall be [enter free text].

5.15 The type of electricity connection from the electricity supplier into the electricity interface (EI) cabinet shall be as stated in TC 131/WSR/005.

The type of electricity connection from the electricity supplier into the electricity interface (EI) cabinet		
EI cabinet reference	**Incoming supply earthing arrangement**	**Number of phases**
(a)	(b)	(c)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter a value, from options TN-C-S, TT, TN-S, to identify the type of earthing arrangement from the electricity supplier into the EI cabinet.

c) Enter a value, from options Single, 3-phase, dual phase, to identify the number of phases to be supplied by the DNO into the EI cabinet.

5.16 The structural integrity of the fence shall be unaffected by the installation of the EI cabinet.

5.17 The EI cabinet shall not form part of the fence nor provide structural integrity for the fence.

5.18 The foundations of the EI cabinet shall be separate from the foundations of the fence.

5.19 The earthing arrangements for EI cabinets using a TT system as defined in BS 7671 [Ref 53.N] shall be as stated in TC 131/WSR/005.

SI.5.19 The details of the earthing arrangements for EI cabinets using a TT system as defined in BS 7671 [Ref 53.N] shall be [enter free text].

5.20 The gate used to access EI cabinets from third party land shall be lockable with a padlock.

5.21 The gate used to access EI cabinets from third party land shall include a mechanism to hold the gate open during maintenance activities.

5.22 The internal assembly for EI cabinets shall be in accordance with MCX 0164 [Ref 13.N].

5.23 The internal wiring for EI cabinets shall be as described in TC 131/WSR/005.

The internal wiring for EI cabinets	
EI cabinet reference	**Circuit diagram document reference**
(a)	(b)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter text, to identify the document in the document register detailing the circuit diagram for the EI cabinet.

5.24 The clearance gap between the EI cabinet foundation and the fence post shall be as specified in TC 131/WSR/005.

The clearance gap between the EI cabinet foundation and the fence post		
EI cabinet reference	**Clearance gap between the EI cabinet foundation and fence posts foundation**	**Gap between fence rails and EI cabinet**
(a)	(b)	(c)

a) Enter a unique reference, to identify the EI cabinet.

b) Enter text, to identify the clearance gap required between the EI cabinet foundation and fence posts foundation.

c) Enter text, to identify the requirements for the gap between the EI cabinet and the fence rails.

Installation of gantry power cabinets for roadside technology and communications

5.25 Gantry power cabinets for roadside technology and communications shall be installed in accordance with MCE 2651 [Ref 64.N].

5.26 The internal assembly of gantry power cabinets for roadside technology and communications shall be in accordance with MCX 0170 [Ref 19.N].

5.27 The internal wiring of gantry power cabinets for roadside technology and communications shall be as described in TC 131/WSR/005.

The internal wiring of gantry power cabinets for roadside technology and communications	
Local power cabinet reference	**Circuit diagram document reference**
(a)	(b)

a) Enter a unique reference, to identify the local power cabinet that is to be used as the gantry power cabinet.

b) Enter text, to identify the scheme drawing detailing the circuit diagram for the gantry power cabinet.

5.28 The installation of cable labelling in gantry power cabinets for roadside technology and communications shall be in accordance with MCE 2651 [Ref 64.N].

5.29 Miniature circuit breakers installed in gantry power cabinets for roadside technology and communications shall be provided with the capability to be locked in the off position.

Documentation requirements for power cabinets for roadside technology and communications

Product compliance documentation for power cabinets for roadside technology and communications

5.30 The following Documentation shall be submitted for each power cabinet for roadside technology and communications prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

5.31 The following Documentation shall be submitted for each security strap prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

Testing and commissioning documentation for power cabinets for roadside technology and communications

5.32 The following Documentation shall be submitted for each power cabinet for roadside technology and communications prior to the commencement of project closure: power cabinet handover certificate in accordance with GG 182 [Ref 31.N].

5.33 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the power cabinet handover certificate information.

5.34 The following Documentation shall be submitted for each power cabinet for roadside technology and communications prior to the commencement of project closure: power cabinet maintenance handover documentation in accordance with GG 182 [Ref 31.N].

5.35 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the power cabinet maintenance handover documentation.

6. Communications cabinets for roadside technology and communications

Product requirements for communications cabinets for roadside technology and communications

NI/6.1 The Type 640 combined communications cabinet for roadside technology and communications shall be in accordance with TR 2637 [Ref 68.N].

NI/6.2 The Type 600 communications cabinet for roadside technology and communications shall be in accordance with TR 1153 [Ref 84.N].

6.3 The communications cabinet standoff base for roadside technology and communications shall be in accordance with TR 2638 [Ref 83.N].

6.4 The mini termination frame for communications cabinets for roadside technology and communications shall be in accordance with MCX 1103 [Ref 3.N].

6.5 The full height termination frame for communications cabinets for roadside technology and communications shall be in accordance with MCX 1092 [Ref 2.N].

6.6 Security straps for Type 600 cabinets for roadside technology and communications shall be in accordance with MCX 1032 [Ref 4.N].

Installation of communications cabinets for roadside technology and communications

6.7 Communications cabinets for roadside technology and communications shall comply with "Electrical installations for roadside technology and communications" in Section 3 of this document.

6.8 Communications cabinets for roadside technology and communications shall comply with "General requirements for cabinets for roadside technology and communications" in Section 4 of this document.

6.9 Communications cabinets for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

6.10 Labels for communications cabinets for roadside technology and communications shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

6.11 The accommodation requirements of the TSP's equipment, including aerials, cabling and mounting arrangements in communications cabinets

for roadside technology and communications, shall be as stated in TC 131/WSR/006.

SI.6.11 The accommodation requirements of the TSP's equipment, including aerials, cabling and mounting arrangements in communications cabinets for roadside technology and communications shall be [enter free text].

6.12 The termination frame supplied with communications cabinets for roadside technology and communications shall allow for the termination of non-armoured cable using insulation displacement connectors (IDCs) and screw type connectors.

6.13 The termination frame for the communications cabinet for roadside technology and communications shall be wired off-site and the completed frame then installed on site, unless the cabinet has been ordered direct from the supplier fully wired.

6.14 Communication cabinets for roadside technology and communications containing laser operated equipment or fibre optic cables shall be labelled with a laser hazard warning label.

6.15 When communication cabinets and associated communications infrastructure are installed within the Overseeing Organisation’s boundary fence line to permit access by the maintainer, the clearance gap between the communications cabinet and the fence post shall be as specified in TC 131/WSR/006.

When communication cabinets and associated communications infrastructure are installed within the Overseeing Organisation’s boundary fence line to permit access by the maintainer, the clearance gap between the communications cabinet and the fence post		
Communications cabinet reference	**Clearance gap between the communications cabinet foundation and fence posts**	**Gap between fence rails and communications cabinet**
(a)	(b)	(c)

a) Enter a unique reference, to identify the communications cabinet for roadside technology equipment.

b) Enter text, to identify the clearance gap required between the communications cabinet foundation and fence posts.

c) Enter text, to identify the requirements for the gap between the communications cabinet and the fence rails.

Installation of internal wiring within communications cabinet for roadside technology and communications

6.16 Cables entering cabinets for roadside technology and communications , shall not be loomed within 50 mm of internal cabinet cables or wiring.

6.17 The installation of all terminal blocks within a communications cabinet for roadside technology and communications shall be in accordance with the communications cabinet termination frame wiring drawing for that cabinet.

6.18 The installation of all terminal blocks within a communications cabinet for roadside technology and communications shall be in accordance with the manufacturer's instructions.

6.19 Within communications cabinets for roadside technology and communications, cables shall be terminated within terminal blocks that are compatible with the cable.

6.20 The cables within communications cabinets for roadside technology and communications shall be secured in terminals in accordance with the cable and terminal manufacturer’s instructions.

6.21 Terminal blocks within communications cabinets for roadside technology and communications shall be installed where cables run from an IDC to a termination frame.

6.22 All terminations and link cabling from the TSP's Service Delivery Point (SDP) to the equipment within the communications cabinet for roadside technology and communications shall be installed.

6.23 All interconnections within a communications cabinet for roadside technology and communications shall be labelled at the terminal block end with cable identification collets detailing the IDC block position.

6.24 Cable identification collets within communications cabinet for roadside technology and communications shall be visible and located a maximum of 50 mm from the terminations and joints.

6.25 Cables within communications cabinet for roadside technology and communications shall be identified by using cable markers at each end.

6.26 Cables within communications cabinet for roadside technology and communications shall be tied, supported, and of a length to facilitate routine maintenance and allow a minimum excess length of 1.5 m for subsequent re-terminations.

6.27 Cable ties within communications cabinet for roadside technology and communications shall not be used to secure fibre optic cables.

6.28 The correct pairing of conductors within communications cabinet for roadside technology and communications shall be maintained at all times.

6.29 Resistors and break-jacks within communications cabinets for roadside technology and communications shall be installed as specified in TC 131/WSR/006.

Resistors and break-jacks within communications cabinets for roadside technology and communications			
Communications cabinet reference	**Resistor requirements**	**Break-jack requirements**	**Drawing reference**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the communications cabinet for roadside technology equipment.

b) Enter text, to indicate the type and location of the resistor to be installed where these are not installed by the TSP.

c) Enter text, to indicate the type and location of the break-jack to be installed where these are not installed by the TSP.

d) Enter text, to provide the scheme drawing reference, where provided, indicating the installation of the resistor or break-jack.

Installation of jumper leads between connection boxes within a communications cabinet for roadside technology and communications

6.30 Multi-pair colour coding of jumper leads, without duplication and with correct pairing, shall be maintained within communications cabinets for roadside technology and communications.

6.31 Jumper leads shall be installed between connection boxes wherever two or more connection boxes are installed within one cabinet for roadside technology and communications.

6.32 The jumper leads within communications cabinets for roadside technology and communications between connection boxes shall be of a length to avoid stress and strain on connectors.

6.33 The jumper leads within communications cabinets for roadside technology and communications between connection boxes shall not obstruct any accessory in the connection boxes.

Documentation requirements for communications cabinets for roadside technology and communications

Product compliance documentation for communications cabinets for roadside technology and communications

NI/6.34 The following Documentation shall be submitted for Type 640 combined communications cabinet for roadside technology and communications prior to the commencement of the installation of the cabinet: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

NI/6.35 The following Documentation shall be submitted for Type 600 communications cabinet for roadside technology and communications prior to the commencement of the installation of the cabinet: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

6.36 The following Documentation shall be submitted for standoff bases for communications cabinets for roadside technology and communications prior to the commencement of the installation of the standoff base: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

6.37 The following Documentation shall be submitted for mini termination frames prior to the commencement of the installation of the mini termination frame: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

6.38 The following Documentation shall be submitted for the full height termination frames prior to the commencement of the installation of the full height termination frame: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

6.39 The following Documentation shall be submitted for each security strap prior to the commencement of the installation of the security strap: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

Testing and commissioning documentation for communications cabinets for roadside technology and communications

6.40 The following Documentation shall be submitted for each communications cabinet for roadside technology and communications prior to the commencement of submission of the cabinet to the TSP: communication cabinet testing and commissioning certificates.

6.41 Documentation communication cabinet testing and commissioning certificate shall be submitted within 10 working days of completion of commissioning.

6.42 The following Documentation shall be submitted for each communications cabinet for roadside technology and communications prior to the commencement of project closure: communication cabinet handover certificate in accordance with GG 182 [Ref 31.N].

6.43 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the communication cabinet handover certificate.

6.44 The following Documentation shall be submitted for each communications cabinet for roadside technology and communications prior to the commencement of project closure: communication cabinet maintenance handover documentation in accordance with GG 182 [Ref 31.N].

6.45 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the communication cabinet maintenance handover documentation.

7. Cables for roadside technology and communications

Product requirements for cables for roadside technology and communications

7.1 Power and communications cables for roadside technology and communications shall be compliant with TRH 2583 [Ref 20.N].

7.2 Optical fibre cables for roadside technology and communications shall be in accordance with ITU-T G.652 [Ref 57.N] sub-category G.652.C or G.652.D``.

7.3 Cable accessories used to repair power cables for roadside technology and communications shall be compliant with BS EN 50393 [Ref 89.N].

7.4 The cable accessories used to repair power cables for roadside technology and communications shall meet the following performance characteristics: water immersion depth of 1 m and joint Type III.

Scope of works for cable installations for roadside technology and communications

7.5 The power cables and cable terminations to be provided and installed for roadside technology and communications shall be as stated in TC 131/WSR/007.

The power cables and cable terminations to be provided and installed for roadside technology and communications						
Cable reference number	**Source cabinet identification**	**Source cabinet chainage**	**Source cabinet marker post**	**Source cabinet carriageway**	**Source cabinet X (Easting) co-ordinate**	**Source cabinet Y (Northing) co-ordinate**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the power cable.

b) Enter text, to identify the source cabinet for power cables to be installed to.

c) Enter text, to identify the chainage location of the source cabinet for power cable installation.

d) Enter text, to identify the marker post location of the source cabinet for power cable installation.

e) Enter text, to identify the carriageway location of the source cabinet for power cable installation.

f) Enter a number in units of m, to identify the X (Easting) co-ordinate of the source cabinet for power cable installation.

g) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the source cabinet for power cable installation.

The power cables and cable terminations to be provided and installed for roadside technology and communications (continued)					
Cable reference number	**Terminal identification at the source**	**Destination cabinet identification or equipment**	**Destination chainage**	**Destination marker post**	**Destination carriageway**
(a)	(h)	(i)	(j)	(k)	(l)

h) Enter text, to identify the termination identification block for the source end of the power cable installation.

i) Enter text, to identify destination equipment for power cables to be installed to.

j) Enter text, to identify the chainage location of destination cabinet or equipment for power cable installation.

k) Enter text, to identify the marker post location of destination cabinet or equipment for power cable installation.

l) Enter text, to identify carriageway location of destination cabinet or equipment for power cable installation.

The power cables and cable terminations to be provided and installed for roadside technology and communications (continued)						
Cable reference number	**Destination X (Easting) co-ordinate**	**Destination Y (Northing) co-ordinate**	**Terminal identification at the destination**	**Estimated cable length**	**Cable size**	**Cable type**
(a)	(m)	(n)	(o)	(p)	(q)	(r)

m) Enter a number in units of m, to identify the X (Easting) co-ordinate of destination cabinet or equipment for power cable installation.

n) Enter a number in units of m, to identify the Y (Northing) co-ordinate of destination cabinet or equipment for power cable installation.

o) Enter text, to , identify the termination identification block for the destination end of the power cable installation.

p) Enter a number in units of m, to identify power cable length.

q) Enter a number in units of mm^2, to identify the cross sectional area of the cable conductor to be installed.

r) Enter a value, from options Armoured, Non-armoured, to identify the type of power cable.

7.6 The communications cables, cable terminations and cabling equipment to be provided and installed for roadside technology and communications shall be as stated in TC 131/WSR/007.

The communications cables, cable terminations and cabling equipment to be provided and installed for roadside technology and communications						
Cable reference number	**Source cabinet/equipment identification**	**Source chainage**	**Source marker post**	**Source carriageway**	**Source X (Easting) co-ordinate**	**Source Y (Northing) co-ordinate**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify communications cables.

b) Enter text, to identify source cabinet or equipment for communications cables to be installed to.

c) Enter text, to identify source chainage location for communications cable installation.

d) Enter text, to identify source marker post location for communications cable installation.

e) Enter text, to identify source carriageway location for communications cable installation.

f) Enter a number in units of m, to identify source X (Easting) co-ordinate for communications cable installation.

g) Enter a number in units of m, to identify source Y (Northing) co-ordinate for communications cable installation.

The communications cables, cable terminations and cabling equipment to be provided and installed for roadside technology and communications (continued)					
Cable reference number	**Source termination**	**Destination cabinet/equipment identification**	**Destination chainage**	**Destination marker post**	**Destination carriageway**
(a)	(h)	(i)	(j)	(k)	(l)

h) Enter text, to identify source termination for communications cable installation.

i) Enter text, to identify destination cabinet or equipment for communications cables to be installed to.

j) Enter text, to identify destination chainage location for communications cable installation.

k) Enter text, to identify destination marker post location for communications cable installation.

l) Enter text, to identify destination carriageway location for communications cable installation.

The communications cables, cable terminations and cabling equipment to be provided and installed for roadside technology and communications (continued)					
Cable reference number	**Destination X (Easting) co-ordinate**	**Destination Y (Northing) co-ordinate**	**Destination termination**	**Estimated cable length**	**Cable Type**
(a)	(m)	(n)	(o)	(p)	(q)

m) Enter a number in units of m, to identify destination X (Easting) co-ordinate for communications cable installation.

n) Enter a number in units of m, to identify destination Y (Northing) co-ordinate for communications cable installation.

o) Enter text, to identify destination termination for communications cable installation.

p) Enter a number in units of m, to identify communications cable length.

q) Enter text, to identify the type of cable.

7.7 The tolerance of the estimated power and communications cable lengths for roadside technology and communications shall be as stated in TC 131/WSR/007.

SI.7.7 The tolerance of the estimated power and communications cable lengths for roadside technology and communications shall be [enter free text].

7.8 The requirements for the protection of cables for roadside technology and communications against environmental damage shall be as stated in TC 131/WSR/007.

SI.7.8 The requirements for the protection of cables for roadside technology and communications against environmental damage shall be [enter free text].

7.9 Direct buried cables to be provided and installed for roadside technology and communications shall be as stated in TC 131/WSR/007.

Direct buried cables to be provided and installed for roadside technology and communications						
Cable reference number	**Start chainage**	**Start marker post**	**Start X (Easting) co-ordinate**	**Start Y (Northing) co-ordinate**	**End chainage**	**End marker post**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the direct buried cable.

b) Enter text, to identify the start chainage location for direct buried cable installation.

c) Enter text, to identify the start marker post location for direct buried cable installation.

d) Enter a number in units of m, to identify the start X (Easting) co-ordinate location for direct buried cable installation.

e) Enter a number in units of m, to identify the start Y (Northing) co-ordinate location for direct buried cable installation.

f) Enter text, to identify the end chainage location for direct buried cable installation.

g) Enter text, to identify the end marker post location for direct buried cable installation.

Direct buried cables to be provided and installed for roadside technology and communications (continued)						
Cable reference number	**End X (Easting) co-ordinate**	**End Y (Northing) co-ordinate**	**Carriage way**	**Type of cable**	**Minimum depth of installation**	**Installation drawing (optional)**
(a)	(h)	(i)	(j)	(k)	(l)	(m)

h) Enter a number in units of m, to identify the end X (Easting) co-ordinate location for direct buried cable installation.

i) Enter a number in units of m, to identify the end Y (Northing) co-ordinate location for direct buried cable installation.

j) Enter text, to identify the carriageway location for direct buried cable installation.

k) Enter text, to identify the type of direct buried cable to be installed.

l) Enter a number in units of mm, to identify the minimum depth of installation.

m) Enter text, to identify the scheme drawing reference that describes specific requirements for cables located on a slope.

Storage of cables for roadside technology and communications

7.10 Cables for roadside technology and communications shall be stored prior to installation in accordance with BS 8512 [Ref 16.N].

Installation of cables for roadside technology and communications

7.11 Cable labels for roadside technology and communications shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

7.12 Cabling for roadside technology and communications to be installed shall be free from defects.

7.13 Verification shall be undertaken for each cable by visual inspection to ensure there are no visible defects, with the results recorded in the inspection and test plan.

7.14 The frequency of the visual inspection of each cable shall be once prior to installation of the cable.

7.15 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection of each cable.

7.16 Cable accessories for roadside technology and communications shall be installed in accordance with the manufacturer’s instructions.

7.17 Cables for roadside technology and communications shall be handled and installed in accordance with BS 8512 [Ref 16.N].

7.18 The order of cable installation within a duct for roadside technology and communications shall be such that damage to other cables is avoided.

7.19 Cable installation for roadside technology and communications shall provide a dressed cable length inside the cabinet sufficient for termination and three subsequent re-terminations without disturbance to the cable fixing point.

7.20 Cable installation for roadside technology and communications shall allow sufficient cable length outside of the cabinet for three subsequent re-terminations of the cable into the cabinet.

7.21 Un-terminated cable ends for roadside technology and communications shall be end sealed to IPX7 in accordance with BS EN 60529 [Ref 10.N]to prevent moisture ingress at the end of any work period or after disconnection.

7.22 Cable ends on cable drums shall be sealed to IPX7 in accordance with BS EN 60529 [Ref 10.N]to prevent moisture ingress.

7.23 Cables for roadside technology and communications that are to be installed prior to installation of cables by the TSP shall be as specified in TC 131/WSR/007.

Cables for roadside technology and communications that are to be installed prior to installation of cables by the TSP	
Cable reference	**Cables to be installed prior to installation of cables by the TSP**
(a)	(b)

a) Enter a unique reference, to identify the cable.

b) Enter a value, from options Yes, No, to identify cables to be installed prior to TSP cable installation.

7.24 Damage to cables incurred during the installation of cables for roadside technology and communications shall be identified, recorded and reported to the Overseeing Organisation, maintainer and the TSP.

7.25 Cables for roadside technology and communications shall be labelled before the end of the working shift following installation, complying with the requirements under the sub-heading of 'Installation of cable marking for roadside technology and communications' in Section 7 of this document.

7.26 Temporary labels applied to cables for roadside technology and communications shall be replaced with a permanent label prior to the completion of the works.

7.27 Cables for roadside technology and communications passing through intermediate chambers shall be labelled with the cable destination joint chamber or equipment reference 150 mm from the entry and exit points of the chamber before the end of the working shift following installation.

7.28 Cables for roadside technology and communications shall not be bent to an internal radius of less than the manufacturer’s specifications or 12 times the outside diameter of the cable, whichever is greater, taking account of the tensile load present in the cable during installation.

7.29 Cables for roadside technology and communications shall be dressed within communications chambers, longitudinal and local ducts to prevent hazards to maintainers and cable congestion.

7.30 Cables for roadside technology and communications secured to the chamber walls shall be kept within the minimum cable bend radius without a tensile load applied.

7.31 Cable loops formed due to a change in direction of the cable run shall be such that the minimum cable bend radius is observed.

7.32 The cables in a longitudinal and local duct installation shall be orientated to enable accessible maintenance of all cables.

Installation of cable management for roadside technology and communications

7.33 Cable management for roadside technology and communications shall be installed such that it maximises the available space within the chamber, allowing for future cabling of the remaining ducts.

Installation requirements for the separation of cables

7.34 The minimum separation of copper cables for roadside technology and communications shall be as stated in TC 131/WSR/007.

SI.7.34a The minimum separation of communication cable to communication cable shall be [enter a number] .

SI.7.34b The minimum separation of communications power cable to communications power cable shall be [enter a number] .

SI.7.34c The minimum separation of communications power cable and communication cable shall be [enter a number] .

SI.7.34d The minimum separation of non-technology power cable (e.g. lighting) and communication power cable shall be [enter a number] .

SI.7.34e The minimum separation of non-technology power cable (e.g. lighting) and communications cable shall be [enter a number] .

SI.7.34f The minimum separation of Overseeing Organisations cables and TSP cables in a cable trench for armoured cables shall be [enter a number] .

Installation of cables laid in ducts for roadside technology and communications

7.35 When cables are required to be laid in ducts, the duct shall be clear of debris prior to drawing in the cables and draw cord.

7.36 The installation of cables laid in ducts shall not damage the cable being installed, existing cables in the duct or the duct itself.

7.37 The sequence of cable installation for roadside technology and communications shall be agreed with the TSP.

Installation of cables laid in a trench for roadside technology and communications

7.38 Verification shall be undertaken for the separation of cables within a trench by measurement to be in accordance with the specification, with the results recorded in the inspection and test plan.

7.39 The frequency of the measurement of the separation of cables within a trench shall be once upon completion of the installation of all cables within the trench, prior to backfilling the trench, at a distance of every 20 m along the trench.

7.40 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the measurement of the separation of cables.

7.41 Verification shall be undertaken for the depth of each directly buried cable by measurement to ensure that it is in accordance with the specification, with the results recorded on inspection and test plan.

7.42 The frequency of the measurement of the depth of each directly buried cable shall be once upon completion of the installation of the cable, prior to backfilling, at a distance of every 10 m along the cable route.

7.43 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the measurement of the depth of each directly buried cable.

7.44 Cable marker tape shall be laid in the trench between the sand layer and backfill layer, complying with the requirements of 'Installation requirements for marker tape for roadside technology and communications' in "Ducts for roadside technology and communications" in Section 15 of this document.

7.45 Where several cables are laid in one trench, one line of marker tape shall be installed for every 600 mm of trench width.

7.46 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.

7.47 Verification shall be undertaken for the cables laid in each trench by visual inspection to ensure they are accommodated in one horizontal layer, with the results recorded in the inspection and test plan.

7.48 The frequency of the visual inspection of the cables laid in each trench shall be once upon completion of the installation of all cables with the trench, prior to backfilling the trench, at a distance of every 20 m along the trench.

7.49 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection of the cables laid in each trench.

7.50 Direct buried cables shall be run between adjacent cabinets from a single drum.

7.51 For armoured cable lengths buried loops of a minimum of 3 m length shall be provided adjacent to each of the cabinets ensuring the minimum bend radius of the cable is not compromised.

7.52 The location of loops for armoured communications cables shall be included on the as-built drawings.

7.53 Armoured cables in the vicinity of filter drains shall be laid in accordance with the requirements in 'Installation requirements for ducts for roadside technology and communications near filter drains' of "Ducts for roadside technology and communications" in Section 15 of this document.

7.54 Armoured cables shall not be laid if damage has been sustained which compromises the integrity of the sheath.

7.55 Armoured cables shall be laid so as to minimise cable waste during installation.

7.56 The installation of armoured cable into cabinets shall be as stated in TC 131/WSR/007.

SI.7.56 The installation of armoured cable into cabinets shall be as detailed in the scheme drawings: [enter free text].

Installation requirements for the backfill of cable trenches

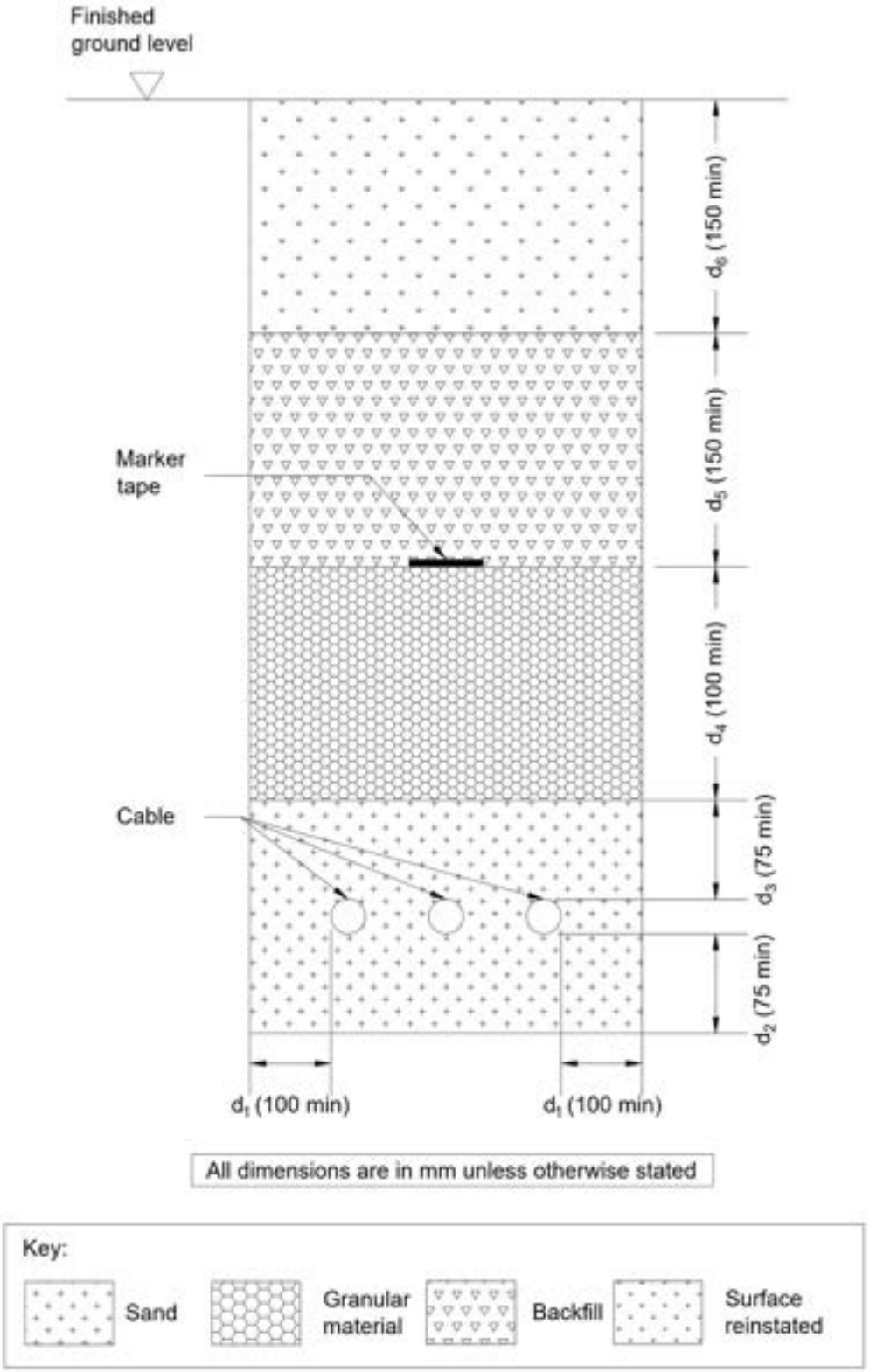
7.57 The grass seeding and turfing of cable trenches shall comply with "Finishing and topsoiling of earthworks" in Section 8 of CC 601 [Ref 15.N].

7.58 The grass seeding and turfing of cable trenches shall comply with "Grass seeding, wildflower seeding and turfing works" in Section 5 of LC 120 [Ref 29.N].

7.59 The backfill of a cable trench shall be as shown in Figure 7.59 where the finished ground level is defined as the level of ground on the shallowest side of the trench, unless otherwise stated in TC 131/WSR/007.

SI.7.59 The scheme drawing showing the backfill of a cable trench when it is not as shown in Figure 7.59 shall be [enter free text].

Figure 7.59 Backfill of a cable trench under a verge or open ground.



7.60 Cables laid in trenches shall be both bedded on and covered by a 75 mm thickness of sand complying with the product requirements for bedding and surround material for drainage pipes contained in "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

7.61 The bedding and cover layer of sand in the cable trench shall be compacted in accordance with "Acceptable earthwork material classes, properties, and testing" in Section 3 of CC 601 [Ref 15.N].

7.62 An additional 100 mm layer of Class 1C coarse granular material shall be laid on top of the bedding and cover layer of sand in the cable trench in accordance with "Acceptable earthwork material classes, properties, and testing" in Section 3 of CC 601 [Ref 15.N].

7.63 Class 8 backfill material shall be laid on top of the Class 1C granular material in the cable trench to a depth of 150 mm in accordance with "Acceptable earthwork material classes, properties, and testing" in Section 3 of CC 601 [Ref 15.N].

7.64 Backfilling of trenches shall be in accordance with Class 8 material complying with "Acceptable earthwork material classes, properties, and testing" in Section 3 of CC 601 [Ref 15.N].

7.65 The backfill material shall be spread and compacted evenly without dislodging, disturbing or damaging cables, ducts or troughs.

7.66 Vibrating compaction equipment shall not be used within a distance of 300 mm horizontally or vertically of cables.

7.67 Cable trenches requiring topsoiling shall have topsoil and grass seed or turf placed in the top 150 mm of the cable trench, unless otherwise stated in TC 131/WSR/007.

SI.7.67a The locations where the topsoiling of cable trenches is shallower than 150 mm shall be [enter free text].

SI.7.67b The alternative method of topsoiling the cable trenches shall be [enter free text].

Installation of cables in existing troughs for roadside technology and communications

7.68 The sand within the trough shall comply with Pipes for Drainage bedding and surround product requirements in "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

7.69 The locations and methods of installing cables in existing troughs shall be as stated in TC 131/WSR/007.

SI.7.69 The locations and methods of installing cables in existing troughs shall be [enter free text].

7.70 Prior to the installation of cables into existing troughs, all sand and debris shall be removed from the trough.

7.71 Armoured cables installed in existing troughs shall be covered with 2 mm size sand up to the level underside or cover seating, whichever is the lower.

7.72 Non-armoured cables installed in existing troughs shall be installed in sub-ducts as shown on scheme drawings, that are retained in position with sand.

Installation of cables in transmission stations for roadside technology and communications

7.73 The scope of work to be undertaken in transmission station buildings or transmission cabinets shall be as stated in TC 131/WSR/007.

SI.7.73 The scope of work to be undertaken in transmission station buildings or transmission cabinets shall be [enter free text].

7.74 Work to be undertaken in transmission station buildings or transmission cabinets shall have a permit to work issued by the TSP.

7.75 Access to the transmission station buildings or transmission cabinets shall be arranged with the TSP using their permit to work system and notice periods.

Installation requirements for cable ends for roadside technology and communications

7.76 Before capping, cables shall be cleanly cut at 90^{o} to the cable length.

7.77 Before capping, the length of cable to be capped shall be cleaned in accordance with the cable manufacturer's instructions.

7.78 Cable ends shall be heat shrink capped with adhesive lined heat shrink endcaps to prevent ingress of moisture to IPX7 in accordance with BS EN 60529 [Ref 10.N].

7.79 Cable ends shall be heat shrink capped to a minimum length of 3 times the diameter of the cable.

7.80 Caps shall have a wall thickness of greater than 2 mm.

Installation of cable glands for roadside technology and communications

7.81 A cable gland shall permit a single cable to pass through, unless it has been specifically designed for more than one cable.

7.82 Cable glands shall be compatible in size with the retained cable to prevent the ingress of water to IPX7 in accordance with BS EN 60529 [Ref 10.N].

7.83 Cable glands shall be installed onto a cable in accordance with the manufacturer’s instructions.

7.84 For cables, where electrical connections to cable armouring or screening is required, metallic conductive cable glands shall be installed.

7.85 Where metallic conductive cable glands are used, galvanic corrosion between the cable gland and the enclosure shall be prevented by the choice of materials.

7.86 Thread lengths of cable glands installed on armoured cables shall allow for earthing tag or lock nuts to be installed.

7.87 Where cable glands are fitted into holes which are larger than specified by the manufacturer, cable gland reduction kits shall be used to reduce the hole size to the cable gland specification.

Installation of 20/30 to 2 pair quad cable gland conversions

7.88 The ends of polyvinyl chloride (PVC) shrouds shall be cut so as to provide a tight fit against the cable.

7.89 The earth tag with a reducing cable gland shall be used to connect to the earthing ring.

7.90 Materials used for the cable gland conversion kit shall not cause galvanic corrosion to the terminating assembly of cable armour.

Installation of cable marking for roadside technology and communications

7.91 The method of cable marking shall be CR for cabinet cable terminations and CB for cable markings in chambers in accordance with BS EN 62491 [Ref 28.N].

7.92 A numerical identification shall be applied to all communications cable conductor pairs.

7.93 Cable marking on power cables shall be white lettering on a red background.

7.94 Cable marking on communication cables shall black lettering on a white background.

7.95 The marking of cables terminated into cabinets or locations for which the TSP is solely responsible for maintaining, which have been agreed by the TSP, shall be as stated in TC 131/WSR/007.

SI.7.95 The marking of cables terminated into cabinets or locations for which the TSP is solely responsible for maintaining, which have been agreed by the TSP, shall be [enter free text].

7.96 All inter-cabinet cables shall be clearly and unambiguously marked to show details of cable routes and destinations.

Installation of power cables for roadside technology and communications

7.97 Power cables within chambers shall be supported and routed in a manner that does not impede access to the telecommunications infrastructure.

7.98 Power cables within chambers shall be supported and routed in a manner that does not create a hazard when using the access steps where present.

7.99 The roadside technology cabinets shall not take power cables greater in size than a cross sectional area of 25 mm^2, unless otherwise stated in TC 131/WSR/007.

SI.7.99 The type of roadside technology cabinet that allows termination of power cables greater in size than a cross sectional area of 25 mm^2 shall be [enter free text].

7.100 At power cable reduction joints a main power cable shall be jointed onto a reduction power cable with cross sectional areas as stated in TC 131/WSR/007.

At power cable reduction joints a main power cable				
Cable reference number	**Cross sectional area of main power cable**	**Location of power cable reduction joints**	**Cross sectional area of the reduction power cable at the EI cabinet**	**Cross sectional area of the reduction power cable at the remote power cabinet (Optional)**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the power cable with the cable reduction joints.

b) Enter a number in units of mm^2, to state the size of the cross sectional area of main power cable.

c) Enter a value, from options EI cabinet and remote power cabinet , EI cabinet only, to identify the locations for the power cable reduction joints in the power cable.

d) Enter a number in units of mm^2, to identify the size of the reduction power cable at the EI cabinet.

e) Enter a number in units of mm^2, to identify the size of the reduction power cable at the remote power cabinet.

7.101 Locations of chambers that will contain power cable joints shall be shown on the scheme drawings.

Installation of communications cables for roadside technology and communications

7.102 The communications cables shall meet the performance characteristics stated in TC 131/WSR/007.

SI.7.102a The requirements of types of communications cables that are not covered by TRH 2583 [Ref 20.N] shall be [enter free text].

SI.7.102b The additional requirements of types communications cables that are in TRH 2583 [Ref 20.N] shall be [enter free text].

Installation of multi-pair communications cables for roadside technology and communications

7.103 All jointing and termination of multi-pair communications cables shall be carried out in accordance with the manufacturer’s instructions.

7.104 All cable conductors and terminals shall be protected from undue stress by supporting the cable with a mechanical securing method prior to its termination.

7.105 Termination of cables using IDCs shall be undertaken in accordance with the manufacturer's instructions using the correct insertion tool.

Installation of optical fibre cables for roadside technology and communications

7.106 Optical fibre cables that are less than 40 km in length shall be in accordance with ITU-T G.652 [Ref 57.N] version C.

7.107 Optical fibre cables that are greater than or equal to 40 km in length shall be in accordance with ITU-T G.652 [Ref 57.N]version D.

7.108 The sections of optical fibre cables that are visible inside chambers shall be marked at intervals of 500 mm along their length inside each chamber to make users aware of the possibility of laser hazard.

7.109 Optical fibre communications cable joints shall be sealed to IPX7 in accordance with BS EN 60529 [Ref 10.N] so as to prevent moisture damage.

7.110 Optical fibre communications cables shall be fusion spliced and protected from mechanical strain.

7.111 Copper conductors in composite optical fibre cables shall be secured in terminals in accordance with the terminal manufacturers instructions.

Installation of cross carriageway cables for roadside technology and communications

7.112 Cross carriageway cables shall be installed at right angles to the carriageway, unless otherwise stated in TC 131/WSR/007.

SI.7.112 The details of the cross carriageway cables that are not to be installed at right angles to the carriageway due to constraints shall be [enter free text].

Installation of cable joints for roadside technology and communications

7.113 Additional joints for power cables shall not be permitted to overcome inaccuracies in measurement or cable damage.

7.114 Reduction joint details shall be displayed within the cabinet where the jointed power cable is terminated.

7.115 Joints shall be made using a suitable jointing system in which all components are mutually compatible for the type of cables to be jointed, and achieve the required ingress protection of IPX7 in accordance with BS EN 60529 [Ref 10.N].

7.116 Heat-shrink or cold-shrink type joints for power cables shall not be used.

7.117 Power cable joints and cables entering joints shall be supported to prevent damage during the curing period.

7.118 Jointing of power cables shall only be carried out when all the materials used in the joint are free from visible signs of moisture.

7.119 Joints of power cables shall be protected from water, frost, direct sunlight and extremes of temperature during the curing period for the joint materials.

7.120 The installation of cable joints in loop detector systems shall be in accordance with MCH 1540 [Ref 65.N].

Installation of cable joints in chambers for roadside technology and communications

7.121 At cable joint enclosures (CJEs), the cable shall be marked immediately adjacent to the CJE.

7.122 Power cable joints shall be mounted on a cable bearer bar.

7.123 Joints of power cables shall be installed on the lowest cable bearer within the chambers to prevent damage to other cables.

NI/7.124 Joints of power cables with a cross sectional area less than or equal to 50 mm^2 shall be installed on a separate support to the TSP joints in the same chamber to prevent damage.

7.125 The accommodation requirements for power cable joints to be located in the same chamber as a TSP's cable joint shall be as stated in TC 131/WSR/007.

SI.7.125 The accommodation requirements of power cable joints to be located in the same chamber as a TSP's cable joint shall be [enter free text].

Installation of above ground cable joints (AGJ) for roadside technology and communications

7.126 The AGJ or other cable joint types installed in cabinets shall be as stated in TC 131/WSR/007.

The AGJ or other cable joint types installed in cabinets		
Cable joint reference	**Cabinet reference**	**Joint type**
(a)	(b)	(c)

a) Enter a unique reference, to identify the cable joint.

b) Enter a unique reference, to identify the roadside technology equipment cabinet.

c) Enter text, to identify cable joint types.

7.127 The AGJ or other cable joint types installed in enclosures such as post, mast or pillars shall be as stated in TC 131/WSR/007.

The AGJ or other cable joint types installed in enclosures such as post, mast or pillars					
Cable joint reference	**Type of enclosure**	**Type of joint**	**Chainage**	**Marker post**	**Carriage way**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the cable joint.

b) Enter text, to identify the type of enclosure.

c) Enter text, to identify the type of joint to be housed in the enclosure.

d) Enter text, to identify the chainage location of the enclosure.

e) Enter text, to identify the marker post location of the enclosure.

f) Enter text, to identify the carriageway location of the enclosure.

The AGJ or other cable joint types installed in enclosures such as post, mast or pillars (continued)		
Cable joint reference	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**
(a)	(g)	(h)

a) Enter a number in units of m, to identify the X (Easting) co-ordinate of of the AGJ or cable joint.

b) Enter a number in units of m, to identify the Y (Northing) co-ordinate of of the AGJ or cable joint.

7.128 At AGJs, cables shall be marked prior to the cable gland, before entry into the terminal housing.

Installation of buried cable joints for roadside technology and communications

7.129 Underground power cable reduction joints shall be installed at the interface of a change in cable size.

7.130 The location of underground power cable reduction joints shall be recorded to an accuracy of +/- 1 m using GPS co-ordinates.

7.131 Power cable joints within a direct buried network shall be made within 2 m of the cabinet cable entry duct.

7.132 Backfilling shall only take place when the joints of power cables are completely cured and able to withstand any stresses imposed on them.

Installation requirements for cable continuity for roadside technology and communications

7.133 Continuity shall be provided for cable screens and protective conductors, unless otherwise stated in TC 131/WSR/007.

SI.7.133 The requirements of cable screens and protective conductors that do not need continuity shall be [enter free text].

7.134 Cables with a metallic sheath, drain wire or metallic foil barrier shall be earthed to provide a secure earth termination.

Modification to existing cables for roadside technology and communications

7.135 Prior to laying any cable to the cabinets, the position of all cabling and re-termination loops shall be located, by exposing all cables that are not in ducts, to identify the type, size and designation of each cable.

7.136 Cables shall not be damaged during the location and excavation works to expose the cables.

Removal and re-siting of existing cables for roadside technology and communications

7.137 Cables, including those to be removed, shall be located and temporarily marked at ground level where they are maintained by the Overseeing Organisation.

7.138 The trial holes to be excavated to expose cables for removal at pre-determined locations shall be as stated in TC 131/WSR/007.

SI.7.138a The location of trial holes shall be [enter free text].

SI.7.138b The method of excavation for the trial holes shall be [enter free text].

SI.7.138c The description of backfill requirements for the trial holes shall be [enter free text].

7.139 The method to be used to remove cables shall be as stated in TC 131/WSR/007.

SI.7.139a The identification of the cable to be removed shall be [enter free text].

SI.7.139b The location of the cable to be removed shall be [enter free text].

SI.7.139c The method of removal for the cable shall be [enter free text].

7.140 The cable routes to be excavated by hand excavation or vacuum excavation to ensure cables are not damaged shall be as stated in TC 131/WSR/007.

SI.7.140 The details of cable routes to be excavated by hand excavation or vacuum excavation to ensure cables are not damaged shall be [enter free text].

Removal of cables in trenches for roadside technology and communications

7.141 The removal of cables sharing a trench with other existing cables shall be as stated in TC 131/WSR/007.

SI.7.141a The method for the removal of cables sharing a trench with other existing cable shall be [enter free text].

SI.7.141b The reinstatement of the trench after the removal of the cables shall be [enter free text].

7.142 All unsuitable and surplus material after cable removal shall be removed and disposed of in accordance with "Site clearance" in Section 1 of GC 109 [Ref 58.N].

Removal of cables in ducts for roadside technology and communications

7.143 The removal of cables from duct routes that are to be retained shall be as stated in TC 131/WSR/007.

SI.7.143 The removal of cables from duct routes that are to be retained shall be [enter free text].

7.144 Removal of cables in ducts shall include the removal of duct seal, re-sealing and re-roping.

Removal of cables in troughs for roadside technology and communications

7.145 The details of the cables to be removed from troughs shall be as stated in TC 131/WSR/007.

SI.7.145 The details of the cables to be removed from troughs shall be [enter free text].

7.146 Removal of cables in troughs shall include the removal of all trough lids, all debris from troughs and all sand from troughs.

7.147 Clean sand shall be installed after the removal of cables from troughs.

7.148 New cable trough lids to replace lids that are damaged during the cable removal shall be installed after the clean sand is installed.

Testing of cables for roadside technology and communications

7.149 Verification shall be undertaken for armoured and non-armoured copper cables and power cables in accordance with MCG 1022 [Ref 90.N], and fibre optic cables in accordance with MCG 1099 [Ref 34.N] or to the manufacturer's instructions for continuity and insulation, with the results recorded in the test and check proforma.

7.150 The frequency of the testing of each cable shall be at least once post-installation of the cable.

7.151 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the testing of each cable.

7.152 The cable sections and scope of testing of cables to be undertaken post-installation during the works shall be as stated in TC 131/WSR/007.

SI.7.152 The cable sections and scope of testing of cables to be undertaken post-installation during the works shall be [enter free text].

7.153 Test instrument calibration certificates shall be in date at the time of the testing.

7.154 Cable testing shall be carried out after the cable trench has been backfilled, the ground above the cable reinstated and the cable ends have been installed, un-terminated, in the respective termination cabinets.

Documentation requirements for cable installations for roadside technology and communications

Product compliance documentation for cable installations for roadside technology and communications

7.155 The following Documentation shall be submitted for power and communications cables prior to the commencement of the installation of the cables: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

7.156 The following Documentation shall be submitted for optical fibre cables prior to the commencement of installation: manufacturers data sheet showing compliance with ITU-T G.652 [Ref 57.N].

7.157 The following Documentation shall be submitted for cable accessories prior to the commencement of the installation: report detailing the type tests proving compliance with BS EN 50393 [Ref 89.N].

Testing and commissioning documentation for cable installations

7.158 The following Documentation shall be submitted for the results of each cable test prior to the commencement of cable termination onto equipment: MCG 1022 [Ref 90.N] test and check proforma.

7.159 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the test and check proforma.

Other documentation requirements for cable installations

7.160 The following Documentation shall be submitted for the notification of cable testing prior to the commencement of each section of cable testing works: cable testing programme.

7.161 Documentation detailing the cable testing programme shall be submitted 2 weeks prior to the commencement of each section of testing.

7.162 The following Documentation shall be submitted for any damaged outer sheath identified during cable testing prior to the commencement of the continuation of works: details of damaged outer cable sheath identified during cable testing.

7.163 Documentation detailing any damaged outer sheath identified during cable testing shall be submitted prior to the continuation of works.

7.164 The following Documentation shall be submitted for works that involve installing cables within an existing duct or trench prior to the commencement of the cable installation: method statement detailing the installation process and mitigation methods to ensure the existing cables are not damaged.

7.165 Documentation method statement detailing the installation process and mitigation methods to ensure the existing cables are not damaged shall be submitted 2 weeks before the cable installation.

7.166 The following Documentation for location and installation details of underground cable lengths shall be submitted as continuous records: the cable installation record as shown in Table 7.166.

Table 7.166 Format of Cable installation record

Cable ID	Cable source	Cable source geographic address	Cable destination	Cable destination geographic address	Cable type	Actual cable length	Drum number	Installation date

7.167 The requirements of "Records" in Section 3 of GC 101 [Ref 21.N] shall apply to the cable installation record.

7.168 The following Documentation for damaged cables shall be submitted as continuous records: a damage report detailing the cable, location, date and cause of damage.

7.169 The requirements of "Records" in Section 3 of GC 101 [Ref 21.N] shall apply to the damage report detailing the cable, location, date and cause of damage.

8. Variable message signs and signals for roadside technology and communications

Product requirements for variable message signs and signals for roadside technology and communications

8.1 MS1 variable message signs for roadside technology and communications shall be compliant with SE 1116 [Ref 73.N].

8.2 MS3 2 x 12 variable message signs for roadside technology and communications shall be compliant with SE 1118 [Ref 72.N].

8.3 MS3 2 x 16 variable message signs for roadside technology and communications shall be compliant with SE 1119 [Ref 74.N].

8.4 MS3 3 x 18 variable message signs for roadside technology and communications shall be compliant with SE 1120 [Ref 75.N].

8.5 MS4 variable message signs for roadside technology and communications shall be compliant with SE 1121 [Ref 76.N].

8.6 MS4R variable message signs for roadside technology and communications shall be compliant with SE 1122 [Ref 77.N].

8.7 Advanced Motorway Indicators (AMI) for roadside technology and communications shall be compliant with MCE 0107 [Ref 35.N] and SE 1117 [Ref 71.N].

8.8 Signal posts for variable message signs and signals, used for roadside technology and communications shall be compliant with MCE 1109 [Ref 41.N].

8.9 Weatherproof cable assemblies, used on the interconnection of variable message signs and signals for roadside technology and communications shall be compliant with TR 2033 [Ref 87.N].

Scope of works for variable message signs and signals for roadside technology and communications

Scope of works for post-mounted signals for roadside technology and communications

8.10 The installation of a post-mounted signal for roadside technology and communications shall be as stated in TC 131/WSR/008.

The installation of a post-mounted signal for roadside technology and communications					
Post reference	**Signal type**	**Model reference ID (optional)**	**Input power supply**	**Chainage**	**Marker post**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the post-mounted signal.

b) Enter text, to identify signal type.

c) Enter text, to identify the 3D model reference of the post-mounted signals.

d) Enter a value, from options 30-0-30 V AC,230 V AC Mains, to identify the type of power supply to the signal.

e) Enter text, to identify the chainage location of the post-mounted signal.

f) Enter text, to identify the marker post location of the post-mounted signal.

The installation of a post-mounted signal for roadside technology and communications (continued)						
Post reference	**Carriageway**	**Post X (Easting) co-ordinate**	**Post Y (Northing) co-ordinate**	**Nearside/ offside**	**Indicator type**	**Post type**
(a)	(g)	(h)	(i)	(j)	(k)	(l)

g) Enter text, to identify the carriageway location of the post-mounted signal.

h) Enter a number in units of m, to identify the X (Hasting) co-ordinate of the post-mounted signal.

i) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the post-mounted signal.

j) Enter a value, from options nearside, offside, to identify whether the post-mounted signal is installed on the nearside or offside.

k) Enter text, to identify the indicator type.

l) Enter text, to identify the type of post for the signal to be mounted on.

The installation of a post-mounted signal for roadside technology and communications (continued)							
Post reference	**Post foundation**	**Number of posts**	**Signal post label**	**Scheme drawing reference**	**Setback distance**	**Signal horizontal angle**	**Signal height**
(a)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

m) Enter text, to identify the type of foundation to be used for the post.

n) Enter a value, from options 1,2, to identify the number of posts for the signal.

o) Enter text, to identify the text for the post-mounted signal label.

p) Enter text, to identify the scheme drawing reference that describes the setting out coordinates for the foundations for post-mounted signals using two posts.

q) Enter a number in units of m, to identify the perpendicular distance from the edge of carriageway to the centre of the signal (d_2 or d_3 in Figure 8.35 and Figure 8.36).

r) Enter a number in units of °, to identify the horizontal angle of rotation of the indicator or sign towards the carriageway around the central axis of the indicator or sign (θ_1 or θ_2 in Figure 8.35 and Figure 8.36).

s) Enter a number in units of m, to identify the height (h_1 in Figure 8.34) to the lowest edge of the signal above carriageway level.

The installation of a post-mounted signal for roadside technology and communications (continued)			
Post reference	**Signal vertical tilt**	**Wiring diagram drawing**	**Hardstanding maintenance working area**
(a)	(t)	(u)	(v)

t) Enter a number in units of °, to identify the vertical tilt of the signal (α_1 in Figure 8.34).

u) Enter text, to identify the scheme reference for the wiring drawing for the indicators on the post-mounted signal.

v) Enter text, to identify the scheme drawing that details the location, size and type of hardstanding maintenance working area to be provided at the post-mounted signal.

Scope of works for variable message signs and signals mounted on a gantry

8.11 The installation and alignment of variable message signs and signals mounted on a gantry shall be as stated in TC 131/WSR/008.

The installation and alignment of variable message signs and signals mounted on a gantry					
Variable message sign and signal reference	**Gantry**	**Model reference ID (optional)**	**Message sign or signal type**	**Signal enforcement variant**	**Chainage**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the variable message sign and signal that is mounted on a gantry.

b) Enter text, to identify the gantry that the variable sign or signal is mounted on.

c) Enter text, to identify the 3D model reference of the variable message sign or signal that is mounted on the gantry.

d) Enter text, to identify the type of variable message sign or signal that is mounted on the gantry.

e) Enter a value, from options Yes, No, to identify if a signal enforcement variant is to be installed.

f) Enter text, to identify the chainage location of the gantry.

The installation and alignment of variable message signs and signals mounted on a gantry (continued)							
Variable message sign and signal reference	**Marker post**	**Carriageway**	**Gantry X (Easting) co-ordinate**	**Gantry Y (Northing) co-ordinate**	**Lane number**	**Vertical tilt**	**Signal rotation angle (excluding gantry)**
(a)	(g)	(h)	(i)	(j)	(k)	(l)	(m)

g) Enter text, to identify the marker post location of the gantry.

h) Enter text, to identify the carriageway location of the gantry.

i) Enter a number in units of m, to identify the X (Easting) co-ordinate of the gantry.

j) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the gantry.

k) Enter text, to identify the lane number for the signal.

l) Enter a number in units of °, to identify signal tilt angle (α_1 in Figure 8.14) from vertical.

m) Enter a number in units of °, to identify signal rotation from the site line perpendicular to the front face of the gantry.

The installation and alignment of variable message signs and signals mounted on a gantry (continued)								
Variable message sign and signal reference	**Message sign tilt angle downwards**	**Message sign rotation angle (excluding gantry)**	**Shortest legibility distance**	**Maximum legibility distance**	**Test lane**	**Free height**	**Gantry signals wiring diagram**	**MS4 wiring diagram**
(a)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)

n) Enter a number in units of °, to identify message sign tilt angle (α_1 in Figure 8.14) from the vertical.

o) Enter a number in units of °, to identify message sign rotation from the face of the gantry.

p) Enter a number in units of m, to identify the distance d_1 in Figure 8.14.

q) Enter a number in units of m, to identify that maximum distance that the signal shall be viewed.

r) Enter a number, to identify the lane for the drive past verification test.

s) Enter a number in units of m, to identify the height h_1 in Figure 8.14.

t) Enter text, to identify the scheme wiring diagram to be used to connect the signals on the gantry.

u) Enter text, to identify the scheme wiring diagram to be used to connect the MS4 signals on the gantry.

The installation and alignment of variable message signs and signals mounted on a gantry (continued)	
Variable message sign and signal reference	**Physical arrangement drawing**
(a)	(v)

v) Enter text, to identify the scheme drawing that shows the physical arrangement of the signs, signals, data link connection boxes (DLCBs) and cabling on the gantry.

8.12 The tolerances for the setting out and alignment of the variable message signs and signals mounted on a gantry or post mounted shall be as specified in TC 131/WSR/008.

The tolerances for the setting out and alignment of the variable message signs and signals mounted on a gantry or post mounted				
Variable message sign or signal reference	**Tolerance for the setback distance from the edge of carriageway**	**Tolerance for the signal height**	**Tolerance for the tilt angle**	**Tolerance for the horizontal rotation angle**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to identify the variable message sign and signal.

b) Enter a number in units of mm, to specify the tolerance for the setback distance from the edge of carriageway.

c) Enter a number in units of mm, to specify the tolerance for the signal height.

d) Enter a number in units of °, to specify the tolerance for the tilt angle.

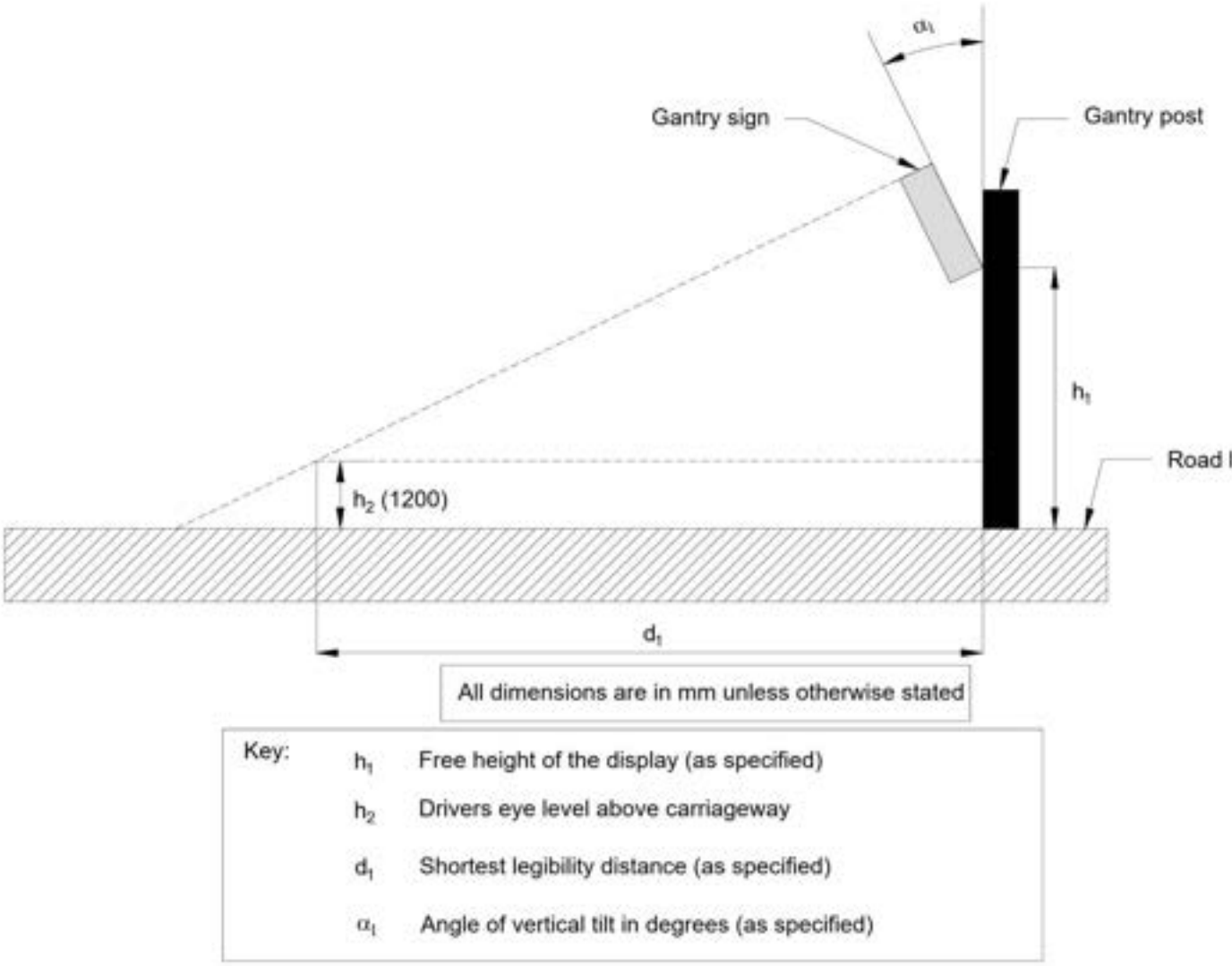
e) Enter a number in units of °, to specify the tolerance for the horizontal rotation angle.

Installation of variable message signs or signals mounted on a gantry

8.13 The variable message sign or signal shall be mounted on the gantry so the lower edge of the sign or signal is at a height if h_1 as shown in Figure 8.14.

8.14 The vertical tilt of the variable message sign or signal on the gantry shall be set up such that the face of the signal is α_1 degrees to the vertical as shown in Figure 8.14.

Figure 8.14 The alignment of variable message signs and signals mounted on a gantry.



8.15 Verification shall be undertaken for the vertical alignment of each variable message sign and signal by measuring the tilt angle α_1 as shown in Figure 8.14, with the results recorded in the inspection and test plan.

8.16 The frequency of the measurement of the vertical alignment of each variable message sign and signal shall be once upon completion of the installation of the sign or signal.

8.17 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the vertical alignment of each variable message sign and signal.

8.18 Verification shall be undertaken for the visibility of each variable message sign and signal by measuring the distance along the carriageway at a height of h_2 (as shown in Figure 8.14), that the sign or signal is legible, to ensure that the shortest legibility distance for the sign is d_1 (as shown in Figure 8.14), with the results recorded in the inspection and test plan.

8.19 The frequency of the visibility measurement for each variable message sign and signal shall be once upon completion of the installation of the sign or signal.

8.20 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visibility measurement of each variable message sign and signal.

8.21 Verification shall be undertaken for the visibility of each gantry with variable message signs and signals by providing evidence that all of the signs and signal aspects can be viewed with a consistent luminance across all lanes for the duration of the viewing distance, i.e. the maximum specified viewing distance upstream of the gantry to distance d_1 (as shown in Figure 8.14), with the results recorded in the inspection and test plan.

8.22 The frequency of the inspection of the visibility of each gantry with variable message signs and signals shall be once upon completion of the alignment of the signs and signals on the gantry.

8.23 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the inspection of the visibility of each gantry with variable message signs and signals.

8.24 Cables used for the inter-connection of variable message signs and signals shall comply with the requirements in 'Cable glands for roadside technology and communications' of "Cables for roadside technology and communications" in Section 7 of this document.

Installation of post-mounted signals

8.25 Post-mounted signal installations using a Type 610 plinth shall comply with the requirements in 'Type 610 plinth for roadside technology and communications cabinets' of "General requirements for cabinets for roadside technology and communications" in Section 4 of this document.

8.26 Post-mounted signals installations using a Type 610 plinth shall comply with the requirements in 'Product requirements for roadside technology and communications cabinets' of "General requirements for cabinets for roadside technology and communications" in Section 4 of this document.

8.27 Post-mounted signal installations shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

8.28 Hardstanding maintenance working areas for post-mounted signals shall comply with the 'Hardstanding maintenance working areas for roadside technology equipment sites' requirements of "General requirements for roadside technology and communications" in Section 1 of this document.

8.29 Post-mounted signals posts shall be aligned within ±1° of vertical.

8.30 Post-mounted signals shall be mounted on Type 610 plinths using the fixings provided.

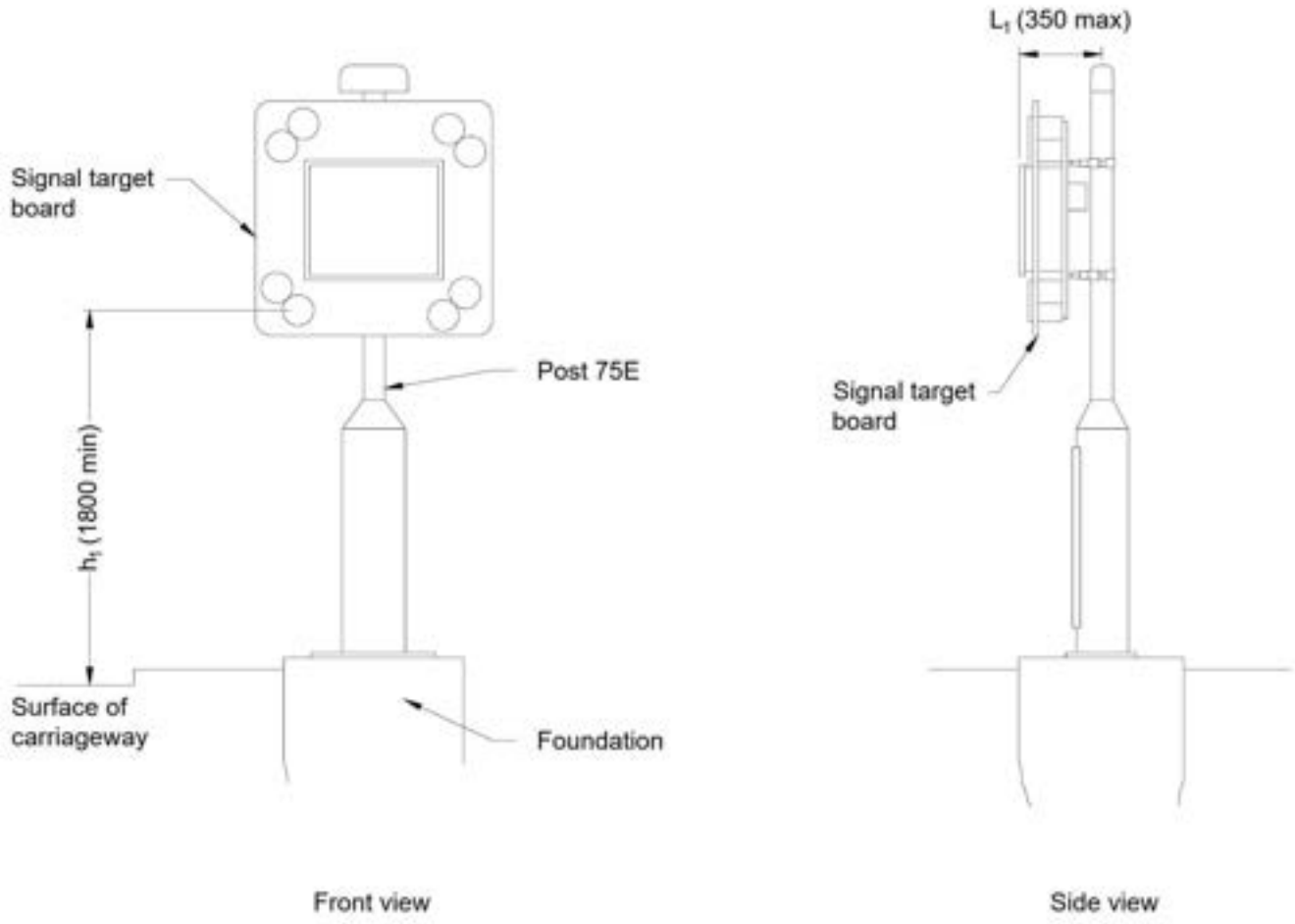
8.31 The signal posts of the AMI shall align with the mounting brackets of the AMI.

8.32 Post-mounted signals shall be orientated so that the enclosure doors are as shown on the scheme design.

Installation of signal head assembly on signal posts

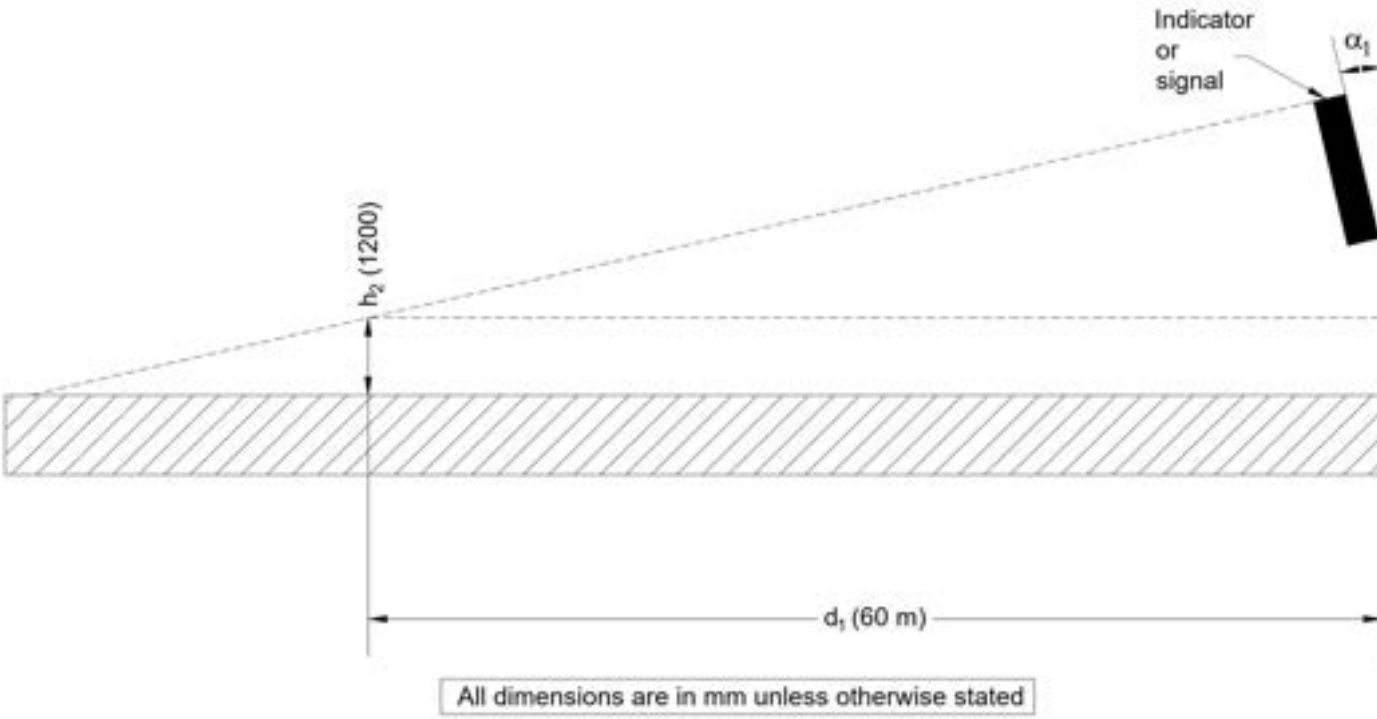
8.33 The signal head assembly shall be mounted on the signal post in accordance with Figure 8.33.

Figure 8.33 The mounting of the signal head assembly on the signal post showing side and front view.



8.34 The vertical tilt of the signal mounted on the signal post shall be set up as angle α_1 in accordance with Figure 8.34.

Figure 8.34 The vertical alignment of signal mounted on a signal post



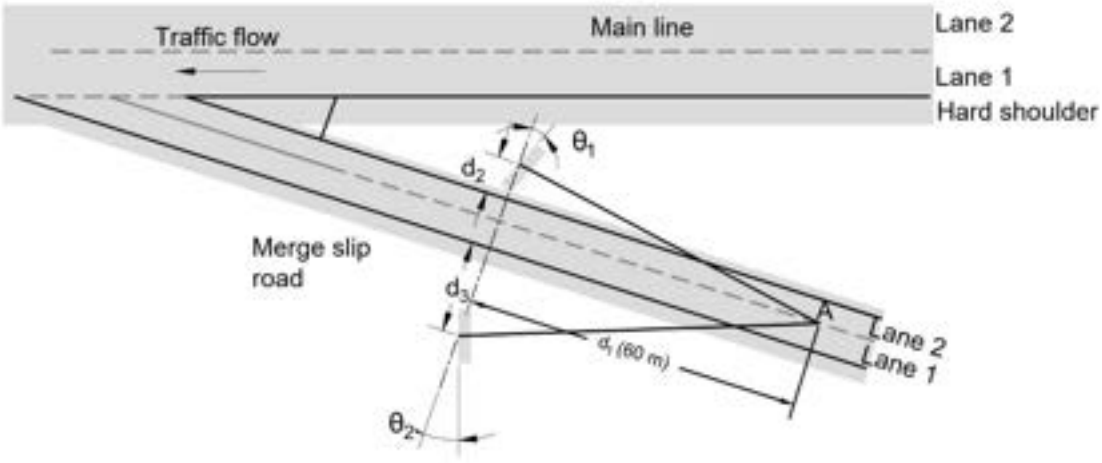
All dimensions are in mm unless otherwise stated

Key:

h_1	Free height of the indicator or signal above carriageway (as specified)
h_2	Drivers eye level above carriageway
d_1	Viewing distance
α_1	Vertical tilt (as specified)

8.35 The signals mounted on signal posts on merge slips shall be aligned such that the horizontal angle of the signal is in accordance with θ_1 in Figure 8.35.

Figure 8.35 Horizontal alignment of signal mounted on a signal post on a merge slip



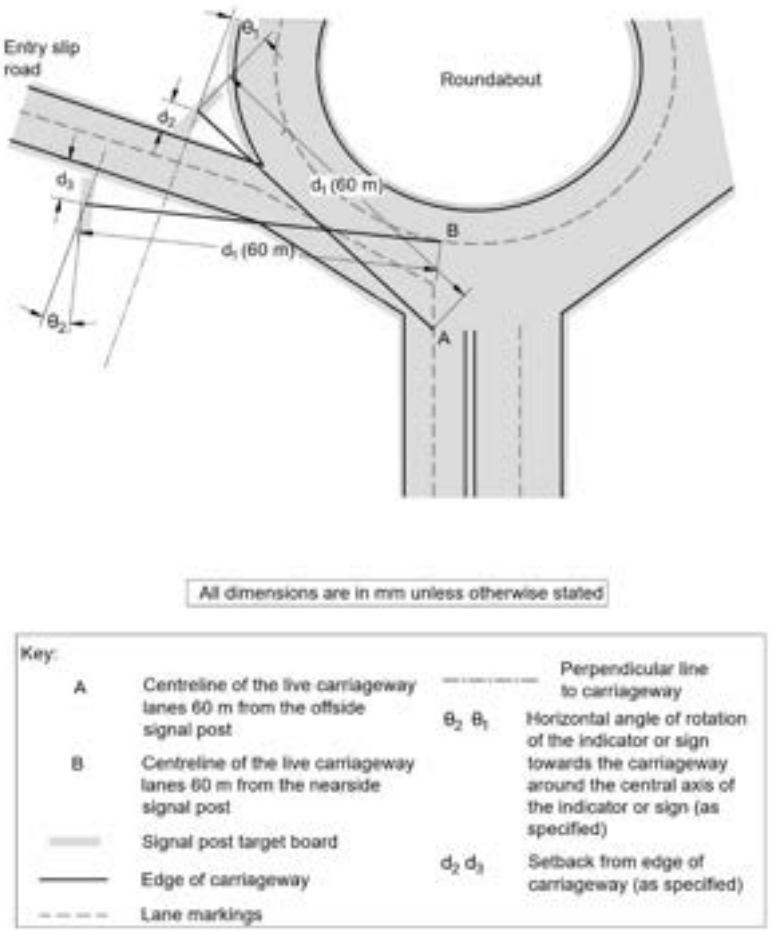
All dimensions are in mm unless otherwise stated

Key:

A	Centerline of the live carriageway lanes 60 m from the signal post	—·—·—	Perpendicular line to carriageway
	Signal post target board (as specified)	θ_1 θ_2	Horizontal angle of rotation of the indicator or sign towards the carriageway around the central axis of the indicator or sign (as specified)
———	Edge of carriageway		
– – – –	Lane markings	d_2 d_3	Setback from edge of carriageway (as specified)

8.36 The signals mounted on signal posts on entry slips shall be aligned such that the horizontal angle of the signal target board is in accordance with θ_1 and θ_2 in Figure 8.36.

Figure 8.36 Horizontal alignment of signal mounted on a signal post on an



entry slip

8.37 Verification shall be undertaken for the vertical alignment of the signal mounted on a signal post by measuring the tilt angle α_1 as shown in Figure 8.34, with the results recorded in the inspection and test plan.

8.38 The frequency of the measurement of the vertical alignment of each signal mounted on a signal post shall be once upon completion of the installation of the signal.

8.39 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the vertical alignment of the each signal.

8.40 Verification shall be undertaken for the horizontal alignment of the signal mounted on a signal post by measuring the horizontal angle θ_1 or θ_2 as shown in Figure 8.35 and Figure 8.36, with the results recorded in the inspection and test plan.

8.41 The frequency of the measurement of the horizontal alignment of each signal mounted on a signal post shall be once upon completion of the installation of the signal.

8.42 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the horizontal alignment of each signal.

8.43 Verification shall be undertaken for the visibility of the signal mounted on a signal post by undertaking a drive past and videoing the view of the lit signal from 100 m upstream of the signal to ensure that all of the signal aspect can be viewed from points A or B as described in Figures 8.35 and 8.36 up to the signal location with a consistent luminance across the aspect and for the duration of the viewing distance, with the results recorded in the inspection and test plan.

8.44 The frequency of the inspection of the visibility of each signal mounted on a signal post shall be once upon completion of the alignment of the signal.

8.45 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the inspection of the visibility of each signal.

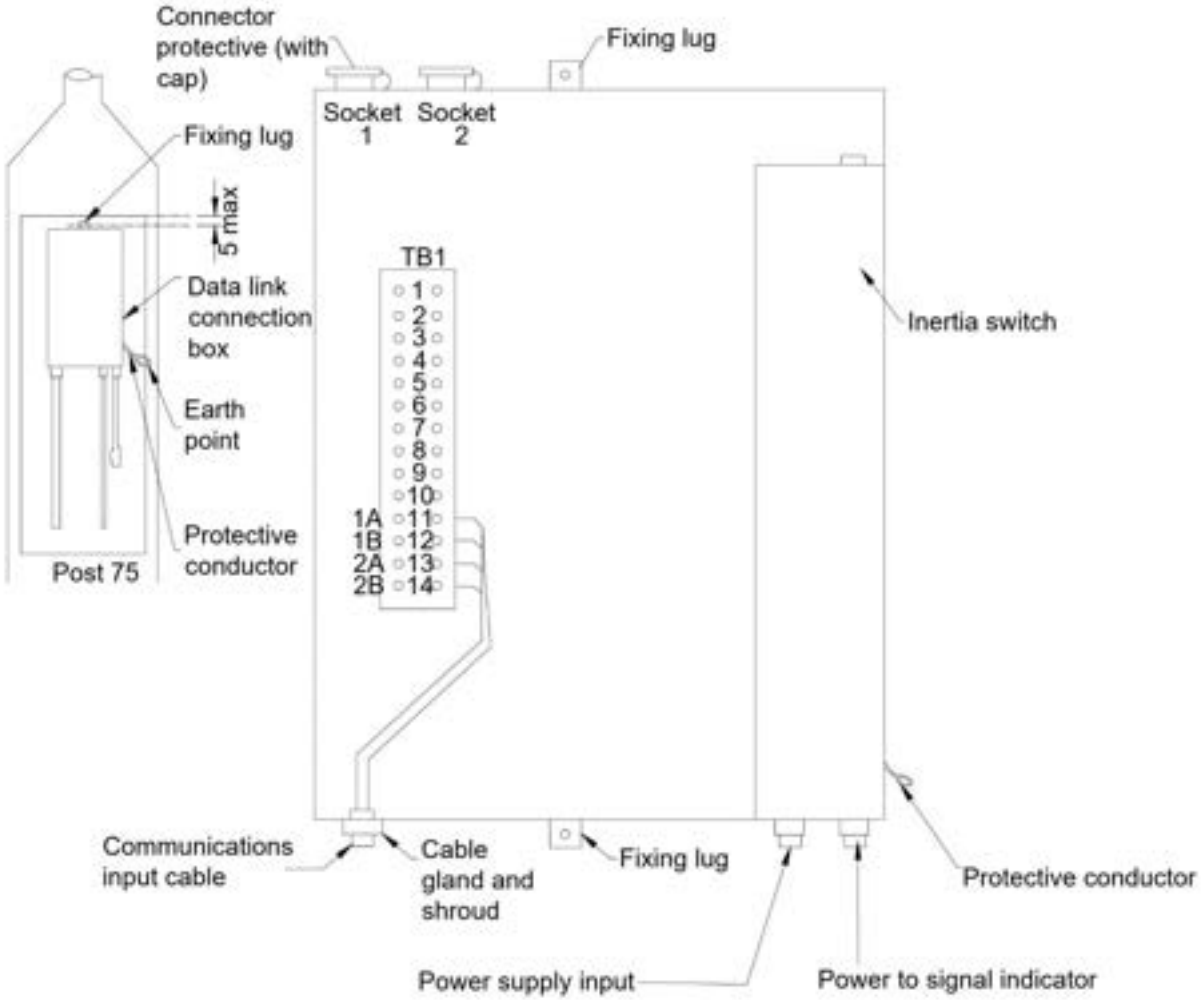
Installation requirements for labelling post mounted signals

8.46 Type VI labels shall be fitted to the signal target board or Type V labels to the bottom of the post and positioned to be facing the carriageway.

Installation requirements for signal wiring when installed on signal posts

8.47 Cable connections to the data link connection box (DLCB) within a signal post shall be in accordance with Figure 8.47.

Figure 8.47 Detail of DLCB connections within a signal post



Installation requirements for data link connection boxes (DLCBs)

8.48 The cable pair allocations for DLCBs shall be in accordance with Table 8.48.

Table 8.48 DLCB cable pair allocations					
Location of DLCB	Data pair	Line	Cable colour	Communications input 1 termination point	Communications input 2 termination point
Gantry	1	A	White	16	11
Gantry	1	B	Orange	17	12
Gantry	2	A	Black	18	13
Gantry	2	B	Green	19	14
Signal Post	1	A	White	11	Not applicable
Signal Post	1	B	Orange	12	Not applicable
Signal	2	A	Black	13	Not applicable

Post					
Signal Post	2	B	Green	14	Not applicable

8.49 The cable pair colours for DLCBs shall be in accordance with Table 8.48.

8.50 The installation requirements for DLCBs and gantry isolation switches, including the type and location, shall be as stated in TC 131/WSR/008.

SI.8.50 The installation requirements of DLCBs and gantry isolation switches, including the type and location, shall be [enter free text].

Installation requirements for signal interconnections of equipment on remote sites

8.51 The locations where space is to be provided at signal posts for the TSP to install a cable joint enclosure (CJE) for the Service Delivery Point (SDP) and to facilitate the isolation and testing of RS485 and other communication circuits shall be as stated in TC 131/WSR/008.

SI.8.51 The locations where space is to be provided at signal posts for the TSP to install a CJE for the SDP and to facilitate the isolation and testing of RS485 and other communication circuits shall be [enter free text].

8.52 The size of the space for the TSP to install a CJE for the SDP and to facilitate the isolation and testing of RS485 and other communication circuits shall be as stated in TC 131/WSR/008.

SI.8.52 The size of the space for the TSP to install a CJE for the SDP and to facilitate the isolation and testing of RS485 and other communication circuits shall be [enter free text].

Testing and commissioning of variable message signs and signals

8.53 The testing and commissioning requirements for variable message signs and signals shall be as stated in TC 131/WSR/008.

SI.8.53 The testing and commissioning requirements of variable message signs and signals shall be [enter free text].

8.54 Verification shall be undertaken for each variable message sign or signal by undertaking the testing and commissioning as specified, with the results recorded in the test certificate for each variable message sign or signal.

8.55 The frequency of the testing and commissioning for each variable message sign or signal shall be as stated in the testing and commissioning requirements.

8.56 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the testing and commissioning for each variable message signs or signal.

Documentation requirements for variable message signs and signals

Product compliance documentation for variable message signs and signals

8.57 The following Documentation shall be submitted for electronic motorway display equipment prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.58 The following Documentation shall be submitted for MS1 variable message signs prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.59 The following Documentation shall be submitted for MS3 2 x 12 variable message signs prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.60 The following Documentation shall be submitted for MS3 2 x 16 variable message signs prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.61 The following Documentation shall be submitted for MS3 3 x 18 variable message signs prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.62 The following Documentation shall be submitted for MS4 variable message signs prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.63 The following Documentation shall be submitted for MS4R variable message signs prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.64 The following Documentation shall be submitted for AMIs prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.65 The following Documentation shall be submitted for signal posts prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

8.66 The following Documentation shall be submitted for weatherproof cable assemblies used on the inter-connection of message signs and signals prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

Testing and commissioning documentation for variable message signs and signals

8.67 The Documentation for recording the results of the testing of each variable message sign or signal shall be test certificates in the format as stated in TC 131/WSR/008.

SI.8.67 The format of the test certificates recording the results of the testing of each variable message sign or signal shall be [enter free text].

8.68 The following Documentation shall be submitted for each variable message sign and signal prior to the commencement of project closure: variable message signs and signals handover certificate in accordance with GG 182 [Ref 31.N].

8.69 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the variable message signs and signals handover certificate.

8.70 The following Documentation shall be submitted for each variable message sign and signal prior to the commencement of project closure: variable message signs and signals maintenance handover documentation in accordance with GG 182 [Ref 31.N].

8.71 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the variable message signs and signals maintenance handover documentation.

9. Roadside technology on gantries

Product requirements for roadside technology on gantries

9.1 Roadside technology on gantries shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

9.2 The protective bonding of gantries for roadside technology shall be compliant with BS EN 60228 [Ref 8.N].

9.3 The protective bonding of gantries for roadside technology shall meet the following performance characteristics: Table 2: Class 2, stranded copper conductor, minimum 10 mm^2 cross sectional area.

9.4 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 21.N] shall apply to the protective bonding of gantries for roadside technology.

9.5 Terminal lugs for roadside technology on gantries shall be compliant with BS EN 61238-1 [Ref 7.N].

9.6 The terminal lugs for roadside technology on gantries shall meet the following performance characteristics: Electrical : Class A, Mechanical: Class 1.

9.7 Gantry lightning protection system components for roadside technology shall be compliant with BS EN 62561-1 [Ref 30.N].

9.8 Cable trays on gantries for roadside technology shall be compliant with BS 6946 [Ref 61.N].

Installation requirements for roadside technology on gantries

9.9 The installation of gantry identification labels for roadside technology equipment shall comply with the requirements in 'Installation of Type I motorway gantry labels' of "Labels for roadside technology and communications" in Section 16 of this document.

9.10 Variable message signs and signals to be installed on gantries shall comply with "Variable message signs and signals for roadside technology and communications" in Section 8 of this document.

9.11 A roadside technology equipment installation survey shall be carried out to establish installation requirements for mounting signalling equipment on gantries.

9.12 The location of gantries requiring roadside technology equipment installation surveys to establish the installation requirements for mounting the signalling equipment shall be as stated in TC 131/WSR/009.

SI.9.12 The location of gantries requiring roadside technology equipment installation surveys to establish the installation requirements for mounting the signalling equipment shall be [enter free text].

9.13 The roadside technology equipment installation survey to be carried out to establish installation requirements for mounting signalling equipment shall be as stated in TC 131/WSR/009.

SI.9.13 The specification of the roadside technology equipment installation survey to be carried out to establish installation requirements for mounting signalling equipment shall be [enter free text].

9.14 All roadside technology equipment and cabling equipment on gantries shall be secured to the gantry in accordance with CD 365 [Ref 40.N].

9.15 Safety earth labels which read 'SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE' shall be provided at each bond to the gantry structure in accordance with BS 7671 [Ref 53.N] 'Warning notices: earthing and bonding connections'.

9.16 Ancillary items installed for roadside technology equipment shall not prevent the installation of closure plates for message signs on gantries.

9.17 Location pads shall be provided for signals on gantry structures to prevent slippage of clamps.

9.18 No drilling into the gantry structure shall be permitted to install signs, signals and infill panels.

9.19 The installation of a signal onto a gantry structure shall not prevent the signal adjustment throughout its intended range.

9.20 The retrofitting of ancillary items to existing gantry structures shall be as stated in TC 131/WSR/009.

SI.9.20 The retrofitting of ancillary items to existing gantry structures shall be [enter free text].

9.21 Signals on gantry structures shall be securely clamped to vertical members.

Installation of cable management for roadside technology on gantries

9.22 Cables, when entering or exiting cable trays shall be secured to the cable tray to prevent wear and damage.

9.23 Cable trays shall not cause damage to cables entering or exiting the cable tray.

9.24 Cable tray and cable tray fixings shall not cause galvanic corrosion.

9.25 The additional requirements for the protection of cables installed on gantries shall be as stated in TC 131/WSR/009.

SI.9.25 The additional requirements for the protection of cables installed on gantries shall be [enter free text].

9.26 The cable trays running the full length of walkways for signals installed on gantries shall be as stated in TC 131/WSR/009.

The cable trays running the full length of walkways for signals installed on gantries						
Gantry reference	**Chainage**	**Marker post**	**Carriage way**	**Cable tray width**	**Cable tray depth**	**Location of cable tray**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the gantry for the cable tray.

b) Enter text, to identify the chainage location of gantry for the cable tray.

c) Enter text, to identify the marker post location of gantry for the cable tray.

d) Enter text, to identify carriageway location of the gantry for the for the cable tray.

e) Enter a number in units of mm, to identify the cable tray width to be used.

f) Enter a number in units of mm, to identify the cable tray depth to be used.

g) Enter text, to define where the cable tray is to be positioned on the gantry.

The cable trays running the full length of walkways for signals installed on gantries (continued)		
Gantry reference	**Method of cable protection**	**Minimum height of cable protection**
(a)	(h)	(i)

h) Enter text, to identify the method of continuous protection for the cables against mechanical damage, theft or vandalism.

i) Enter a number in units of m, to identify the minimum height for the method of continuous protection against mechanical damage, theft or vandalism to extend.

9.27 Cable shall be installed in a single layer on the cable tray.

9.28 The use of non-metallic cable trays, trunking, cable clips and cable ties shall not be permitted.

9.29 Cable management systems for signals on gantry structures shall run from the interface point at the top of the plinth to the local connection box (if supplied), or to the far end of the gantry.

9.30 Cable management systems for signals on gantry structures that run inside the gantry column shall be sealed to IP65 in accordance with BS EN 60529 [Ref 10.N].

9.31 Mounting plates for cable arrangements shall be installed on gantries.

9.32 The duct end plate and cable gland between the duct for roadside technology and communications and the gantry traywork shall be sealed to IP65 in accordance with BS EN 60529 [Ref 10.N].

9.33 Where cables on gantries transition between duct and vertical tray, they shall be supported to protect them from damage.

9.34 All gantry cables shall be secured to the cable tray at a maximum of 1000 mm spacing, centre to centre.

9.35 All cable trays installed for non-armoured cables on gantries shall have covers installed along their whole length to protect the cables against UV degradation and to prevent theft and vandalism.

9.36 Where sign lighting cables on gantries run in trunking or a galvanised conduit supported on gantry cross bracing straps, the cable tray to lighting fittings shall be omitted.

9.37 The sign lighting control distribution cabinet shall be sealed to IP56 in accordance with BS EN 60529 [Ref 10.N] and manufactured from non-metallic material.

Installation of electrical isolation on superspan gantries

9.38 The electrical isolation of superspan gantries, in accordance with MCE 2651 [Ref 64.N] Appendix E shall be as specified in TC 131/WSR/009.

The electrical isolation of superspan gantries, in accordance with Appendix E	
Gantry reference	**Isolation of superspan gantry**
(a)	(b)

a) Enter a unique reference, to identify the gantry.

b) Enter a value, from options Figure E 1, Figure E 2, Figure E 3, Figure E 4, Figure E 5, Figure E 6, Figure E 7, to identify how the superspan gantry is to be isolated.

Installation of lightning protection on gantries

9.39 The provision of lightning protection for gantries shall be as stated in TC 131/WSR/009.

The provision of lightning protection for gantries		
Asset structure reference	**Asset structure type**	**Lightning protection system**
(a)	(b)	(c)

a) Enter a unique reference, to identify the structure that needs lightning protection.

b) Enter text, to identify the type of structure that needs lightning protection.

c) Enter text, to describe the installation details and/or drawing reference for the lightning protection system, including details of equipotential bonds.

9.40 Gantries that require an earth electrode system or test pits shall be as specified in TC 131/WSR/009.

Gantries that require an earth electrode system or test pits			
Gantry reference	**Earth electrode system to be installed**	**Earth electrode system details**	**Test pit details**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the gantry.

b) Enter a value, from options Yes, No, to identify if the gantry requires an earth electrode system to be installed.

c) Enter text, to describe or reference the scheme drawing for earth electrode system to be installed.

d) Enter text, to describe or reference the scheme drawing for the test pit requirements.

9.41 The earthing conductor for the protective bonding for gantries shall have a PVC flame retardant insulated covering.

9.42 The earthing conductor for the protective bonding for gantries shall be protected against UV degradation.

9.43 Earthing cables shall be connected to the structure at provided bonding points using terminal lugs, in accordance with the manufacturer's instructions.

9.44 Earthing cables, terminal lugs, nut, bolt and locking washer arrangements shall be electrochemically compatible to prevent galvanic corrosion.

Testing and commissioning of roadside technology on gantries

9.45 The test requirements for the cable management for roadside technology on gantries shall be as stated in TC 131/WSR/009.

SI.9.45 The test requirements of the cable management for roadside technology on gantries shall be [enter free text].

9.46 Verification shall be undertaken for cable management for roadside technology on gantries by undertaking the testing as specified, with the results recorded in the inspection and test plan.

9.47 The frequency of the testing of the cable management for roadside technology on each gantry shall be once upon completion of the installation of all cable management on the gantry.

9.48 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the cable management for roadside technology on each gantry.

Testing of lightning protection system (LPS) on gantries

9.49 Verification shall be undertaken for each item of the LPS on gantries by visual inspection and testing in accordance with BS EN 62305-3 [Ref 50.N], with the results recorded in the LPS inspection report.

9.50 The frequency of the visual inspection and testing of the LPS on each gantry shall be once upon completion of the installation of the earth electrode system, and once upon completion of the gantry installation.

9.51 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection and testing of the LPS on each gantry.

Testing of lighting and power on gantries

9.52 The test requirements for lighting and communications power supplies at existing gantries shall be as stated in TC 131/WSR/009.

SI.9.52 The test requirements of lighting and communications power supplies at existing gantries shall be [enter free text].

9.53 Verification shall be undertaken for the lighting and communications power supplies at existing gantries by completing the tests as specified, with the results recorded in the test results sheets.

9.54 The frequency of the testing of lighting and communications power supplies at existing gantries shall be once upon completion of the installation of lighting and communications power supplies at the gantry.

9.55 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the tests of lighting and communications power supplies at existing gantries.

Verification requirements for roadside technology on gantries

9.56 Verification shall be undertaken for each cable tray to inspect the delivery packaging for reference to BS 6946 [Ref 61.N].

9.57 The frequency of the inspection of the delivery packaging for the cable tray shall be once before installation of the cable tray.

9.58 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the inspection of the cable trays.

Documentation requirements for roadside technology on gantries

Product compliance documentation for roadside technology on gantries

9.59 The following Documentation shall be submitted for terminal lugs prior to the commencement of the installation: test report demonstrating compliance with BS EN 61238-1 [Ref 7.N].

9.60 The following Documentation shall be submitted for gantry lightning protection system components prior to the commencement of the installation: test report demonstrating compliance with BS EN 62561-1 [Ref 30.N].

Testing and commissioning documentation for roadside technology on gantries

9.61 The following Documentation shall be submitted for lightning protection system on gantries prior to the commencement of on site testing: LPS inspection report in accordance with BS EN 62305-3 [Ref 50.N].

9.62 The following Documentation shall be submitted for lighting and communications power supplies at existing gantries prior to the commencement of operational regime testing in accordance with GG 182 [Ref 31.N]: test results sheets.

10. Detector systems for roadside technology and communications

10.1 Detector systems for roadside technology and communications shall comply with the requirements of "Telecommunications services" in Section 2 of this document.

10.2 Detector systems for roadside technology and communications shall comply with "Electrical installations for roadside technology and communications" in Section 3 of this document.

10.3 Detector systems for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

10.4 Detector systems for roadside technology and communications shall comply with the requirements of 'Installation of jointing chambers for detector loops for roadside technology and communications' in "Chambers for roadside technology and communications" in Section 14 of this document.

10.5 Detector systems for roadside technology and communications shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

Product requirements for detector systems for roadside technology and communications

10.6 Traffic and environmental sensors for roadside technology and communications shall be compliant with MCH 2636 [Ref 12.N].

10.7 Stopped vehicle detection (SVD) systems for roadside technology and communications shall be compliant with TR 2642 [Ref 55.N].

10.8 Below ground vehicle detection equipment shall be compliant with SE 1131 [Ref 67.N].

10.9 Radar based vehicle detection equipment shall be compliant with SE 1170 [Ref 79.N].

Scope of works for detector system installations for roadside technology and communications

10.10 The installation of detector systems for roadside technology and communications shall be as stated in TC 131/WSR/010.

The installation of detector systems for roadside technology and communications					
Detector reference	**Detector type**	**Model reference ID (optional)**	**Chainage**	**Marker post**	**Carriage way**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the detector.

b) Enter text, to identify the detector type such as loop, radar or camera for automatic number plate recognition (ANPR) or journey time monitoring.

c) Enter text, to identify the 3D model reference of the detector.

d) Enter text, to identify chainage location of the detector.

e) Enter text, to identify marker post location of the detector.

f) Enter text, to identify carriageway location of the detector.

The installation of detector systems for roadside technology and communications (continued)							
Detector reference	**Mounted on**	**Mounting height (above level of road surface)**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**New/Existing/ Modified**	**Outstation cabinet ID**	**Carriageway(s) covered**
(a)	(g)	(h)	(i)	(j)	(k)	(l)	(m)

g) Enter text, to identify detector mount.

h) Enter a number in units of m, to identify the mounting height of the above ground detector above the level of the road surface.

i) Enter a number in units of m, to identify the X (Easting) co-ordinate of the detector.

j) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the detector.

k) Enter a value, from options New, Existing, Modified, to identify whether the detector to be installed is new, existing or modified.

l) Enter text, to identify the detector outstation cabinet.

m) Enter text, to identify the carriageway(s) covered by the detector.

The installation of detector systems for roadside technology and communications (continued)	
Detector reference	**Chainage coverage from...to...**
(a)	(n)

n) Enter text, to identify the section of carriageway covered by the detector.

Installation of detector systems for roadside technology and communications

Installation of below ground detector systems for roadside technology and communications

10.11 Detector loops for roadside technology and communications shall be installed in accordance with MCH 1540 [Ref 65.N].

10.12 Slots for the detector loops for roadside technology and communications that are not to be cut into the sub-surface prior to final resurfacing shall be as specified in TC 131/WSR/010.

Slots for the detector loops for roadside technology and communications that are not to be cut into the sub-surface prior to final resurfacing			
Detector reference	**Chainage**	**Carriageway**	**Construction method**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the detector.

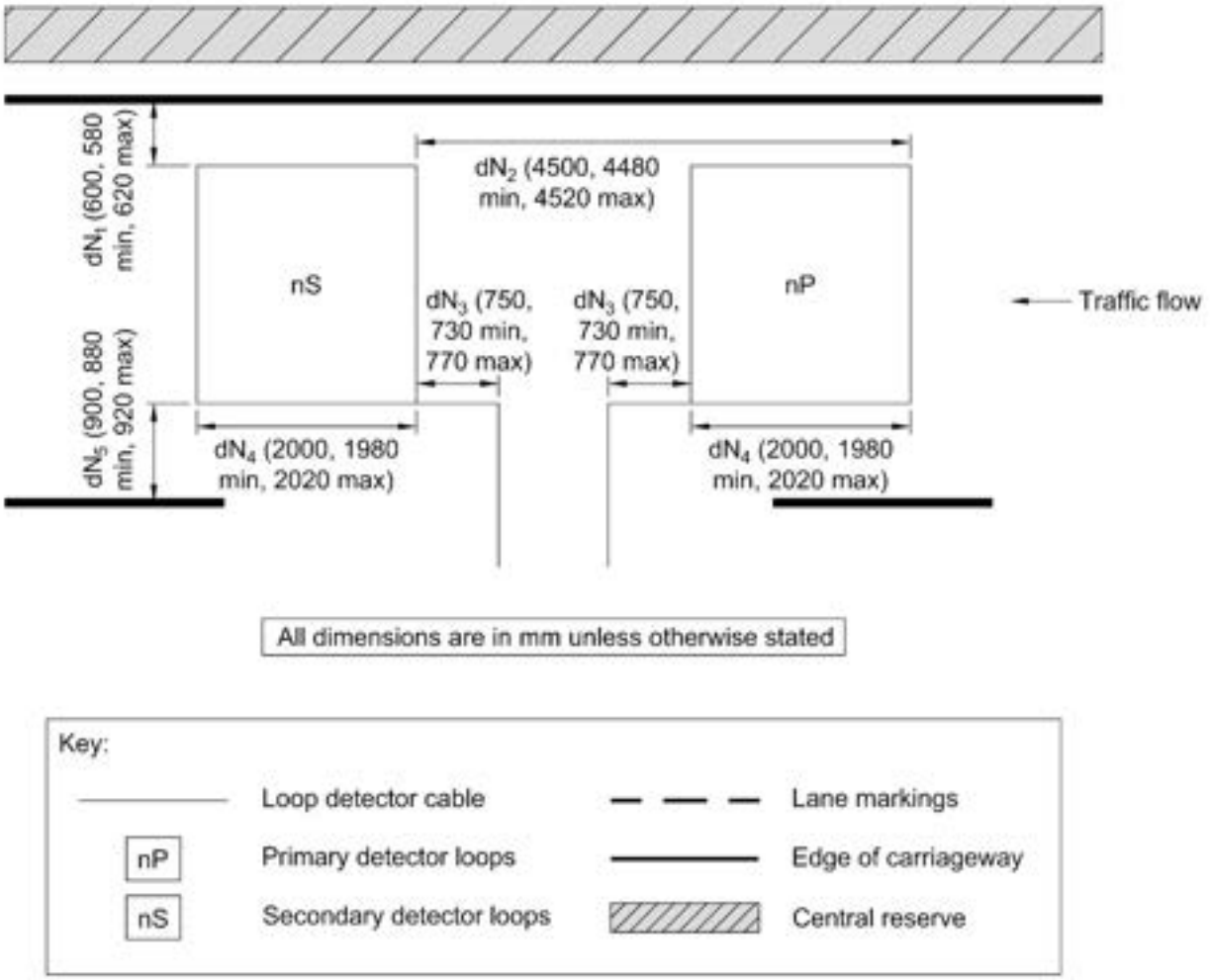
b) Enter text, to identify the chainage location of the loop site.

c) Enter text, to identify the carriageway location of the loop site.

d) Enter text, to identify the construction method for cutting slots for the detector loops when they are not cut prior to resurfacing.

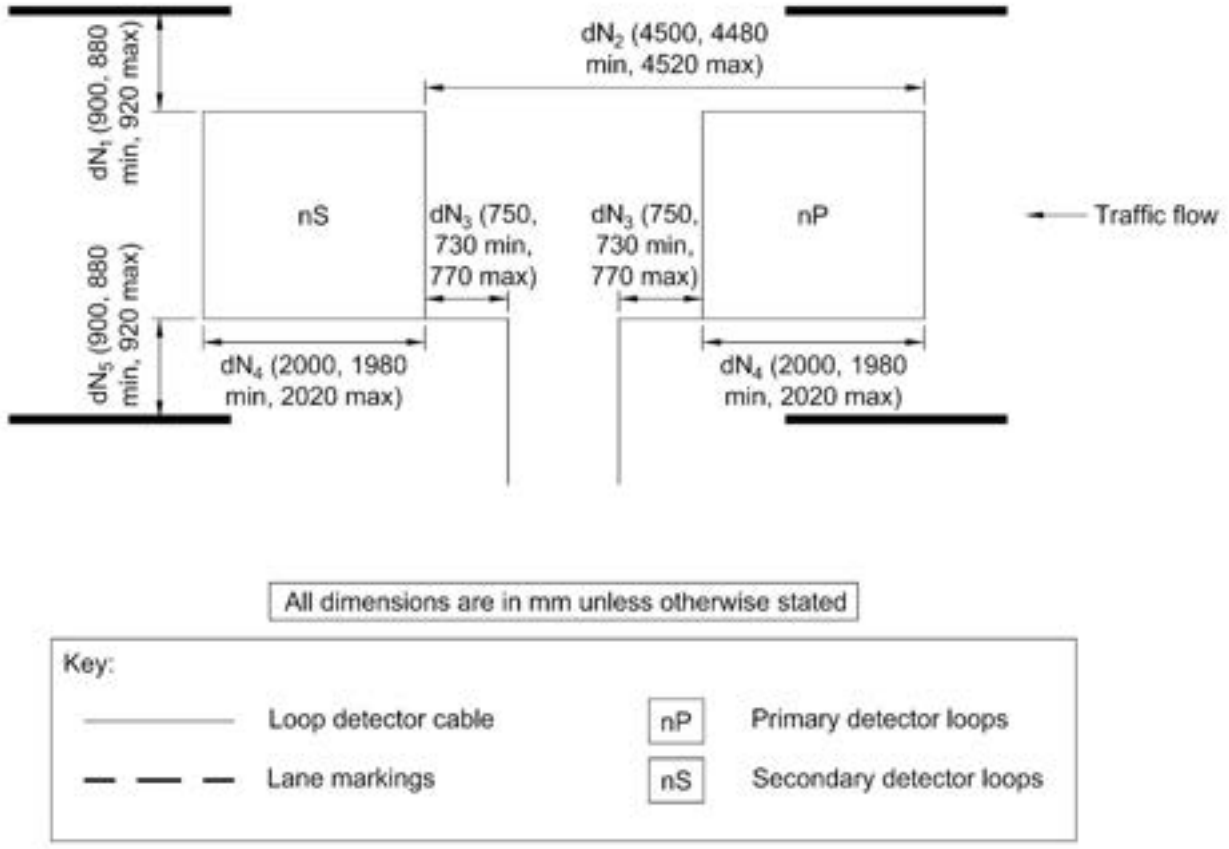
10.13 Motorway Incident Detection and Automatic Signalling (MIDAS) detector loop installation measured from the central reserve shall be in accordance with Figure 10.13.

Figure 10.13 MIDAS detector loop installation from the central reserve.



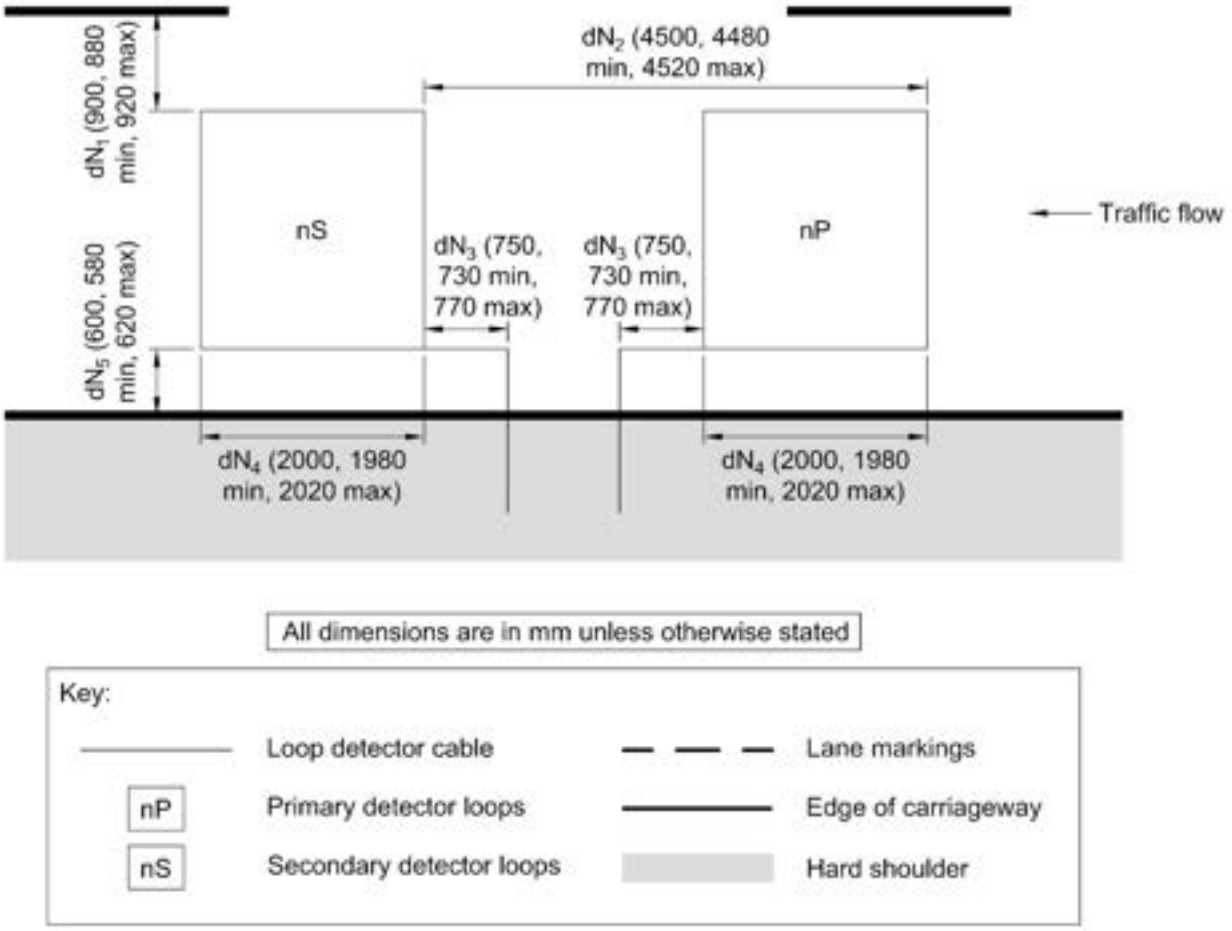
10.14 MIDAS detector loop installation, with reference to the lane markings, shall be in accordance with Figure 10.14.

Figure 10.14 MIDAS detector loop installation from the lane markings.



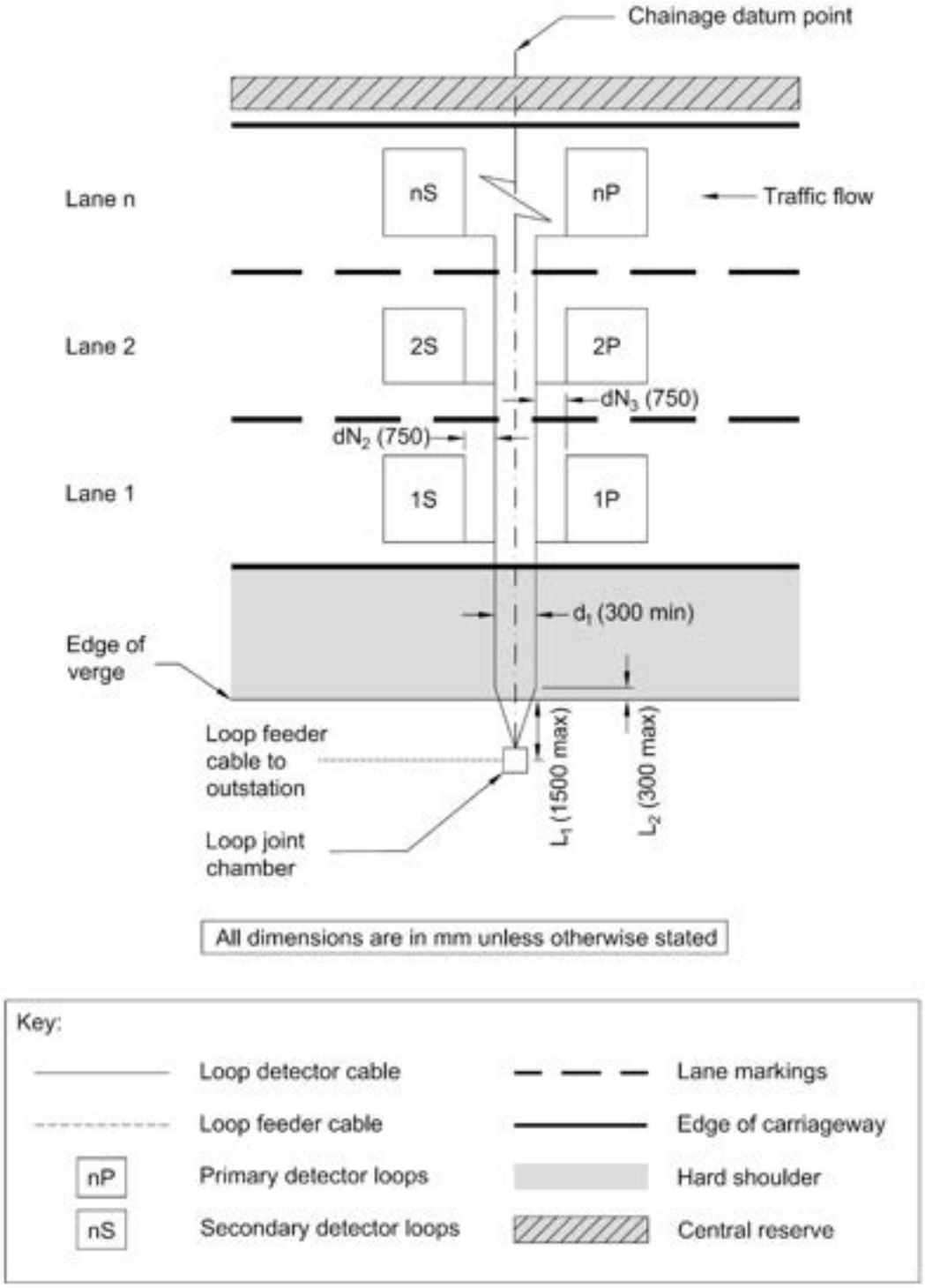
10.15 MIDAS detector loop installation from the hard shoulder shall be in accordance with Figure 10.15.

Figure 10.15 MIDAS detector loop installation from the hard shoulder or edge of carriageway.



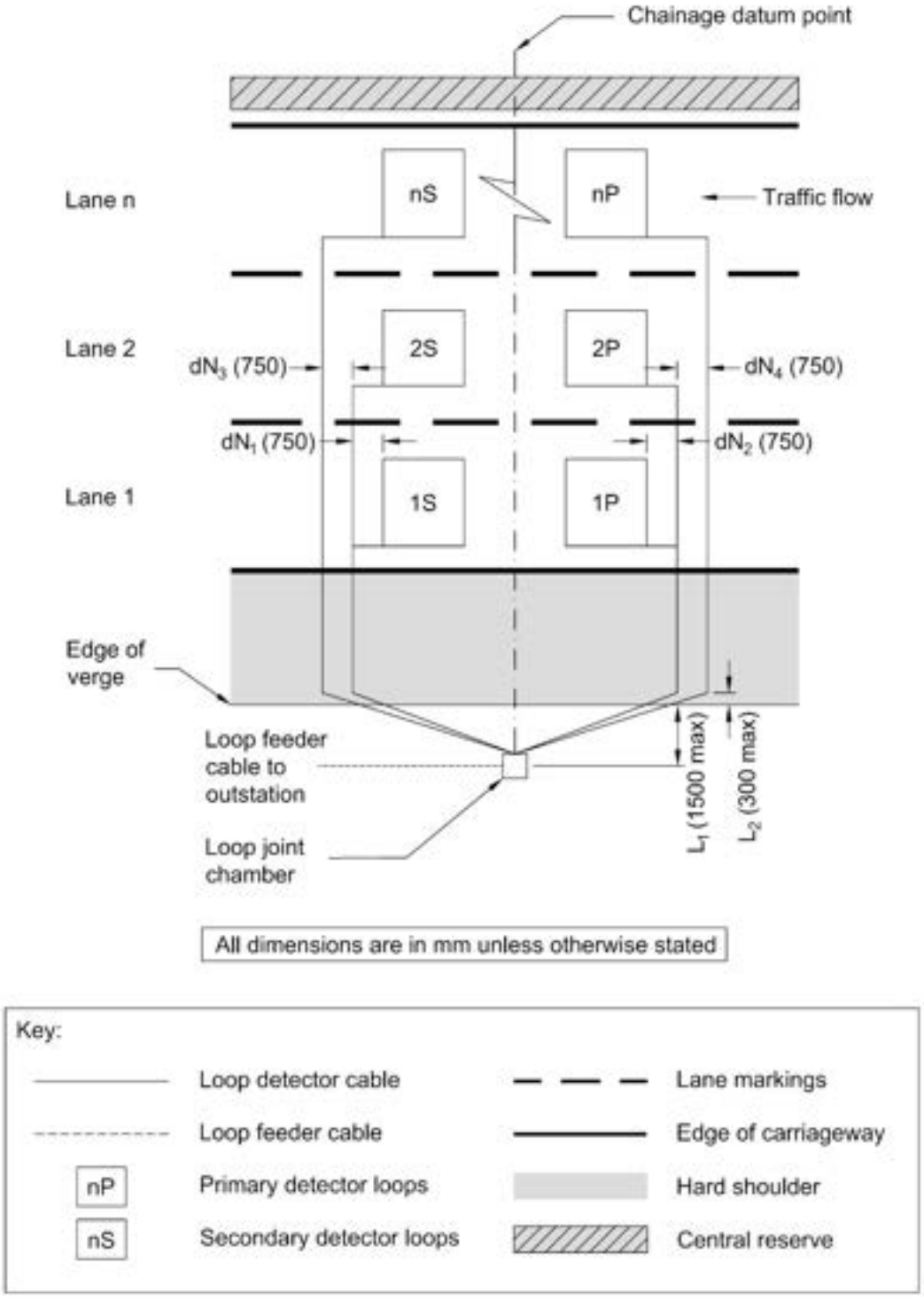
10.16 The positioning of loop detector cables from the detector loops over to the verge shall be in accordance with either Figure 10.16a or b.

Figure 10.16a Loop detector cables positioned between the detector loops



Figure

10.16b Loop detector cables positioned outside the detector loops

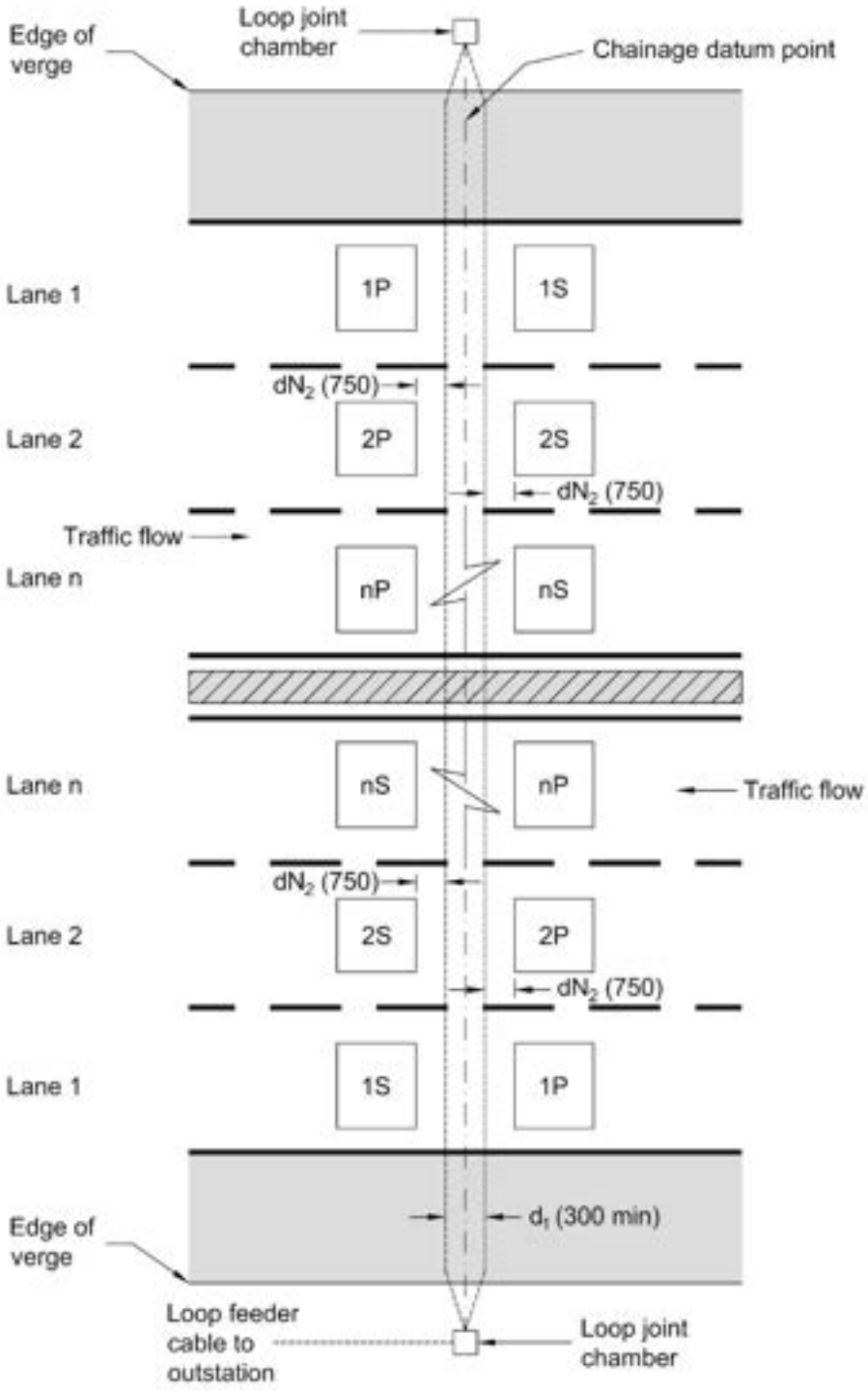


10.17 When the loop detector cables are located between the loops as in Figure 10.16a they shall be symmetrically positioned so that dimensions dN_2 and dN_3 are equal.

10.18 When the loop detector cables are located outside the loops as in Figure 10.16b they shall symmetrically positioned so that dimensions dN_1 and dN_2 are equal as well as dN_3 and dN_4.

10.19 Loop feeder cable arrangements to cross the central reserve with a loop joint chamber in each verge shall be in accordance with Figure 10.19a or b.

Figure 10.19a Loop feeder cables across central reserve with dual loop joint chambers option A.



All dimensions are in mm unless otherwise stated

Figure 10.19b Loop feeder cables across central reserve with dual loop joint chambers

option B.

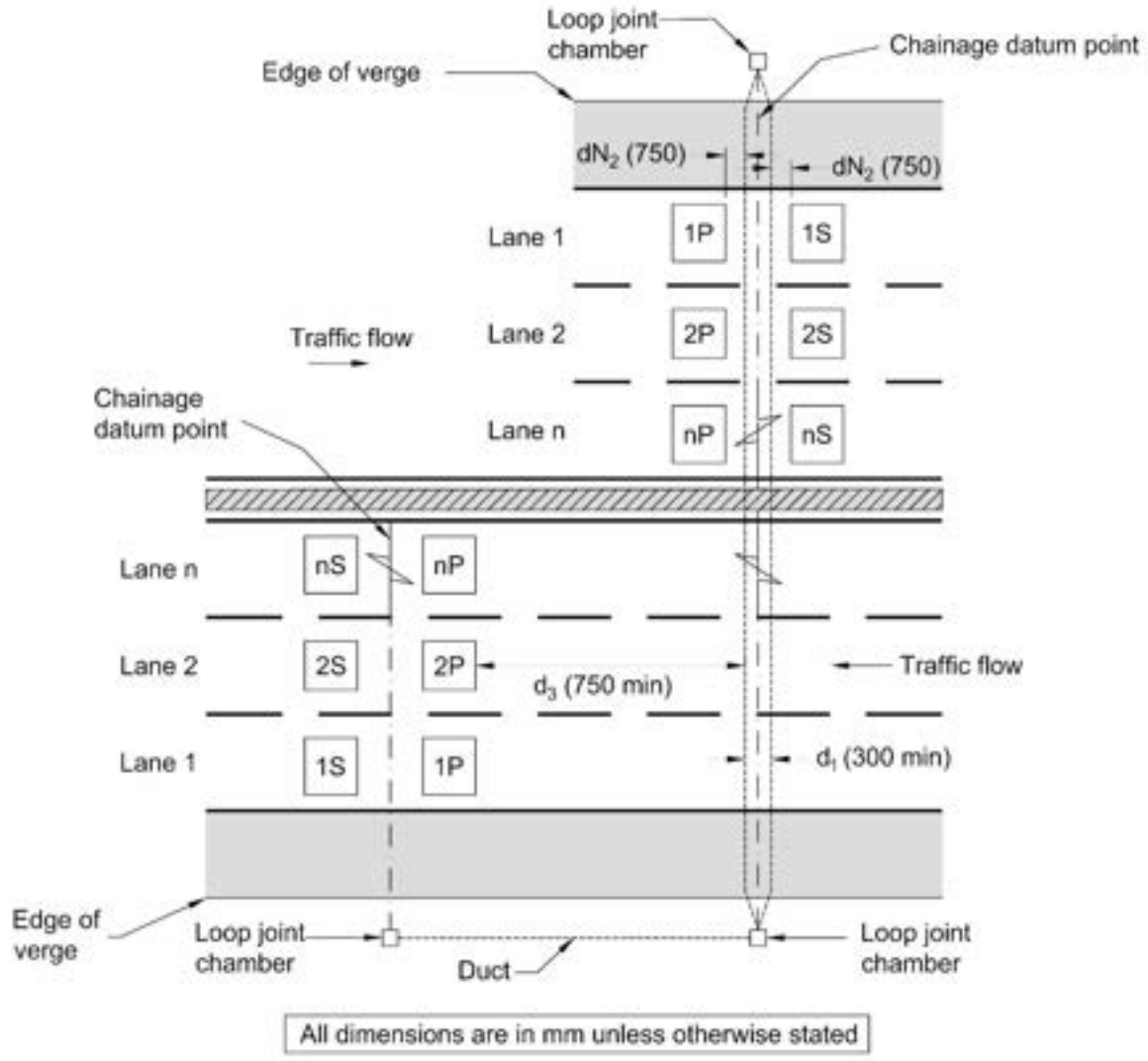
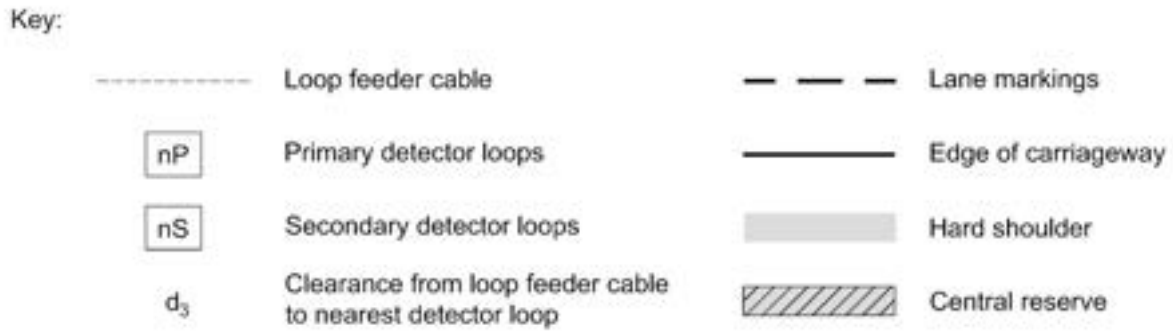


Figure 10.19c Key for Figures 10.19 a and b



10.20 Loop feeder cables shall be installed in either a trough, duct or a chamber when crossing the central reserve.

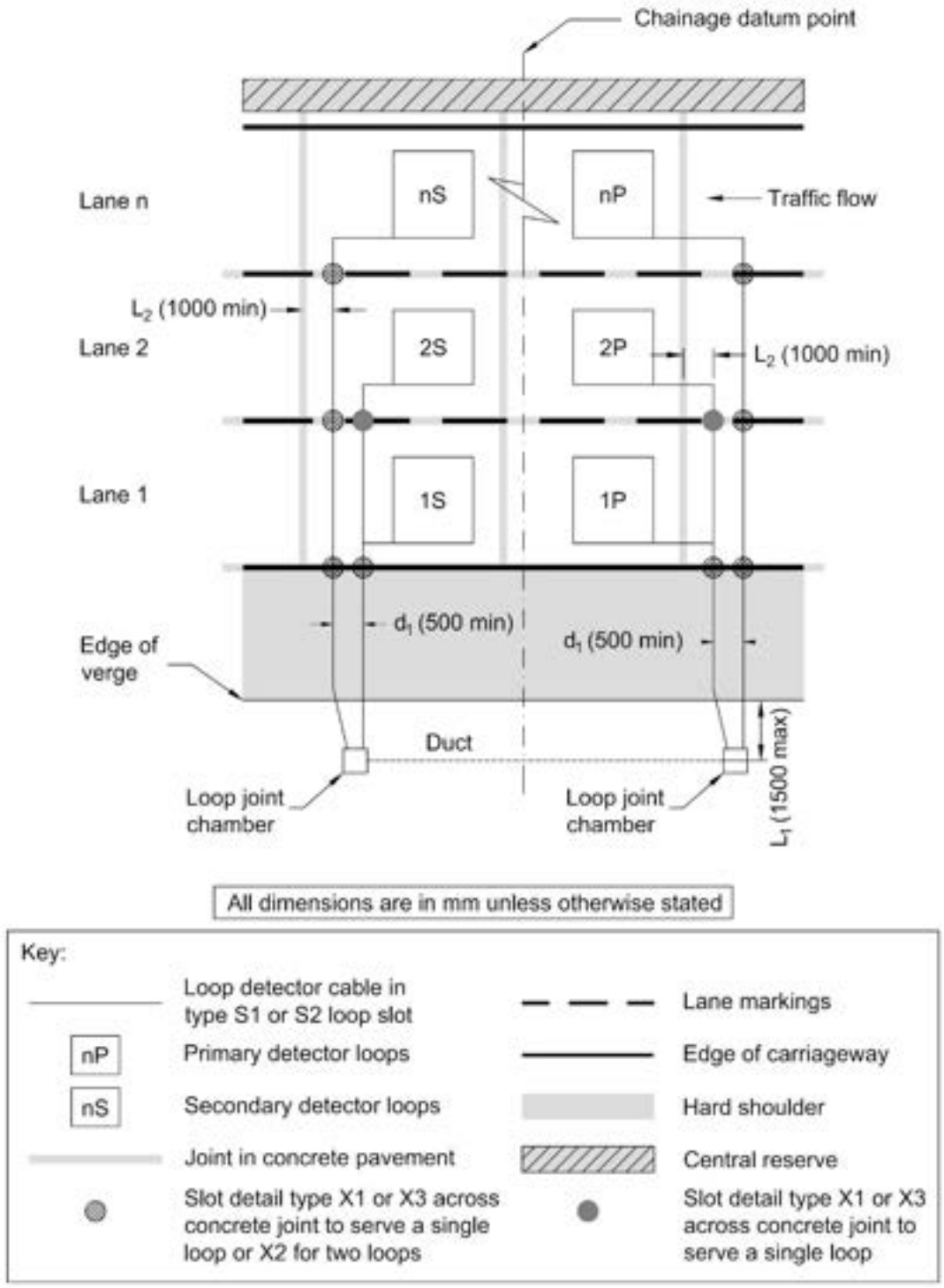
10.21 No joints shall be used on the installation of loop feeder cables when crossing the central reserve.

10.22 In soft central reserves, a duct or trough shall interface with the loop feeder cables on either carriageway.

10.23 The duct or trough in the soft central reserve shall be sized to contain all loop feeder cables traversing the central reserve.

10.24 Detector loop installation on concrete pavement and hard shoulder shall be in accordance with Figure 10.24.

Figure 10.24 Detector loop installation on concrete pavement and hardshoulder.



10.25 Locations where detector loops are not 3 turns shall be specified in TC 131/WSR/010.

Locations where detector loops are not 3 turns	
Detector reference	**Number of turns for detector loops**
(a)	(b)

a) Enter a unique reference, to identify the detector.

b) Enter a number, to represent the number of turns for the detector loop when it is not 3.

10.26 Loop detector cables shall be twisted between 10 and 15 twists per m in order to reduce the potential for cross-talk between loops and also to ensure that loop detector cables stay together throughout their length.

10.27 Cutting shall be a minimum distance of 600 mm away from longitudinal joints in concrete during the installation of loops on concrete roads.

10.28 Loops shall have a minimum clearance of 50 mm above any road reinforcement.

10.29 Loops shall be cut so there is a minimum distance between the loop slot and the transverse joint in concrete slabs, as shown by L_2 in Figure 10.24.

10.30 Slots for loop feeder cables in concrete shall be separated by a minimum distance as shown by d_1 in Figure 10.24.

10.31 Slots for loop feeder cables in bitumen shall be separated by a minimum distance as shown by d_1 in Figure 10.16a, 10.19a and 10.19b.

10.32 Each loop slot shall have no more than 4 loop detector cables installed to prevent the buckling of cables.

10.33 Installed loops shall not be within 1 m of ferrous objects such as piping and drains.

10.34 Loop detector cables shall be fed under or through the kerb at an angle which does not damage the cable.

10.35 The depth of loop detector cables shall be maintained for the width of the road surface.

10.36 The loop feeder cables shall be laid in the inspection chamber with a slack of between 0.25 m and 0.5 m.

10.37 The termination of loop feeder cables shall be as stated in TC 131/WSR/010.

The termination of loop feeder cables	
Detector reference	**Location of loop feeder cable termination**
(a)	(b)

a) Enter a unique reference, to identify the detector.

b) Enter text, to identify the location of the termination of loop feeder cable.

10.38 At the cabinet, the loop feeder cable cores shall be terminated in compatible terminals secured to the equipment frame.

10.39 Each loop feeder and loop detector cable shall be individually identified by means of a label.

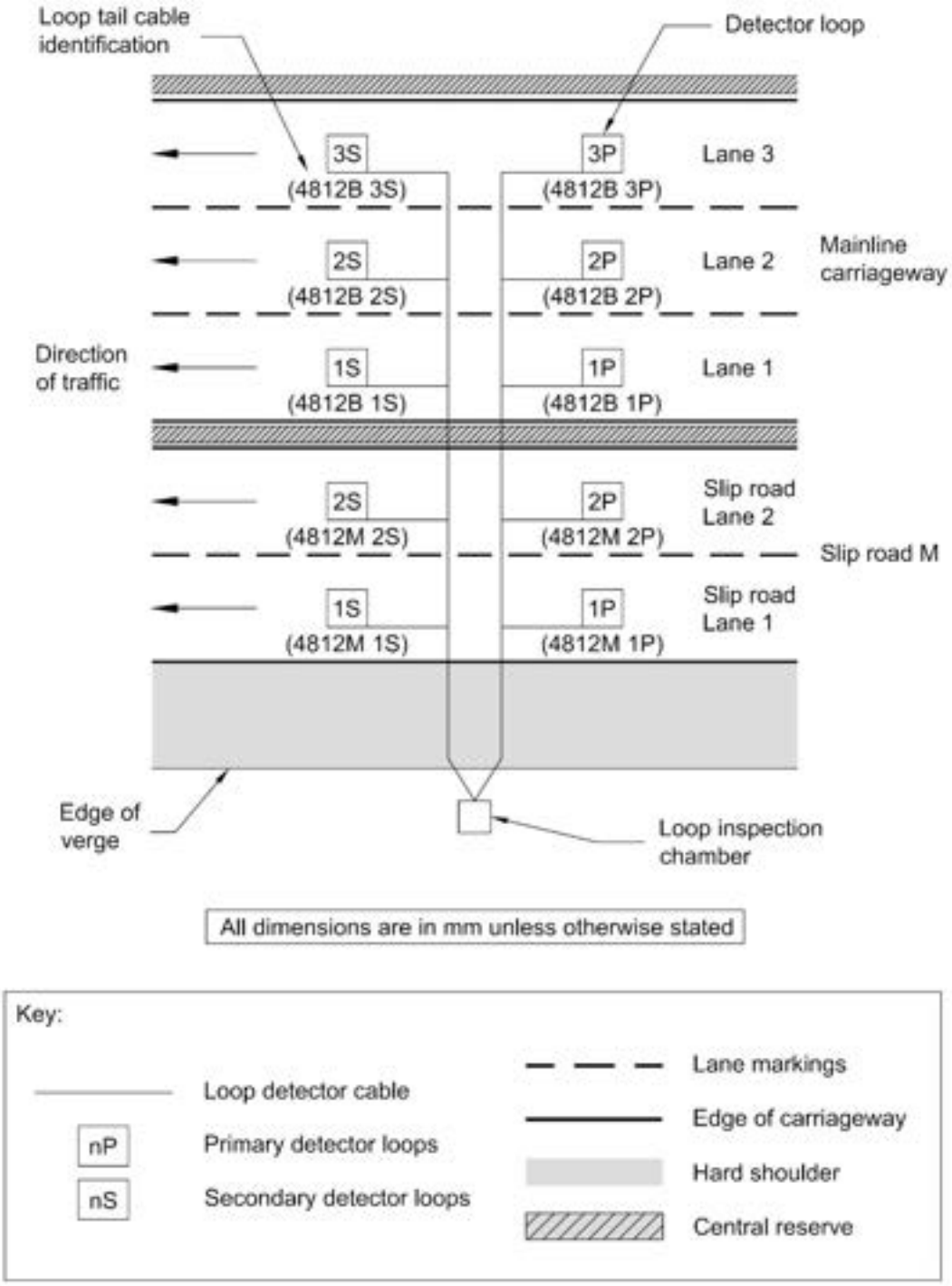
10.40 Loop feeder core allocation within MIDAS loop feeder cable joints shall be:

1. Red/blue for primary loops; and

2. Yellow/black for secondary loops.

10.41 Cable identification on loop detector cables and loop feeder cables shall be indelibly marked in accordance with Figure 10.41.

Figure 10.41 Cable identification for loops.



10.42 Loop detector cables and loop feeder cables shall be labelled with their loop references using pre-printed durable plastic sleeves.

10.43 The installation requirements of below ground detector systems other than loops shall be as stated in TC 131/WSR/010.

SI.10.43 The installation requirements of below ground detector systems other than loops shall be [enter free text].

Installation of above ground detector systems

10.44 Above ground detectors shall be installed in accordance with the manufacturer's instructions.

10.45 The location of the above ground detector shall be agreed with the detector manufacturer.

10.46 The fixing and mounting of SVD detectors shall be as stated in TR 2642 [Ref 55.N].

10.47 The additional requirements for fixing and mounting above ground detectors shall be as stated in TC 131/WSR/010.

SI.10.47a The additional requirements for fixing and mounting requirements of above ground detectors except SVD detectors shall be [enter free text].

SI.10.47b The fixing and mounting requirements of SVD detectors that are not covered in TR 2642 [Ref 55.N] shall be [enter free text].

10.48 The hardstanding maintenance working area requirements for above ground detector installations shall be as stated in TC 131/WSR/010.

SI.10.48 The hardstanding maintenance working area requirements of above ground detector installations shall be [enter free text].

Testing and commissioning of detector systems for roadside technology and communications

10.49 Verification shall be undertaken for the functionality of each detector loop by performing loop tests and completing circuit tests in accordance with MCH 1540 [Ref 65.N], with the results recorded in the installation test certificate.

10.50 The frequency of each detector loop test and complete circuit test shall be once upon completion of the loop installation and once during the testing and commissioning of the system.

10.51 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to each detector loop test and complete circuit test.

10.52 Verification shall be undertaken for the functionality of each MIDAS outstation by completing testing in accordance with PT 1190 [Ref 44.N], with the results recorded in the MIDAS outstation site acceptance record for that site as detailed in PT 1190 [Ref 44.N].

10.53 The frequency of the testing of each MIDAS outstation shall be once upon completion of the installation of the loops and MIDAS outstation.

10.54 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the testing of the MIDAS outstation.

10.55 Verification shall be undertaken for end-to-end system testing of each MIDAS site by undertaking the tests in accordance with PT 1191 [Ref 45.N], with the results recorded in the MIDAS site acceptance record for that MIDAS site as detailed in PT 1191 [Ref 45.N].

10.56 The frequency of the testing of each MIDAS site shall be once upon completion of the functionality testing for that MIDAS site.

10.57 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the end-to-end system testing of the MIDAS site.

10.58 The testing and commissioning requirements of detector systems other than loops shall be as stated in TC 131/WSR/010.

SI.10.58 The testing and commissioning requirements of detector systems other than loops shall be [enter free text].

10.59 Verification shall be undertaken for each detector system other than loops by undertaking the testing and commissioning as specified, with the results recorded in the test certificate for each detector system other than loops.

10.60 The frequency of the testing and commissioning for each detector system other than loops shall be as stated in the testing and commissioning requirements.

10.61 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the testing and commissioning for each detector system other than loops.

Documentation requirements for detector systems for roadside technology and communications

Product compliance documentation for detector systems for roadside technology and communications

10.62 The following Documentation shall be submitted for traffic and environmental sensors prior to the commencement of the installation of the sensor: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

10.63 The following Documentation shall be submitted for SVD systems prior to the commencement of the installation of the SVD system: build standard qualification certificate showing that the product conforms with

the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

10.64 The following Documentation shall be submitted for below ground vehicle detection equipment prior to the commencement of the installation of the below ground vehicle detection equipment: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

10.65 The following Documentation shall be submitted for radar based vehicle detection equipment prior to the commencement of the installation of the radar based vehicle detection equipment: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

Testing and commissioning documentation for detector systems for roadside technology and communications

10.66 The following Documentation shall be submitted for detector loops prior to the commencement of the testing of the MIDAS outstation: installation test certificates.

10.67 The following Documentation shall be submitted for MIDAS outstations prior to the commencement of end-to-end system testing of the MIDAS site: MIDAS outstation site acceptance record.

10.68 The following Documentation shall be submitted for MIDAS sites prior to the commencement of operational regime testing in accordance with GG 182 [Ref 31.N]: MIDAS site acceptance record.

10.69 The Documentation for recording the results of the testing and commissioning of detector systems other than loops shall be test certificates in the format as stated in TC 131/WSR/010.

SI.10.69 The format of the test certificates recording the results of the testing and commissioning of detector systems other than loops shall be [enter free text].

10.70 The following Documentation shall be submitted for each detector prior to the commencement of project closure: detector handover certificate in accordance with GG 182 [Ref 31.N].

10.71 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the detector handover certificate information.

10.72 The following Documentation shall be submitted for each detector prior to the commencement of project closure: detector maintenance handover documentation in accordance with GG 182 [Ref 31.N].

10.73 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the detector maintenance handover documentation.

11. Permanent traffic cameras for roadside technology and communications

11.1 Permanent traffic cameras for roadside technology and communications shall comply with "Telecommunications services" in Section 2 of this document.

11.2 Permanent traffic cameras for roadside technology and communications shall comply with "Electrical installations for roadside technology and communications" in Section 3 of this document.

11.3 Permanent traffic cameras for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

11.4 Permanent traffic cameras for roadside technology and communications shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

Product requirements for permanent traffic cameras for roadside technology and communications

11.5 Permanent traffic cameras, traffic camera outstations, traffic camera cables and connectors for roadside technology and communications shall be compliant with SE 2625 [Ref 70.N] and SE 2536 [Ref 69.N].

Scope of works of permanent traffic cameras for roadside technology and communications

11.6 The installation of permanent traffic cameras, cabinets and ancillary items for permanent traffic cameras for roadside technology and communications shall be as stated in TC 131/WSR/011.

The installation of permanent traffic cameras, cabinets and ancillary items for permanent traffic cameras for roadside technology and communications					
Permanent traffic camera reference	**Model reference ID (Optional)**	**Permanent traffic camera system**	**Chainage**	**Marker post**	**Carriageway**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the permanent traffic camera.

b) Enter text, to identify the 3D model reference of the permanent traffic camera.

c) Enter a value, from options Surveillance, H/S monitor, to identify the permanent traffic camera system that the camera is to be connected to.

d) Enter text, to identify the chainage location of the cabinets and ancillary items for the permanent traffic camera site.

e) Enter text, to identify the marker post location of the cabinets and ancillary items for the permanent traffic camera site.

f) Enter text, to identify the carriageway location of the permanent traffic camera site.

The installation of permanent traffic cameras, cabinets and ancillary items for permanent traffic cameras for roadside technology and communications (continued)					
Permanent traffic camera reference	**Permanent traffic camera variant**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**New/Existing/ Modified**	**Outstation cabinet ID**
(a)	(g)	(h)	(i)	(j)	(k)

g) Enter text, to identify the permanent traffic camera variant.

h) Enter a number in units of m, to identify the X (Easting) co-ordinate of the permanent traffic camera location.

i) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the permanent traffic camera location.

j) Enter a value, from options New, Existing, Modified, to identify whether the permanent traffic camera equipment to be installed is new, existing or modified.

k) Enter text, to identify the permanent traffic camera outstation cabinet.

11.7 The type of structure used for supporting permanent traffic cameras for roadside technology and communications shall be as stated in TC 131/WSR/011.

The type of structure used for supporting permanent traffic cameras for roadside technology and communications	
Permanent traffic camera reference	**Type of structure used for support**
(a)	(b)

a) Enter a unique reference, to identify the permanent traffic camera.

b) Enter text, to identify the type of structure used for supporting the permanent traffic camera.

Installation of permanent traffic cameras for roadside technology and communications

11.8 The fixing and mounting of permanent traffic cameras and infrared units for roadside technology and communications shall use the fixings supplied in accordance with the manufacturer's instructions.

11.9 The requirements for the installation of permanent traffic cameras shall be as stated in TC 131/WSR/011.

SI.11.9 The requirements for the installation of permanent traffic cameras shall be [enter free text].

11.10 The drawings that provide the coverage requirements of permanent traffic cameras for roadside technology and communications shall be as stated in TC 131/WSR/011.

SI.11.10 The drawings that provide the coverage requirements of permanent traffic cameras shall be [enter free text].

11.11 The hardstanding maintenance working area requirements for permanent traffic camera for roadside technology and communications locations shall be as stated in TC 131/WSR/011.

SI.11.11 The hardstanding maintenance working area requirements of permanent traffic camera locations shall be [enter free text].

Testing and commissioning of permanent traffic cameras for roadside technology and communications

11.12 Verification shall be undertaken for the functionality of each permanent traffic camera for roadside technology and communications by undertaking the tests in accordance with PT 1142 [Ref 47.N] for analogue or for digital cameras, with the results recorded in the SAT 1 test record form for that permanent traffic camera as detailed in PT 1142 [Ref 47.N].

11.13 The frequency of the functionality test for each permanent traffic camera for roadside technology and communications shall be once upon completion of the installation of the permanent traffic camera.

11.14 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the functionality test for each permanent traffic camera for roadside technology and communications.

11.15 Verification shall be undertaken for end-to-end system testing for each permanent traffic camera for roadside technology and communications by undertaking the tests in accordance with PT 1192 [Ref 48.N], with the results recorded in the SAT 3 test record form for that permanent traffic camera as detailed in PT 1192 [Ref 48.N].

11.16 The frequency of the end-to-end system testing for each permanent traffic camera for roadside technology and communications shall be once upon completion of the functionality test for that permanent traffic camera.

11.17 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the end-to-end system testing for each permanent traffic camera for roadside technology and communications.

11.18 Verification shall be undertaken for the coverage of each permanent traffic camera for roadside technology and communicationsby comparing the actual coverage of the permanent traffic camera with the design coverage drawing, with the results recorded on a marked-up version of the coverage drawing, including a signature and the date of test.

11.19 The frequency of the comparison of the actual coverage of each permanent traffic camera for roadside technology and communicationswith the design coverage drawing shall be once upon completion of the functionality test for that permanent traffic camera.

11.20 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the comparison of the actual coverage of each permanent traffic camera for roadside technology and communicationswith the design coverage drawing.

Documentation requirements of permanent traffic cameras for roadside technology and communications

Product compliance documentation of permanent traffic cameras for roadside technology and communications

11.21 The following Documentation shall be submitted for permanent traffic camera for roadside technology and communications equipment prior to the commencement of the installation of the permanent traffic camera equipment: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

11.22 The following Documentation shall be submitted for permanent traffic camera for roadside technology and communications cable and the connector prior to the commencement of the installation of the permanent traffic camera cable and the connector: build standard qualification

certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

Testing and commissioning documentation of permanent traffic cameras for roadside technology and communications

11.23 The following Documentation shall be submitted for the functionality of each permanent traffic camera for roadside technology and communications prior to the commencement of the end-to-end system testing: SAT 1 test record form.

11.24 The following Documentation shall be submitted for the end-to-end system testing for each permanent traffic camera for roadside technology and communications prior to the commencement of operational regime testing in accordance with GG 182 [Ref 31.N]: SAT 3 test record form.

11.25 The following Documentation shall be submitted for the coverage of each permanent traffic camera for roadside technology and communications prior to the commencement of project closure: marked-up version of the coverage drawing.

11.26 The following Documentation shall be submitted for each permanent traffic camera for roadside technology and communications prior to the commencement of project closure: permanent traffic camera handover certificate in accordance with GG 182 [Ref 31.N].

11.27 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the permanent traffic camera for roadside technology and communications handover certificate.

11.28 The following Documentation shall be submitted for each permanent traffic camera for roadside technology and communications prior to the commencement of project closure: permanent traffic camera maintenance handover documentation in accordance with permanent traffic camera maintenance handover documentation in accordance with GG 182 [Ref 31.N].

11.29 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the permanent traffic camera for roadside technology and communications maintenance handover documentation.

12. Permanent traffic enforcement systems for roadside technology and communications

12.1 Permanent traffic enforcement systems for roadside technology and communications shall comply with "Telecommunications services" in Section 2 of this document.

12.2 Permanent traffic enforcement systems for roadside technology and communications shall comply with "Electrical installations for roadside technology and communications" in Section 3 of this document.

12.3 Permanent traffic enforcement systems for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

12.4 Permanent traffic enforcement systems for roadside technology and communications shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

Scope of works for permanent traffic enforcement systems for roadside technology and communications

Scope of works for Highways Agency Digital Enforcement Camera System (HADECS) enforcement systems for roadside technology and communications

12.5 The mountings, cable tray and other ancillary items for HADECS enforcement system equipment for roadside technology and communications shall be as stated in TC 131/WSR/012.

The mountings, cable tray and other ancillary items for HADECS enforcement system equipment for roadside technology and communications						
Gantry reference	**Chainage**	**Marker post**	**Carriageway**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**Mounting requirements**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the gantry for the HADECS enforcement system equipment.

b) Enter text, to identify the chainage location of the gantry for the HADECS enforcement system equipment.

c) Enter text, to identify the marker post location of the gantry for the HADECS enforcement system equipment.

d) Enter text, to identify the carriageway location of the gantry for the HADECS enforcement system equipment.

e) Enter a number in units of m, to identify the X (Easting)Y (Northing) co-ordinate of the gantry for the HADECS enforcement system equipment.

f) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the gantry for the HADECS enforcement system equipment.

g) Enter text, to identify mounting requirements for HADECS enforcement system equipment.

The mountings, cable tray and other ancillary items for HADECS enforcement system equipment for roadside technology and communications (continued)						
Gantry reference	**Cable tray requirements**	**Ancillary items**	**Enforcement system cabinet reference**	**External aspect verification (EAV) camera reference**	**Model reference ID (optional)**	**EAV chainage**
(a)	(h)	(i)	(j)	(k)	(l)	(m)

h) Enter text, to identify the cable tray requirements for the HADECS enforcement system equipment.

i) Enter text, to identify ancillary items required for the HADECS enforcement system equipment.

j) Enter a unique reference, to identify the HADECS enforcement system cabinet for roadside technology equipment.

k) Enter a unique reference, to identify the EAV camera.

l) Enter text, to identify the 3D model reference of the EAV camera.

m) Enter text, to identify the chainage location of the EAV camera.

The mountings, cable tray and other ancillary items for HADECS enforcement system equipment for roadside technology and communications (continued)						
Gantry reference	**EAV marker post**	**EAV carriageway**	**EAV X (Easting) co-ordinate**	**EAV Y (Northing) co-ordinate**	**New/Existing/ Modified**	**Site layout drawing**
(a)	(n)	(o)	(p)	(q)	(r)	(s)

n) Enter text, to identify the marker post location of the EAV camera.

o) Enter text, to identify the carriageway location for the EAV camera.

p) Enter a number in units of m, to identify the X (Easting) co-ordinate of the EAV camera.

q) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the EAV camera.

r) Enter a value, from options New, Existing, Modified, to identify whether the HADECS enforcement system to be installed is new, existing or modified.

s) Enter text, to identify the scheme site layout drawing for the HADECS location.

Scope of works for non-HADECS enforcement systems for roadside technology and communications

12.6 The installation of cabinets and ancillary items for non-HADECS enforcement systems for roadside technology and communications shall be as stated in TC 131/WSR/012.

The installation of cabinets and ancillary items for non-HADECS enforcement systems for roadside technology and communications					
Enforcement system reference	**Enforcement system type**	**Enforcement system site**	**Chainage**	**Marker post**	**Carriageway**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the non-HADECS enforcement system.

b) Enter text, to identify the type of non-HADECS enforcement system to be installed, for example Gatso.

c) Enter text, to identify the non-HADECS enforcement system site.

d) Enter text, to identify the chainage location of the non-HADECS enforcement system site.

e) Enter text, to identify the marker post location of the non-HADECS enforcement system site.

f) Enter text, to identify the carriageway location of the non-HADECS enforcement system site.

The installation of cabinets and ancillary items for non-HADECS enforcement systems for roadside technology and communications (continued)					
Enforcement system reference	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**New/Existing/ Modified**	**Outstation cabinet ID**	**Mounted arrangement**
(a)	(g)	(h)	(i)	(j)	(k)

g) Enter a number in units of m, to identify the X (Easting) co-ordinate of the non-HADECS enforcement system site.

h) Enter a number in units of m, to identify Y (Northing) co-ordinate of the non-HADECS enforcement system site.

i) Enter a value, from options New, Existing, Modified, to identify whether the non-HADECS enforcement system to be installed is new, existing or modified.

j) Enter text, to identify the non-HADECS enforcement system outstation cabinet.

k) Enter text, to identify the mounting arrangement to be installed for the non-HADECS enforcement system camera.

Installation of permanent traffic enforcement systems for roadside technology and communications

Installation of HADECS enforcement systems for roadside technology and communications

12.7 The HADECS enforcement systems for roadside technology and communications infrastructure shall be compliant with TRH 2487 [Ref 27.N].

12.8 The positioning of the HADECS enforcement systems for roadside technology and communications mounting shelf shall be compliant with MCX 0187 [Ref 26.N].

12.9 The installation of the External aspect verification (EAV) pole and foundation shall be compliant with MCX 0204 [Ref 25.N].

12.10 The hardstanding maintenance working area requirements for the EAV locations shall be as stated in TC 131/WSR/012.

SI.12.10 The hardstanding maintenance working area requirements of the EAV locations shall be [enter free text].

Installation of non-HADECS enforcement systems for roadside technology and communications

12.11 The hardstanding maintenance working area requirements for the non-HADECS enforcement system for roadside technology and communicationslocations shall be as stated in TC 131/WSR/012.

SI.12.11 The hardstanding maintenance working area requirements of the non-HADECS enforcement system for roadside technology and communications locations shall be [enter free text].

Testing and commissioning of permanent traffic enforcement systems for roadside technology and communications

12.12 Verification shall be undertaken for the positioning of the HADECS enforcement systems for roadside technology and communications mounting shelf by measuring the location of each shelf relative to the carriageway and line markings to ensure compliance with MCX 0187 [Ref 26.N], with the results recorded in the inspection and test plan.

12.13 The frequency of the measurement of the location of each HADECS enforcement systems for roadside technology and communications mounting shelf relative to the carriageway and line markings shall be once upon completion of the installation of the shelf and lane markings for that section of carriageway.

12.14 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the measurement of the location of each HADECS enforcement systems for roadside technology and communications mounting shelf.

12.15 The testing and commissioning requirements for non-HADECS enforcement systems for roadside technology and communications shall be as stated in TC 131/WSR/012.

SI.12.15 The testing and commissioning requirements of non-HADECS enforcement systems for roadside technology and communications shall be [enter free text].

12.16 Verification shall be undertaken for each non-HADECS enforcement system for roadside technology and communications by undertaking the testing and commissioning as specified, with the results recorded in the test certificate for each non-HADECS enforcement system.

12.17 The frequency of the testing and commissioning for each non-HADECS enforcement system for roadside technology and communications shall be as stated in the testing and commissioning requirements.

12.18 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the testing and commissioning for each non-HADECS enforcement system for roadside technology and communications.

Documentation for permanent traffic enforcement systems for roadside technology and communications

12.19 The Documentation for recording the results of the testing and commissioning of non-HADECS enforcement systems for roadside technology and communications shall be test certificates in the format as stated in TC 131/WSR/012.

SI.12.19 The format of the test certificates recording the results of the testing and commissioning of non-HADECS enforcement systems for roadside technology and communications shall be [enter free text].

12.20 The following Documentation shall be submitted for each permanent traffic enforcement system for roadside technology and communications location prior to the commencement of project closure: permanent traffic enforcement system handover certificate information in accordance with GG 182 [Ref 31.N].

12.21 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the permanent traffic enforcement system for roadside technology and communications handover certificate information.

12.22 The following Documentation shall be submitted for each permanent traffic enforcement system for roadside technology and communications location prior to the commencement of project closure: permanent traffic enforcement system maintenance handover documentation in accordance with GG 182 [Ref 31.N].

12.23 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the permanent traffic enforcement system for

roadside technology and communications maintenance handover documentation.

13. Emergency roadside telephones (ERTs) for roadside technology and communications

Product requirements for ERTs for roadside technology and communications

13.1 ERTs for roadside technology and communications shall be compliant with MCE 2663 [Ref 78.N].

13.2 The plinth for ERTs for roadside technology and communications shall be compliant with MCX 1049 [Ref 88.N].

Scope of works for ERT installations for roadside technology and communications

13.3 ERTs for roadside technology and communications shall be installed as detailed in TC 131/WSR/013.

ERTs for roadside technology and communications					
ERT reference	**Model reference ID**	**Chainage**	**Marker post**	**Carriage way**	**Geographic address**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the ERT.

b) Enter text, to identify the 3D model reference of the ERT.

c) Enter text, to identify the chainage location of the ERT.

d) Enter text, to identify the marker post location of the ERT.

e) Enter text, to identify carriageway location of the ERT.

f) Enter text, to identify the geographic address for the ERT to be used on the label.

ERTs for roadside technology and communications (continued)							
ERT reference	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**	**New/Existing/ Modified**	**ERT variant**	**Scheme drawing reference**	**Plinth type**	**Mounting arrangement**
(a)	(g)	(h)	(i)	(j)	(k)	(l)	(m)

g) Enter a number in units of m, to identify the X (Easting) co-ordinate of the ERT.

h) Enter a number in units of m, to identify Y (Northing) co-ordinate of the ERT.

i) Enter a value, from options New, Existing, Modified, to identify whether the ERT to be installed is new, existing or modified.

j) Enter text, to identify the variant of ERT to be installed.

k) Enter text, to identify the site layout drawing to be used to install the ERT showing the mounting arrangement, orientation of the phone, height of the instrument (if applicable) and location of infrastructure such as handrails.

l) Enter a value, from options Pre-formed cube, Pre-formed base, Formed on site, to identify the type of plinth for the ERT.

m) Enter a value, from options Socket, Mounting plate, Not applicable, to identify the mounting arrangement for the ERT.

ERTs for roadside technology and communications (continued)		
ERT reference	**ERT instrument module orientation**	**Handrail required?**
(a)	(n)	(o)

n) Enter text, to identify the orientation of the ERT instrument module relative to the carriageway.

o) Enter a value, from options Yes, No, to indicate if a handrail is required at the ERT.

Installation of ERTs for roadside technology and communications

13.4 ERT for roadside technology and communications installations shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

13.5 Geographic address labels for ERTs for roadside technology and communications shall be fitted in accordance with MCX 1049 [Ref 88.N].

13.6 The entire ERT for roadside technology and communications module shall be aligned within ±1° of vertical.

13.7 The header module of the ERT for roadside technology and communications installation shall be orientated such that external labels face upstream and downstream, with respect to traffic flow, of the ERT.

13.8 The security key access shall be located downstream of the column.

13.9 The Service Delivery Point (SDP) for the TSP shall be located in the column module where installed, or at the base of the instrumentation module when the column module is not installed.

13.10 ERTs for roadside technology and communications installed on existing highways shall be covered with ‘Not in Use’ covers until they have been commissioned and are available for use.

13.11 ERTs for roadside technology and communications installed on existing highways that use local renewable energy shall be covered with ‘Not in Use’ covers that do not prevent the charging of the ERT battery until they have been commissioned and available for use,.

13.12 ERT 'Not in Use' covers shall be in accordance with MCX 1049 [Ref 88.N].

Installation requirements for ducting to ERTs for roadside technology and communications

13.13 Ducting for ERTs for roadside technology and communications shall comply with "Ducts for roadside technology and communications" in Section 15 of this document.

13.14 Ducting for ERTs for roadside technology and communications shall extend a minimum of 200 mm beyond the edge of the plinths at sites.

13.15 Joints into ducted networks for ERTs for roadside technology and communications shall be sealed with a removable duct sealing system rated to IPX7 in accordance with BS EN 60529 [Ref 10.N].

Installation requirements for ERT plinths formed on site for roadside technology and communications

13.16 ERT for roadside technology and communications plinths formed on site shall be in accordance with MCX 1049 [Ref 88.N] sheet 4.

13.17 The placing of concrete in plinths for ERTs for roadside technology and communications formed at site shall comply with 'Placing of fresh concrete for structural concrete' in "Concreting of structural concrete" in Section 6 of CC 482 [Ref 82.N].

13.18 The compaction of concrete in plinths for ERTs for roadside technology and communications formed at site shall comply with

'Compaction of fresh concrete for structural concrete (excluding self-compacting concrete)' "Concreting of structural concrete" in Section 6 of CC 482 [Ref 82.N].

Installation requirements for surface mounting plates for ERTs for roadside technology and communications

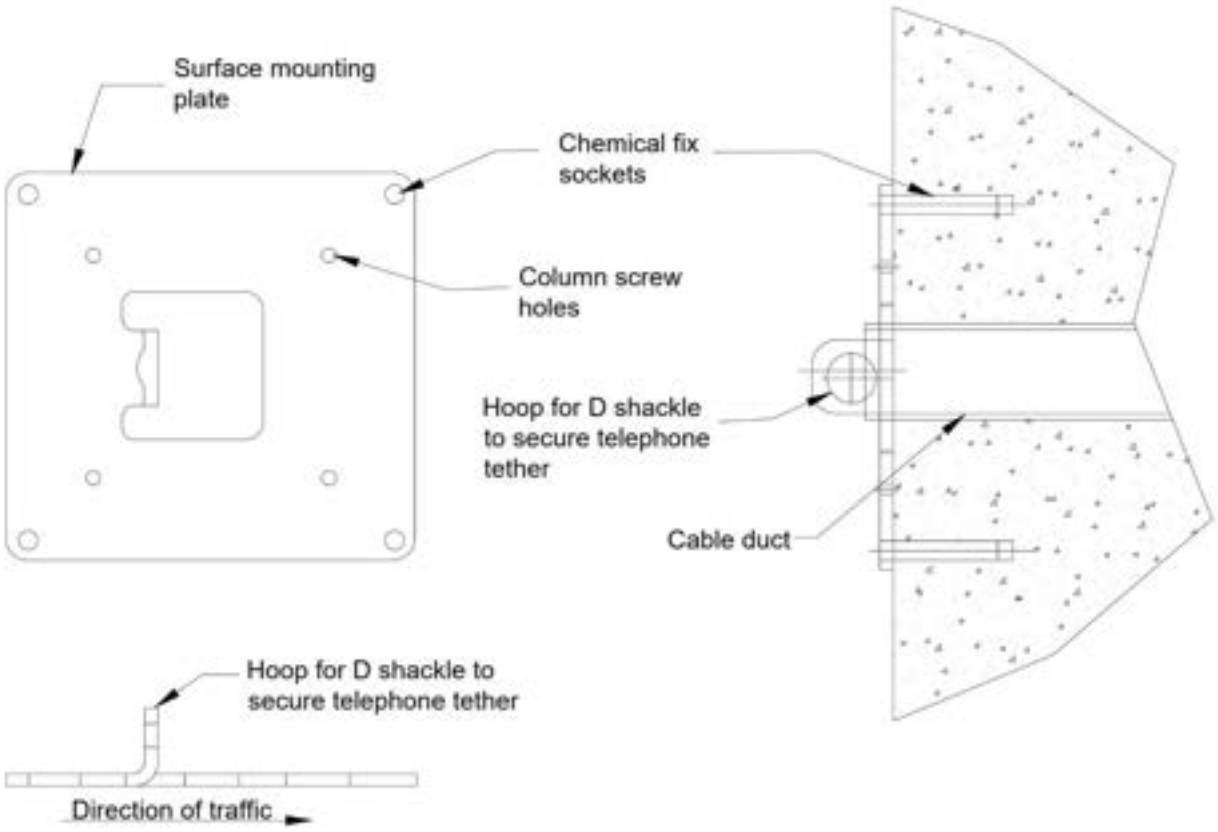
13.19 The chemical fix galvanised sockets for the surface mounting plate for ERTs for roadside technology and communications shall be fitted to the mounting surface to protrude by 0 to 3 mm in accordance with MCX 1049 [Ref 88.N] sheet 10.

13.20 The chemical fix galvanised sockets for the surface mounting plate for ERTs for roadside technology and communications shall be in accordance with MCX 1049 [Ref 88.N] sheet 2.

13.21 The drilling for the surface mounting plate for ERTs for roadside technology and communications shall not impact the rebar within the existing infrastructure.

13.22 The ERT for roadside technology and communications tether shall be secured onto the telephone tether hoop in the surface mounting plate with a D shackle in accordance with Figure 13.22.

Figure 13.22 Surface mounting plate.



13.23 Unattended chemical-fix galvanised threads in the sockets and surface plate for ERTs for roadside technology and communications shall have plastic caps fitted to protect from the environment.

Installation of cables to surface-mounted ERTs for roadside technology and communications

13.24 The cabling to the surface-mounted ERT for roadside technology and communications shall be protected over hard surfaces by a solid or flexible metal conduit with a minimum internal diameter of 25 mm.

13.25 The solid or flexible metal conduit for surface-mounted ERT for roadside technology and communications cabling over hard surfaces shall run to within 100 mm of the base of the ERT.

13.26 The solid or flexible metal conduit for surface-mounted ERT for roadside technology and communications cables shall be fixed to the hard surface at minimum of 30 mm intervals.

13.27 A minimum 50 mm duct shall be provided from the nearest chamber to the point at where the surface-mounted ERT for roadside technology and communications cable is to exit the ground to contain the solid or flexible metal conduit for surface-mounted ERT cables.

13.28 The solid or flexible metal conduit for surface-mounted ERT for roadside technology and communications cables shall be continuous from the ERT through the 50 mm duct into the nearest chamber.

13.29 The surface-mounted ERT for roadside technology and communications cables shall be sealed into the base of the ERT with a compression cable gland to IP 67 in accordance with BS EN 60529 [Ref 10.N].

13.30 The 50 mm duct shall be sealed to IP 65 in accordance with BS EN 60529 [Ref 10.N] where it exits the ground.

Installation of ERTs mounted on walls, parapets and in recesses for roadside technology and communications

13.31 Parapet-mount posts and wall-mount posts for ERTs for roadside technology and communications shall be fixed to the wall using galvanised or stainless steel fasteners into chemical-fix anchors in accordance with the manufacturer's instructions.

13.32 Mounting plates for ERTs for roadside technology and communications mounted on walls, parapets and in recesses shall be sealed to prevent the ingress of water into the surface conduit or channel that connects to the duct, to IP 47 in accordance with BS EN 60529 [Ref 10.N].

13.33 The physical interface to route the cabling from the local duct into the ERT for roadside technology and communications instrument module shall be as stated in TC 131/WSR/013.

SI.13.33 The details of the physical interface to route the cabling from the local duct into the ERT for roadside technology and communications instrument module shall be [enter free text].

Installation of ERTs in tunnels for roadside technology and communications for roadside technology and communications

13.34 No work shall be carried out on assets owned by the tunnel authority without permission from the Tunnel Authority.

13.35 The tunnel mounting bracket assembly for ERTs for roadside technology and communications shall be positioned centrally to the door of the termination enclosure cabinet.

13.36 The height of the lowest edge of the tunnel mounting bracket assembly from ground level for ERTs for roadside technology and communications shall be as stated in TC 131/WSR/013.

SI.13.36 The height of the lowest edge of the tunnel mounting bracket assembly from ground level for ERTs for roadside technology and communications shall be [enter a number] .

13.37 The beacon assembly and mounting bracket for ERTs for roadside technology and communications shall be securely fixed to the termination enclosure cabinet to IP 66 in accordance with BS EN 60529 [Ref 10.N].

13.38 Services running behind the termination enclosure cabinet shall not be impacted either physically or electrically by the mounting of the beacon assembly and mounting bracket of the ERT for roadside technology and communications.

13.39 The ERT for roadside technology and communications geographic address shall be fixed to the user instruction label on the inside of the door housing the ERT instrument module in accordance with MCX 1049 [Ref 88.N] sheet 54.

13.40 A door open signal magnet shall be fixed to the termination enclosure cabinet door housing the ERT for roadside technology and communications instrument module.

Installation of hardstanding maintenance working areas for ERTs for roadside technology and communications

13.41 Hardstanding maintenance working areas for ERTs for roadside technology and communications shall comply with the requirements in

'Hardstanding maintenance working areas for roadside technology equipment sites' of "General requirements for roadside technology and communications" in Section 1 of this document.

13.42 The dimensions of hardstanding maintenance working areas for ERTs for roadside technology and communications, suitable to allow wheelchair user access to the telephone, shall be as stated in TC 131/WSR/013.

SI.13.42 The dimensions of hardstanding maintenance working areas for ERTs, suitable to allow wheelchair user access to the telephone shall be [enter free text].

13.43 The dimensions of hardstanding maintenance working areas to be installed behind the ERT for roadside technology and communications for maintenance purposes shall be as stated in TC 131/WSR/013.

SI.13.43 The dimensions of hardstanding maintenance working areas to be installed behind the ERT for maintenance purposes shall be [enter free text].

13.44 The drawings detailing the kerb re-profiling of ERT for roadside technology and communications sites to allow access for wheelchair users shall be as stated in TC 131/WSR/013.

SI.13.44 The drawings detailing the kerb re-profiling of ERT sites to allow access for wheelchair users shall be [enter free text].

13.45 The details of the access ramp to the ERT for roadside technology and communications shall be as stated in TC 131/WSR/013.

SI.13.45 The details of the access ramp to the ERT shall be [enter free text].

13.46 Local contouring shall be profiled downwards to a level of 12 mm below the edges of the concrete plinth for an ERT for roadside technology and communications.

Installation of cabling to ERTs for roadside technology and communications

13.47 Cabling for ERTs for roadside technology and communications shall comply with "Cables for roadside technology and communications" in Section 7 of this document.

13.48 A 5 m cable re-termination loop shall be provided in a chamber within 50 m of the ERT for roadside technology and communications to allow a new connection to be made by a single person if the existing ERT for roadside technology and communications has to be replaced.

13.49 The installation of the TSP SDP within the ERT for roadside technology and communications column or instrument module shall be as stated in TC 131/WSR/013.

SI.13.49 The installation of the TSP SDP within the ERT column or instrument module shall be [enter free text].

Testing and commissioning of ERTs for roadside technology and communications

13.50 The testing and commissioning of ERTs for roadside technology and communications shall be in accordance with MCH 1983 [Ref 17.N].

13.51 Verification shall be undertaken for the functionality of each ERT for roadside technology and communications by undertaking the testing and commissioning in accordance with MCH 1983 [Ref 17.N], with the results recorded in the ERT testing and commissioning certificate.

13.52 The frequency of the functionality test for each ERT for roadside technology and communications shall be once upon completion of the installation.

13.53 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the functionality test for each ERT for roadside technology and communications.

Documentation requirements for ERTs for roadside technology and communications

Product compliance documentation for ERTs for roadside technology and communications

13.54 The following Documentation shall be submitted for ERTs for roadside technology and communications prior to the commencement of the installation of the ERT: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

13.55 The following Documentation shall be submitted for the plinth prior to the commencement of the installation of the plinth: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

Testing and commissioning documentation for ERTs for roadside technology and communications

13.56 The following Documentation shall be submitted for each ERT for roadside technology and communications prior to the commencement of

operational regime testing in accordance with GG 182 [Ref 31.N]: ERT testing and commissioning certificates.

13.57 Documentation ERT for roadside technology and communications testing and commissioning certificatefor roadside technology and communicationstesting and commissioning certificate shall be submitted within 10 working days of completion of commissioning.

13.58 The following Documentation shall be submitted for each ERT for roadside technology and communications prior to the commencement of project closure: ERT handover certificate in accordance with GG 182 [Ref 31.N].

13.59 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the ERT for roadside technology and communications handover certificate.

13.60 The following Documentation shall be submitted for each ERT for roadside technology and communications prior to the commencement of project closure: ERT maintenance handover documentation in accordance with GG 182 [Ref 31.N].

13.61 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the ERT for roadside technology and communications maintenance handover documentation.

14. Chambers for roadside technology and communications

14.1 Mortar beds for chamber frames for roadside technology and communications shall comply with the requirements for "Masonry mortar" in Section 5 of CC 491 [Ref 32.N].

14.2 Concrete for chambers for roadside technology and communications shall be in accordance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 33.N].

14.3 Concrete chambers walls and base slab that are cast in situ for roadside technology and communications shall be in accordance with GEN3 concrete as defined in CC 495 [Ref 33.N], unless otherwise stated in TC 131/WSR/014.

SI.14.3 The additional requirements of concrete communications chambers walls and base slab that are cast in situ shall be [enter free text].

14.4 Chambers labels for roadside technology and communications shall comply with "Labels for roadside technology and communications" in Section 16 of this document.

Product requirements for chambers for roadside technology and communications

14.5 The bricks for the chambers for roadside technology and communications shall be compliant with BS EN 771-1 [Ref 60.N].

14.6 The bricks shall meet the following performance characteristics: Class B, compressive strength >75 N/mm^2, water absorption < 7%.

14.7 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 21.N] shall apply to bricks for the chambers for roadside technology and communications.

14.8 Chamber covers, gratings and frames for roadside technology and communications shall be compliant with BS EN 124-1 [Ref 24.N].

14.9 The chamber covers, gratings and frames for roadside technology and communications shall meet the following performance characteristics: Class B125, C250 or D400.

14.10 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 21.N] shall apply to chamber covers, gratings and frames for roadside technology and communications.

14.11 Modular access chambers for roadside technology and communications shall be in accordance with TR 2640 [Ref 86.N].

14.12 Steps required for entry and exit from a chamber for roadside technology and communications shall be compliant with BS EN 13101 [Ref 80.N].

14.13 The steps required for entry and exit from a chamber for roadside technology and communications shall meet the following performance characteristics: Type A, B, C or D; Single; Class I or II.

14.14 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 21.N] shall apply to the steps required for entry and exit from a chamber for roadside technology and communications.

14.15 The product requirements for plastic chambers and pre-cast concrete chambers for roadside technology and communications shall be as stated in TC 131/WSR/014.

SI.14.15a The product requirements for plastic chambers for roadside technology and communications are: [enter free text].

SI.14.15b The product requirements for pre-cast concrete chambers for roadside technology and communications are: [enter free text].

Scope of works for chamber installations for roadside technology and communications

14.16 Chambers for roadside technology and communications shall be as detailed in TC 131/WSR/014.

Chambers for roadside technology and communications						
Chamber reference	**Model reference**	**Chainage**	**Marker post**	**Carriage way**	**X (Easting) co-ordinate**	**Y (Northing) co-ordinate**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter text, to identify 3D model reference of the chamber installation.

c) Enter text, to identify the chainage location of the chamber installation.

d) Enter text, to identify the marker post location of the chamber installation.

e) Enter text, to identify carriageway location of the chamber installation.

f) Enter a number in units of m, to identify the X (Easting) co-ordinate of the chamberX (Easting)co-ordinate of the chamber.

g) Enter a number in units of m, to identify the Y (Northing) co-ordinate of the chamberY (Northing)co-ordinate of the chamber.

Chambers for roadside technology and communications (continued)				
Chamber reference	**New/Existing/ Modified**	**Chamber type**	**Chamber cover type**	**Chamber depth**
(a)	(h)	(i)	(j)	(k)

h) Enter a value, from options New, Existing, Modified, to identify whether the chamber to be installed is new, existing or modified.

i) Enter a value, from options A, B, E, to identify the chamber type to be installed.

j) Enter a value, from options B125, C250, D400, to identify the type of chamber cover to be installed.

k) Enter a number in units of mm, to identify the depth of the chamber from the underside of the cover to the internal base of the chamber, excluding the sump.

14.17 The installation of chambers for roadside technology and communications at the ends of Ducts Through Structure (DTS)/ Cross Carriageway Duct (CCD), or at the Interface (I/F) chamber of a new section of duct shall be as stated in TC 131/WSR/014.

The installation of chambers for roadside technology and communications at the ends of Ducts Through Structure (DTS)/ Cross Carriageway Duct (CCD), or at the Interface (I/F) chamber of a new section of duct	
Chamber reference	**Ducts through structure (DTS)/Cross carriageway duct (CCD)/Interface (I/F) chamber**
(a)	(b)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter a value, from options DTS, CCD, I/F, N/A, to identify the type of chamber.

Installation of chambers for roadside technology and communications

14.18 The tolerance of dimensions specified for chambers for roadside technology and communications and sumps shall be as stated in TC 131/WSR/014.

SI.14.18 The tolerance of dimensions specified for chambers for roadside technology and communications and sumps shall be [enter free text].

14.19 The longitudinal position of the chamber for roadside technology and communications shall be in the form of an address comprising the marker post reference, offset in metres to the marker post, carriageway identification and communications chamber reference.

14.20 Ducts into chambers for roadside technology and communications shall be square with the chamber wall, with no burrs or sharp edges to avoid damage to cables when installed into the duct.

14.21 Ducts into chambers for roadside technology and communications shall extend from 50 mm minimum to 60 mm maximum into the chamber to allow the installation of mechanical duct plugs and to protect the seal of the ducts to the chamber wall in the case of duct shrinkage.

14.22 The openings into chambers for roadside technology and communications shall not cause the chamber wall to deform.

14.23 The openings into chambers for roadside technology and communications shall not impede access to ducting and chamber fixing arrangements inside the chamber.

14.24 The structural strength for the chamber for roadside technology and communications to be self-supporting, waterproofing method and the loading requirements for the hardstanding maintenance working areas shall be as stated in TC 131/WSR/014.

The structural strength for the chamber for roadside technology and communications to be self-supporting, waterproofing method and the loading requirements for the hardstanding maintenance working areas

Chamber reference	Chamber and hardstanding maintenance working area loading requirements	Waterproofing method
(a)	(b)	(c)

1. Enter a unique reference, to identify the chamber to be installed.

2. Enter a value, from options 125 kN, 250 kN, 400 kN, to identify structural strength requirements of the communications chamber and hardstanding maintenance working area.

3. Enter text, to identify the waterproofing requirements of the communications chamber.

14.25 The foundation and backfill for chambers for roadside technology and communications shall be as stated in TC 131/WSR/014.

The foundation and backfill for chambers for roadside technology and communications		
Chamber reference	**Foundation type**	**Backfill type**
(a)	(b)	(c)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter text, to identify the foundation for the communications chamber.

c) Enter text, to identify the backfill type for the communications chamber.

14.26 Reinforced concrete cover slabs shall be installed at the top of the chamber for roadside technology and communications on all sides to provide support for the chamber covers to be installed.

14.27 The construction of the raised height of the chambers for roadside technology and communications, upstand and the fall from the chamber to ground level shall be as stated in TC 131/WSR/014.

SI.14.27a The construction of the raised height of the chambers shall be [enter a number] .

SI.14.27b The height of the upstand shall be [enter a number] .

SI.14.27c The construction of the fall from the chamber to ground level shall be [enter a number] .

14.28 In situ concrete cover slabs shall be of strength class Type 32/40 complying with "Pavement quality concrete" in Section 7 of CC 203 [Ref 56.N].

14.29 The requirements for the installation of hardstanding maintenance working areas around chambers for roadside technology and communications shall be as stated in TC 131/WSR/014.

SI.14.29 The requirements for the installation of hardstanding maintenance working areas around chambers for roadside technology and communications shall be [enter free text].

14.30 The strength of the cover slab of a chamber for roadside technology and communications shall be defined by the loading requirements of the chamber.

14.31 Frames for chamber covers for roadside technology and communications shall be set in a 10-20 mm thick compound in accordance with the following requirement, or set in a proprietary quick-setting mortar of equivalent strength with a declaration of performance for its intended use: "Masonry mortar" in Section 5 of CC 491 [Ref 32.N].

14.32 The external buried surfaces of the chamber for roadside technology and communications shall be waterproof to IPX7 in accordance with BS EN 60529 [Ref 10.N].

14.33 The provision of gas removal from chambers for roadside technology and communications shall be as stated in TC 131/WSR/014.

SI.14.33 The provision of gas removal from chambers for roadside technology and communications shall be [enter free text].

14.34 Gas hazard warning labels mandating the use of gas detectors shall be provided at chambers for roadside technology and communications that have provision for gas removal.

14.35 Gas hazard warning labels advising of a potential asphyxiating atmosphere shall be provided at chambers for roadside technology and communications that have provision for gas removal.

14.36 A gas vent pipe hazard warning label shall be installed next to gas vent pipes installed in chambers for roadside technology and communications to prevent the installation of cables into the vent pipe.

14.37 Longitudinal ducts to be continuous through a chamber for roadside technology and communications shall be specified in TC 131/WSR/014.

Longitudinal ducts to be continuous through a chamber for roadside technology and communications	
Chamber reference	**Route ducts continuously through chamber?**
(a)	(b)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter a value, from options Yes, No, to identify the communications chamber with continuous longitudinal ducts.

Installation of chamber covers for roadside technology and communications

14.38 Chambers for roadside technology and communications shall be identified by the legend “HIGHWAY COMMUNICATIONS” on the external surface of each cover complying with the requirements of BS EN 124-1 [Ref 24.N].

14.39 Where chamber covers for roadside technology and communications have a concrete infill, a non-corrodible plate identified by the legend “HIGHWAY COMMUNICATIONS” shall be cast into the concrete flush with the concrete surface.

14.40 The requirement for lockable chamber covers or other measures to deter unauthorised access to chambers for roadside technology and communications shall be as stated in TC 131/WSR/014.

The requirement for lockable chamber covers or other measures to deter unauthorised access to chambers for roadside technology and communications	
Chamber reference	**Security measure**
(a)	(b)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter text, to describe any security measures to be put in place to deter unauthorised access to the communications chamber.

14.41 The requirements of the TSP for lockable chamber covers for roadside technology and communications shall be as stated in TC 131/WSR/014.

SI.14.41 The requirements of the TSP for lockable chamber covers for roadside technology and communications shall be [enter free text].

14.42 The number of sets of keys to be provided on completion of the works for each type of locking system installed on the chambers for roadside technology and communications within the scheme, with the number to include keys required by both the Overseeing Organisation and the TSP, shall be as stated in TC 131/WSR/014.

SI.14.42 The number of sets of keys to be provided on completion of the works for each type of locking system installed on the chambers for roadside technology and communications within the scheme, with the number to include keys required by both the Overseeing Organisation and the TSP, shall be [enter a number].

14.43 The number of sets of chamber lifting keys to be provided on completion of the works for each type of chamber cover for roadside technology and communications installed within the scheme, with the number to include lifting keys required by both the Overseeing Organisation and the TSP, shall be as stated in TC 131/WSR/014.

SI.14.43 The number of sets of chamber lifting keys to be provided on completion of the works for each type of chamber cover for roadside technology and communications installed within the scheme, with the number to include lifting keys required by both the Overseeing Organisation and the TSP, shall be [enter a number].

14.44 The number of chamber cover lifters for roadside technology and communications to be provided on completion of the works, with the number to include cover lifters required by both the Overseeing Organisation and the TSP, shall be as stated in TC 131/WSR/014.

SI.14.44 The number of chamber cover lifters for roadside technology and communications to be provided on completion of the works, with the number to include cover lifters required by both the Overseeing Organisation and the TSP, shall be [enter a number].

Installation requirements for chamber access for roadside technology and communications

14.45 Chamber steps for roadside technology and communications shall be installed as stated in TC 131/WSR/014.

Chamber steps for roadside technology and communications	
Chamber reference	**Chamber steps**
(a)	(b)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter a value, from options Yes, No, to identify whether communications chamber steps need to be installed if the chamber depth exceeds 900 mm.

14.46 Hinged covers on chambers for roadside technology and communications shall be able to be locked in the open position so they cannot fall.

14.47 The hardstanding maintenance working areas around chambers for roadside technology and communications, including the clearance requirements for covers, shall be as stated in TC 131/WSR/014.

SI.14.47 The hardstanding maintenance working areas around chambers for roadside technology and communications, including the clearance requirements for covers, shall be in accordance with the following scheme drawing: [enter free text].

14.48 Hardstanding maintenance working areas around chambers for roadside technology and communications shall not accumulate water.

Installation requirements for chamber drainage for roadside technology and communications

14.49 The installation of a positive drainage system on chambers for roadside technology and communications shall be as stated in TC 131/WSR/014.

The installation of a positive drainage system on chambers for roadside technology and communications	
Chamber reference	**Drainage solution**
(a)	(b)

a) Enter a unique reference, to identify the chamber to be installed.

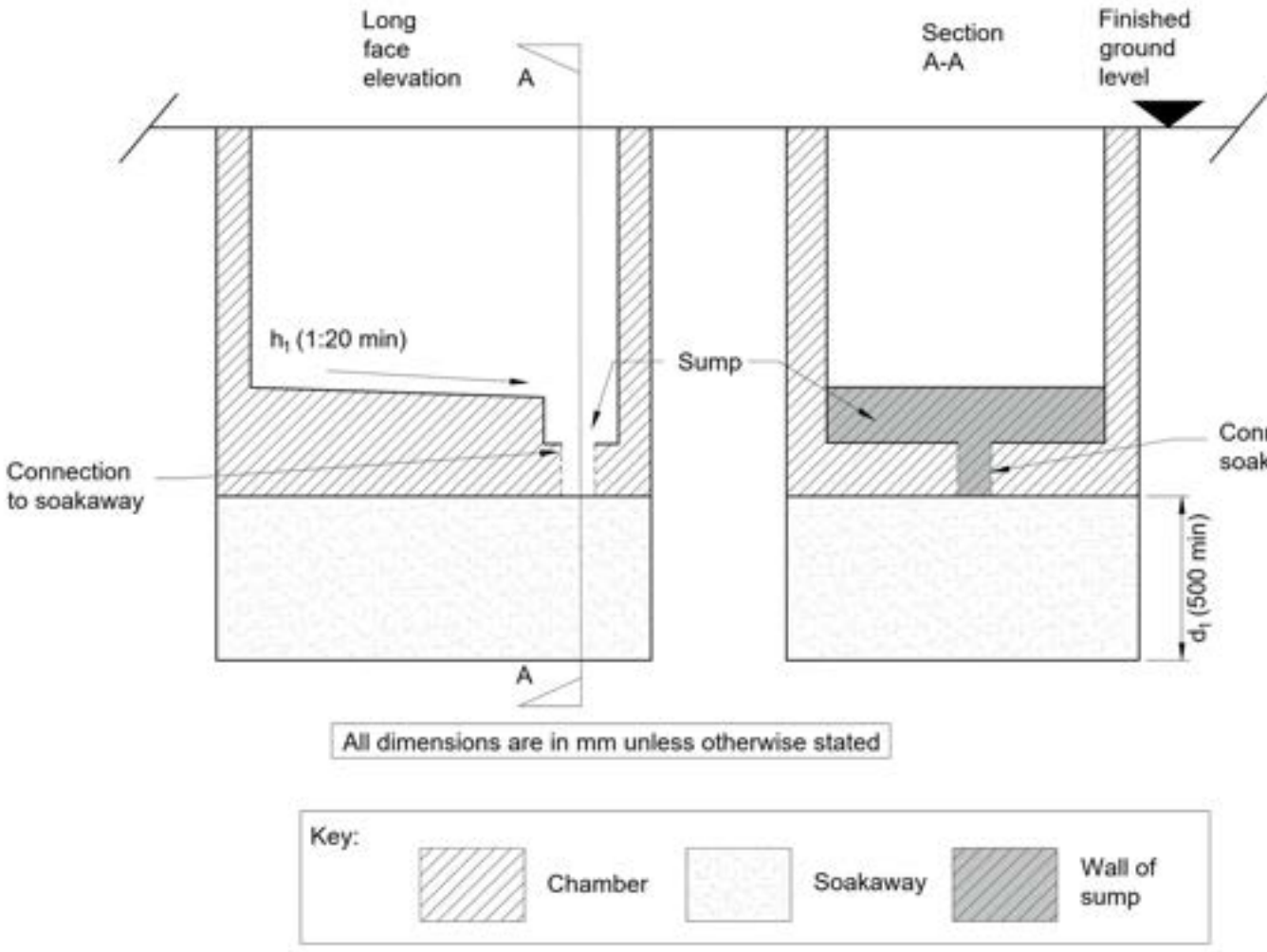
b) Enter text, to identify the drainage solution to be installed to the communications chamber.

14.50 Type A and Type B chambers for roadside technology and communications shall contain a sump to allow water to collect and drain away such that no water collects at the bottom of the chamber.

14.51 Sumps for chambers for roadside technology and communications shall be in accordance with Figure 14.52.

14.52 Soakaways for chambers for roadside technology and communications shall be in accordance with Figure 14.52.

Figure 14.52 Chamber with sump and soakaway directly connected



14.53 The size of the sump shall be 150 mm deep by 225 mm wide and from wall to wall of the chamber, unless otherwise stated in TC 131/WSR/014.

SI.14.53a The depth of the sump, when it is not 150 mm, shall be [enter a number] .

SI.14.53b The width of the sump, when it is not 225 mm, shall be [enter a number] .

SI.14.53c The length of the sump, when it is not from wall to wall shall be [enter a number] .

14.54 The size of the soakaway shall be the width of the chamber, the length of the chamber and a minimum of 500 mm deep, unless otherwise stated in TC 131/WSR/014.

SI.14.54a The width of the soakaway when it is not the width of the chamber shall be [enter a number] .

SI.14.54b The length of the soakaway when it is not the length of the chamber shall be [enter a number] .

SI.14.54c The minimum depth of the soakaway when it is not 500 mm shall be [enter a number] .

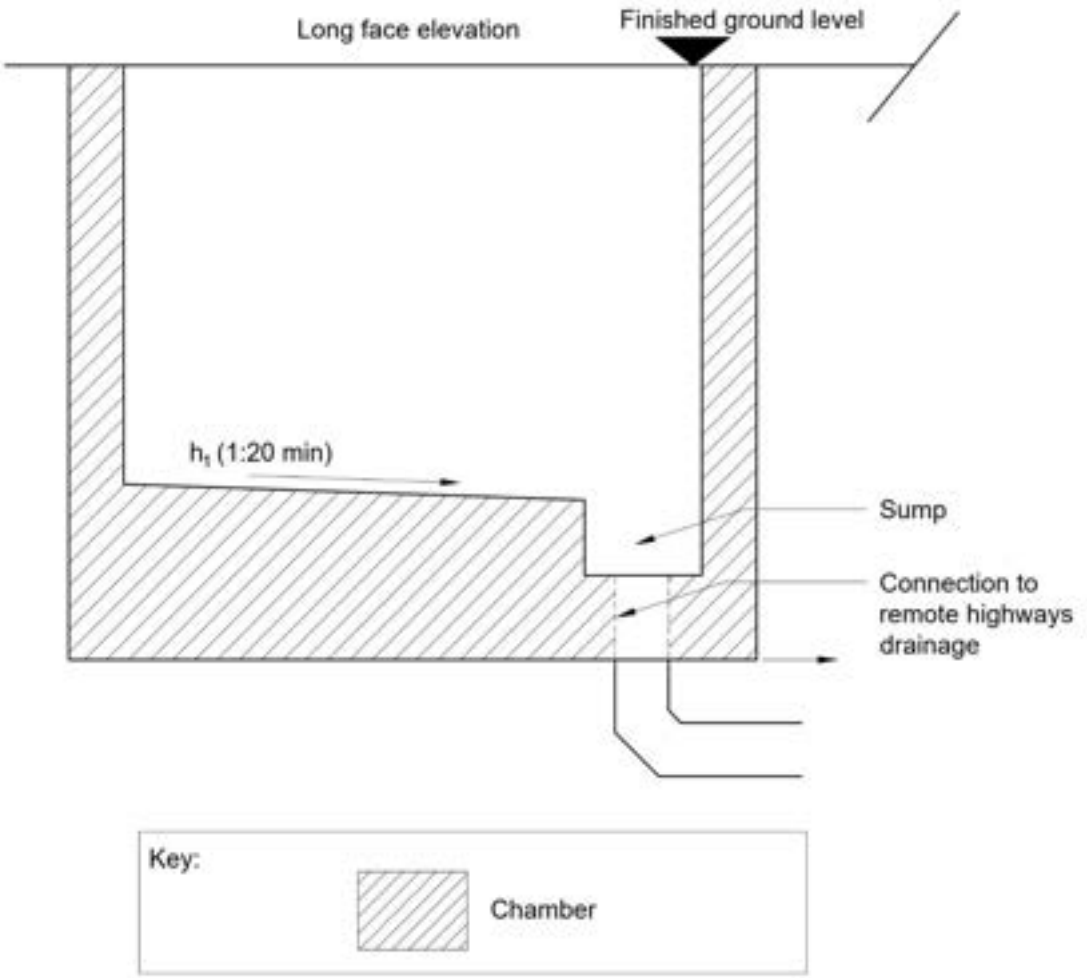
14.55 Soakaways shall comprise of Type B filter material in accordance with Pipes for Drainage backfill product requirements "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

14.56 The installation of the chamber base shall not cause any material to enter the soakaway and adversely affect its performance.

14.57 The connection from the chamber to the soakaway shall be a minimum of 100 mm diameter.

14.58 Chambers which drain to a remote highways drainage feature shall be in accordance with Figure 14.58.

Figure 14.58 Chamber with a connection to remote highways drainage feature



14.59 The diameter of the connection to the remote highways drainage feature shall be 100 mm, unless otherwise stated in TC 131/WSR/014.

SI.14.59 The diameter of the connection to the remote highways drainage feature, when not 100 mm, shall be [enter a number] .

14.60 The slope of the connection to the remote highways drainage feature shall have a gradient of 1:80, unless otherwise stated in TC 131/WSR/014.

SI.14.60 The slope of the connection to the remote highways drainage feature, when not at a gradient of 1:80, shall be [enter a number].

14.61 The minimum length of the connection from the chamber connection to the remote highways drainage feature shall be as stated in TC 131/WSR/014.

SI.14.61 The minimum length of the connection from the chamber connection to the remote highways drainage feature shall be [enter a number] .

14.62 Verification shall be undertaken for the drainage of each chamber for roadside technology and communications by visual inspection and measurement to ensure that the drainage feature has been installed in accordance with the specification, with the results recorded in the inspection and test plan.

14.63 The frequency of the visual inspection and measurement of the drainage of each chamber for roadside technology and communications shall be once upon completion of the installation of the chamber.

14.64 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection and measurement of the drainage of each chamber for roadside technology and communications.

Installation of interrupter ports on chambers for roadside technology and communications

14.65 The installation of 1 x 100 mm diameter interrupter port required for temporary interrupter cables on chambers for roadside technology and communications shall be as stated in TC 131/WSR/014.

The installation of 1 x 100 mm diameter interrupter port required for temporary interrupter cables on chambers for roadside technology and communications	
Chamber reference	**Location of interrupter port**
(a)	(b)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter a value, from options Upstream, Downstream, None, Upstream and Downstream, to identify the location of the interrupter port.

Installation of Type A chambers for roadside technology and communications

14.66 The Type A chambers for roadside technology and communications to be installed shall be as stated in TC 131/WSR/014.

SI.14.66 The Type A chambers for roadside technology and communications to be installed shall be in accordance with the following scheme drawing: [enter free text].

14.67 For Type A chambers for roadside technology and communications, the longitudinal sub-ducts which are separately drawn into the duct shall be continuous through the chamber, where there is no requirement to access the cables within, is as specified in TC 131/WSR/014.

For Type A chambers for roadside technology and communications, the longitudinal sub-ducts which are separately drawn into the duct	
Chamber reference	**Route sub-ducts continuously through chamber**
(a)	(b)

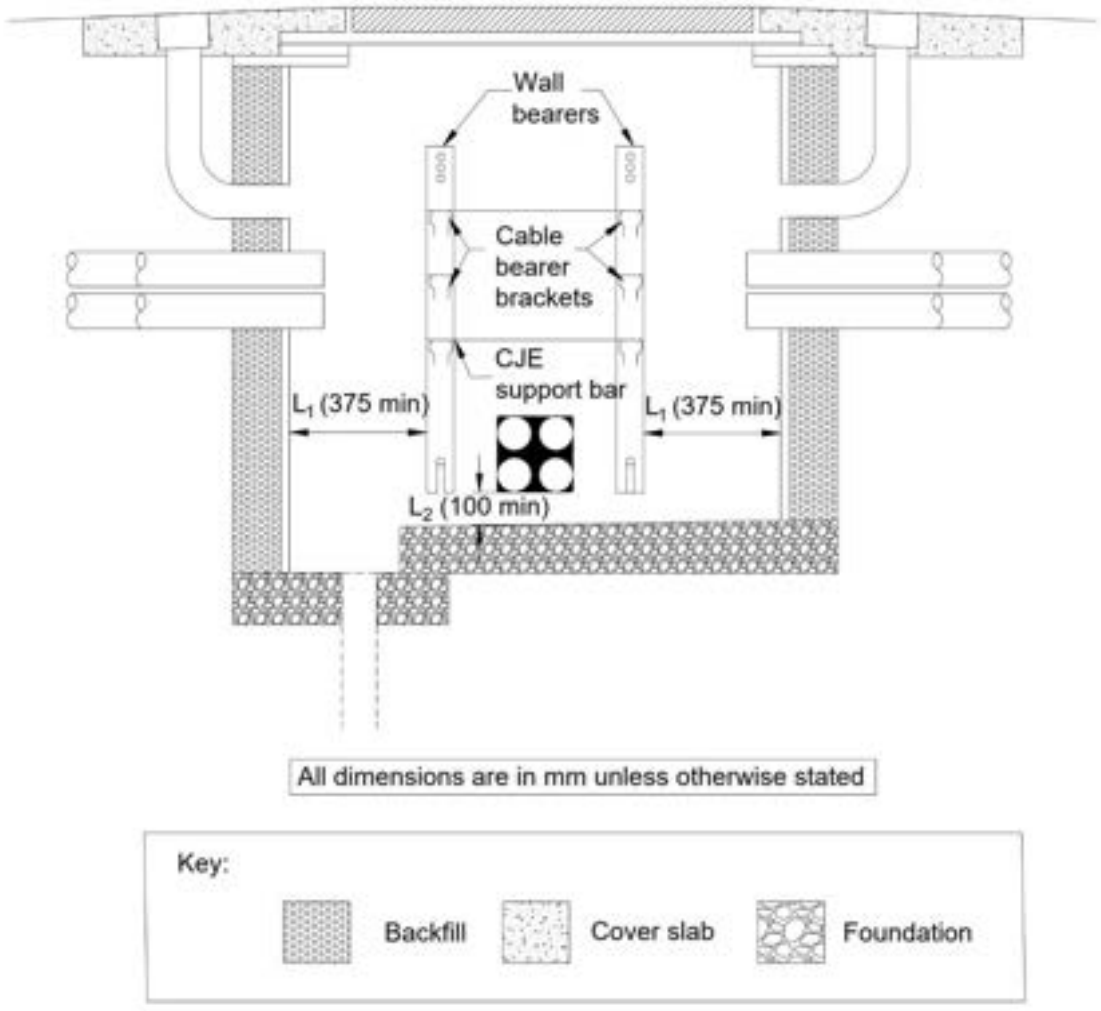
a) Enter a unique reference, to identify the chamber to be installed.

b) Enter a value, from options Yes, No, to specify whether the longitudinal sub-duct, which is to be separately drawn into the duct, shall be continuous through the communications chamber.

Installation of Type A chamber for roadside technology and communications cable support

14.68 Where Type A chambers for roadside technology and communications are specified for telecommunications cable joints, cable joint bearer systems shall be installed within the chamber as shown in Figure 14.68.

Figure 14.68 Cable joint bearer system in type A chambers for roadside technology and communications



14.69 The number of cable joint enclosure (CJE) support bars to be installed when cable joint bearer systems are to be used in a chamber shall be as stated in TC 131/WSR/014.

The number of cable joint enclosure (CJE) support bars to be installed when cable joint bearer systems are to be used in a chamber	
Chamber reference	**Number of CJE support bars**
(a)	(b)

a) Enter a unique reference, to identify the chamber to be installed.

b) Enter a value, from options None, 1, 2, 3, to identify the number of CJE support bars to be installed.

14.70 The design of the cable joint bearer system and fixing method in a chamber for roadside technology and communications shall be in accordance with TC 131/WSR/014.

SI.14.70 The maximum point load, applied at the end of the longest bracket on each wall bearer of the cable joint bearer system in a chamber for roadside technology and communications shall be [select one from: 3.5] .

14.71 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 21.N] shall apply to the cable joint bearer system in a chamber for roadside technology and communications.

14.72 The installed cable joint bearer system in a chamber for roadside technology and communications shall be capable of withstanding the maximum point load, applied at the end of the longest bracket on each wall bearer, without incurring mechanical failure or falling off the chamber wall.

14.73 A minimum of 2 cable bearer brackets shall be installed to support a CJE support bar.

14.74 Cable joint bearer systems components shall be fabricated from steel and hot dip galvanised after fabrication in accordance with "Hot dip galvanised coatings for protection of steelwork against corrosion " in Section 4 of CC 486 [Ref 51.N].

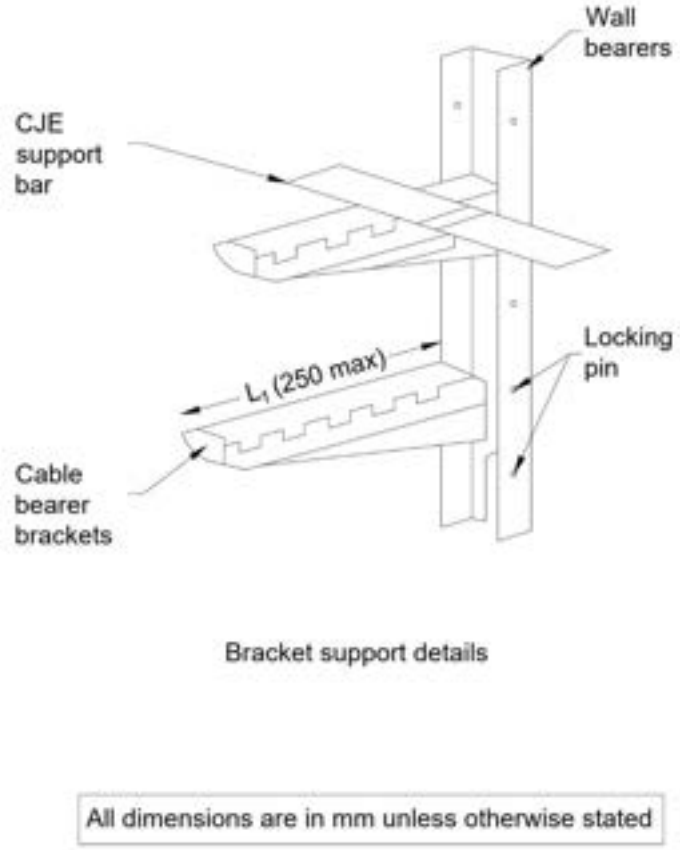
14.75 In chambers for roadside technology and communications, a flexible pad shall be installed between the cable joint and CJE support bar.

14.76 A CJE support bar shall be provided for each cable joint contained within the chamber arrangement for roadside technology and communications, unless otherwise stated in TC 131/WSR/014.

SI.14.76 The number of cable joints permitted on one CJE support bar when greater than one shall be [enter a number].

14.77 The cable bearer bracket shall be attached to the wall bearer (see Figure 14.77) and fixed in place using a split pin retainer in accordance with the manufacturer's instructions.

Figure 14.77 Cable bearer bracket support details.



NI/14.78 Power cables in a chamber for roadside technology and communications equipped for CJEs shall be routed around the chamber and dressed to allow the CJEs to be extracted from the chamber for maintenance.

Installation of Type B chambers for roadside technology and communications

14.79 The Type B chambers for roadside technology and communications to be installed shall be as stated in TC 131/WSR/014.

SI.14.79 The Type B chambers for roadside technology and communications to be installed shall be in accordance with the following scheme drawing: [enter free text].

Installation of Type E chamber for roadside technology and communications

14.80 The Type E chambers for roadside technology and communications to be installed shall be as stated in TC 131/WSR/014.

SI.14.80 The Type E chambers for roadside technology and communications to be installed shall be in accordance with the following scheme drawing: [enter free text].

Installation of jointing chambers for detector loops for roadside technology and communications

14.81 The jointing chambers for detector loops for roadside technology and communications to be installed shall be as stated in TC 131/WSR/014.

SI.14.81 The jointing chambers for detector loops for roadside technology and communications to be installed shall be in accordance with the following scheme drawing: [enter free text].

14.82 The 50 mm duct into the jointing chamber for detector loops for roadside technology and communications shall extend into the pavement by a minimum of 300 mm.

14.83 The outer 100 mm duct shall extend a minimum of 50 mm past the filter drain.

Installation of brick chambers for roadside technology and communications

14.84 Brick chambers for roadside technology and communications shall be constructed in accordance with "Brickwork and blockwork" in Section 13 of CC 491 [Ref 32.N].

14.85 The mortar joints of brickwork where exposed shall be finished in accordance with un-pointed joints in "Brickwork and blockwork" in Section 13 of CC 491 [Ref 32.N].

14.86 Brick chambers for roadside technology and communications shall be built in English bond pattern.

14.87 The brickwork around ducts where they enter brick chambers for roadside technology and communications shall be finished flush up to the ducts with mortar.

14.88 The walls of the chambers for roadside technology and communications shall be 215 mm in thickness.

14.89 The method for treatment of the walls of brick chambers for roadside technology and communications with waterproofing material to prevent the ingress of moisture shall be as stated in TC 131/WSR/014.

SI.14.89 The method for treatment of the walls of brick chambers for roadside technology and communications with waterproofing material to prevent the ingress of moisture shall be [enter free text].

Installation of plastic chambers for roadside technology and communications

14.90 Plastic chambers for roadside technology and communications shall be installed in accordance with the manufacturer’s instructions.

14.91 Where plastic chambers for roadside technology and communications are comprised of multiple sections, all sections shall be sealed in accordance with the manufacturer’s instructions to prevent the ingress of water.

14.92 Verification shall be undertaken for each plastic chamber for roadside technology and communications by visual inspection to ensure they have been installed in accordance with the manufacturer’s instructions, with the results recorded in the inspection and test plan.

14.93 The frequency of the visual inspection of the installation of each plastic chamber for roadside technology and communications shall be once upon completion of the installation of each chamber prior to backfill.

14.94 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection of the installation of each plastic chamber for roadside technology and communications.

14.95 Verification shall be undertaken for each plastic chamber for roadside technology and communications by visual inspection to ensure they have been sealed to prevent the ingress of water, with the results recorded in the inspection and test plan.

14.96 The frequency of the visual inspection of the sealing of each plastic chamber for roadside technology and communications shall be once upon completion of the installation of each chamber prior to backfill.

14.97 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection of the sealing of each plastic chamber for roadside technology and communications.

Documentation requirements for chambers for roadside technology and communications

14.98 The following Documentation shall be submitted for modular access chambers prior to the commencement of the installation: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

14.99 The following Documentation shall be submitted for plastic chambers and pre-cast concrete chambers for roadside technology and communications prior to the commencement of the installation:

manufacturer's data sheet showing compliance with the product requirements specified.

15. Ducts for roadside technology and communications

Product requirements for ducts for roadside technology and communications

15.1 Ducts for roadside technology and communications shall be compliant with BS EN 61386-24 [Ref 9.N].

15.2 The ducts for roadside technology and communications, other than sub-ducts and sleeves, shall meet the following performance characteristics: resistance to compression a minimum type 450 N, normal resistance to impact and either rigid or pliable resistance to bending.

15.3 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 21.N] shall apply to ducts for roadside technology and communications.

15.4 With the exception of ducts in CCD crossings for roadside technology and communications installed using trenchless techniques and sub-ducts, the external wall colour of the ducts shall be in accordance with NJUG 1 [Ref 81.N].

15.5 The additional product requirements for ducts for roadside technology and communications located adjacent to filter drains shall be as stated in TC 131/WSR/015.

SI.15.5 The additional product requirements of ducts for roadside technology and communications located adjacent to filter drains shall be [enter free text].

15.6 The additional product requirements for ducts for roadside technology and communications to be used by the TSP shall be as stated in TC 131/WSR/015.

SI.15.6 The additional product requirements of ducts for roadside technology and communications to be used by the TSP shall be [enter free text].

15.7 The ducts used in the construction of CCDs for roadside technology and communications, installed without a sleeve using trenchless techniques shall be compliant with BS EN 12201-2 [Ref 37.N].

15.8 The ducts used in the construction of CCDs for roadside technology and communications, installed without a sleeve using trenchless techniques shall meet the following performance characteristics: material black PE80 with a standard dimension ratio of 11.

15.9 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 21.N] shall apply to ducts used in the construction of CCDs for roadside technology and communications, installed without a sleeve using trenchless techniques.

15.10 Marker tape used for cables and ducts installed underground shall be compliant with BS EN 12613 [Ref 38.N].

15.11 The marker tape used for cables and ducts installed underground shall meet the following performance characteristics: Type 1 warning device (visual).

Scope of works for cross carriageway duct (CCD) installations for roadside technology and communications

15.12 The locations of CCDs for roadside technology and communications under carriageways shall be as stated in TC 131/WSR/015.

The locations of CCDs for roadside technology and communications under carriageways						
CCD reference	**Chainage**	**Marker post**	**New/Existing/ Modified**	**Size of ducts**	**Number of ducts**	**Depth of CCD**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the CCD.

b) Enter text, to identify the chainage location of the CCD.

c) Enter text, to identify the marker post location of the CCD.

d) Enter a value, from options New, Existing, Modified, to identify whether the CCD to be installed are new, existing or modified.

e) Enter a number in units of mm, to identify the size of ducts for the CCD.

f) Enter text, to identify the number of ducts for the CCD.

g) Enter a number in units of mm, to identify the depth of the CCD.

The locations of CCDs for roadside technology and communications under carriageways (continued)	
CCD reference	**Installation technique**
(a)	(h)

h) Enter text, to identify the installation technique for the CCD.

15.13 The tolerance of the depth of the CCD for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.13 The tolerance of the depth of the CCD for roadside technology and communications shall be [enter free text].

Scope of works for sacrificial ducting for roadside technology and communications

15.14 The duct routes, lengths, number, type and depth of sacrificial ducting for roadside technology and communications, the requirements for reinstatement and locations of intermediate cable pulling pits shall be as specified in TC 131/WSR/015.

The duct routes, lengths, number, type and depth of sacrificial ducting for roadside technology and communications, the requirements for reinstatement and locations of intermediate cable pulling pits						
Sacrificial ducting reference	**Carriageway**	**Start chainage**	**Start marker post**	**Start X (Easting) co-ordinate**	**Start Y (Northing) co-ordinate**	**End chainage**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the sacrificial ducting.

b) Enter text, to identify the carriageway location of the sacrificial ducting.

c) Enter text, to identify the start chainage location of the sacrificial ducting.

d) Enter text, to identify the start marker post location of the sacrificial ducting.

e) Enter a number in units of m, to identify the start X (Easting) co-ordinate of the sacrificial ducting.

f) Enter a number in units of m, to identify the start Y (Northing) co-ordinate of the sacrificial ducting.

g) Enter text, to identify the end chainage location of the sacrificial ducting.

The duct routes, lengths, number, type and depth of sacrificial ducting for roadside technology and communications, the requirements for reinstatement and locations of intermediate cable pulling pits (continued)							
Sacrificial ducting reference	**End marker post**	**End X (Easting) co-ordinate**	**End Y (Northing) co-ordinate**	**Type**	**Size of ducts**	**Number of ducts**	**Depth**
(a)	(h)	(i)	(j)	(k)	(l)	(m)	(n)

h) Enter text, to identify the end marker post location of the sacrificial ducting.

i) Enter a number in units of m, to identify the end X (Easting) co-ordinate of the sacrificial ducting.

j) Enter a number in units of m, to identify the end Y (Northing) co-ordinate of the sacrificial ducting.

k) Enter text, to identify the type of sacrificial ducting.

l) Enter a number in units of mm, to identify the size of sacrificial ducting.

m) Enter text, to identify the number of sacrificial ducting.

n) Enter a number in units of mm, to identify the depth of the sacrificial ducting.

The duct routes, lengths, number, type and depth of sacrificial ducting for roadside technology and communications, the requirements for reinstatement and locations of intermediate cable pulling pits (continued)		
Sacrificial ducting reference	**Requirements for ground reinstatement**	**Type of pulling pit**
(a)	(o)	(p)

o) Enter text, to identify the requirements for ground reinstatement of the sacrificial ducting.

p) Enter text, to identify type of the pulling pit.

15.15 The tolerance of the depth of the sacrificial ducting for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.15 The tolerance of the depth of the sacrificial ducting for roadside technology and communications shall be [enter free text].

Scope of works for ducts through structures (DTS) for roadside technology and communications

15.16 The number of ducts and their contents installed in the verge of an under-bridge or within a structure for roadside technology and communications shall be as stated in TC 131/WSR/015.

The number of ducts and their contents installed in the verge of an under-bridge or within a structure for roadside technology and communications						
DTS reference	**Carriageway**	**Start chainage**	**Start marker post**	**Start X (Easting) co-ordinate**	**Start Y (Northing) co-ordinate**	**End chainage**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, to identify the DTS.

b) Enter text, to identify the carriageway location of the DTS installation.

c) Enter text, to identify the start chainage location of the DTS installation.

d) Enter text, to identify the start marker post location of the DTS installation.

e) Enter a number in units of m, to identify the start X (Easting) co-ordinate of the DTS installation.

f) Enter a number in units of m, to identify the start Y (Northing) co-ordinate of the DTS installation.

g) Enter a number, to identify the end chainage location of the DTS installation.

The number of ducts and their contents installed in the verge of an under-bridge or within a structure for roadside technology and communications (continued)							
DTS reference	**End marker post**	**End X (Easting) co-ordinate**	**End Y (Northing) co-ordinate**	**New/Existing/ Modified**	**Size of ducts**	**Number of ducts**	**Method of Installation**
(a)	(h)	(i)	(j)	(k)	(l)	(m)	(n)

h) Enter text, to identify the end marker post location of the DTS installation.

i) Enter a number in units of m, to identify the end X (Easting) co-ordinate of the DTS installation.

j) Enter a number in units of m, to identify the end Y (Northing) co-ordinate of the DTS installation.

k) Enter a value, from options New, Existing, Modified, to identify whether the DTS to be installed are new, existing or modified.

l) Enter a number in units of mm, to identify the size of ducts for the installation.

m) Enter a number, to identify number of ducts for the installation.

n) Enter text, to identify the method that use to be used to install the ducts across the under-bridge or within the structure.

Installation of ducts for roadside technology and communications

15.17 Ducts for roadside technology and communications, other than those in structures using conduits, shall be installed in trenches.

15.18 The components used within ducts for roadside technology and communications shall be compatible with each other.

15.19 Ducts and fittings for roadside technology and communications that have been damaged shall not be laid into trenches.

15.20 Duct joint surfaces and components for roadside technology and communications shall be free from debris before laying into trenches.

15.21 Existing ducts for roadside technology and communications shall not interface onto a new section of ducting.

15.22 New ducts for roadside technology and communications shall be brushed out before proving and testing the ducts.

15.23 All ducts for roadside technology and communications shall be free from debris before the installation of cables.

15.24 The extension of ducts through retaining walls and concrete bases for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.24 The extension of ducts through retaining walls and concrete bases for roadside technology and communications shall be [enter free text].

15.25 The additional installation requirements for ducts for roadside technology and communications that are not included in TD 133 [Ref 11.N] shall be as stated in TC 131/WSR/015.

SI.15.25 The additional installation requirements of ducts for roadside technology and communications that are not included in TD 133 [Ref 11.N] shall be [enter free text].

15.26 Verification shall be undertaken for each duct for roadside technology and communications by visual inspection to ensure it has been installed in accordance with the requirements of the specifications, with the results recorded in the inspection and test plan.

15.27 The frequency of the visual inspection of each duct for roadside technology and communications shall be once upon completion of the installation of each duct prior to backfilling the trench.

15.28 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection of each duct for roadside technology and communications.

15.29 The ducts and fittings for roadside technology and communications shall be protected from the environment in accordance with the manufacturer's instructions.

Installation requirements for ducts for roadside technology and communications near filter drains

15.30 The provision of ducts for roadside technology and communications that are laid across or within 500 mm of filter drains, excluding detector loop tail cables shall be as stated in TC 131/WSR/015.

The provision of ducts for roadside technology and communications that are laid across or within 500 mm of filter drains, excluding detector loop tail cables						
Carriageway	**Start chainage**	**Start marker post**	**Start X (Easting) co-ordinate**	**Start Y (Northing) coordinate**	**End chainage**	**End marker post**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter text, to identify the carriageway location of the duct for cables that are laid across or within 500 mm of filter drains.

b) Enter text, to identify the start chainage location of the duct for cables that are laid across or within 500 mm of filter drains.

c) Enter text, to identify the start marker post location of the duct for cables that are laid across or within 500 mm of filter drains.

d) Enter a number in units of m, to identify the start X (Easting) co-ordinate of the duct for cables that are laid across or within 500 mm of filter drains.

e) Enter a number in units of m, to identify the start Y (Northing) co-ordinate of the duct for cables that are laid across or within 500 mm of filter drains.

f) Enter text, to identify the end chainage location of the duct for cables that are laid across or within 500 mm of filter drains.

g) Enter text, to identify the end marker post location of the duct for cables that are laid across or within 500 mm of filter drains.

The provision of ducts for roadside technology and communications that are laid across or within 500 mm of filter drains, excluding detector loop tail cables (continued)					
Carriageway	**End X (Easting) co-ordinate**	**End Y (Northing) coordinate**	**New/Existing/ Modified**	**Size of ducts**	**Number of ducts**
(a)	(h)	(i)	(j)	(k)	(l)

h) Enter a number in units of m, to identify the end X (Easting) co-ordinate of the duct for cables that are laid across or within 500 mm of filter drains.

i) Enter a number in units of m, to identify the end Y (Northing) co-ordinate of the duct for cables that are laid across or within 500 mm of filter drains.

j) Enter a value, from options New, Existing, Modified, to identify whether the duct for cables that are laid across or within 500 mm of filter drains are new, existing or modified.

k) Enter a number in units of mm, to identify the size of ducts for cables that are laid across or within 500 mm of filter drains.

l) Enter text, to identify the number of ducts for cables that are laid across or within 500 mm of filter drains.

15.31 The ducts for roadside technology and communications for cables, excluding detector loop tail cables, that are laid across or within 500 mm of filter drains shall be surrounded with 150 mm of GEN2 concrete in accordance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 33.N].

15.32 The 50 mm duct for roadside technology and communications used for detector loop tail cables shall be sub-ducted through a 100 mm duct when passing through a filter drain.

Installation for duct size and configuration for roadside technology and communications

15.33 The duct system for roadside technology and communications throughout the works shall use ducts to the same manufacturing dimensions and material, along with compatible duct jointing systems, unless otherwise stated in TC 131/WSR/015.

SI.15.33 The changes to the type of duct system for roadside technology and communications throughout the works shall be [enter free text].

15.34 The number and size of ducts for roadside technology and communications shall be as shown in the drawings and/or 3D models.

Installation of draw cords for ducts for roadside technology and communications

15.35 The ducts for roadside technology and communications shall be fitted with a pigmented, rot-proof draw cord of not less than 5 kN breaking load.

15.36 The draw cord ends within a duct for roadside technology and communications shall be fixed within the chambers to which the duct is terminated.

15.37 A draw cord for roadside technology and communications shall remain secured in each duct on completion of cable installation.

15.38 The draw cords for roadside technology and communications shall not be knotted within ducts.

15.39 Draw cords for roadside technology and communications that need to be repaired or extended shall be replaced.

15.40 Cut draw cords for roadside technology and communications shall have ends end-spliced to prevent fraying and loss of strength.

Installation requirements for the separation of services for roadside technology and communications

15.41 Sharing of individual ducts for roadside technology and communications for power and data services shall not be permitted, unless otherwise stated in TC 131/WSR/015.

SI.15.41 The locations where sharing of individual ducts for roadside technology and communications for power and data services is permitted shall be [enter free text].

Installation of duct plugs or duct sealing for roadside technology and communications

15.42 The installation locations of duct plugs or other proprietary duct sealing systems for roadside technology and communications shall be stated in TC 131/WSR/015.

The installation locations of duct plugs or other proprietary duct sealing systems for roadside technology and communications	
Chamber reference	**Location of duct plugs**
(a)	(b)

a) Enter a unique reference, to identify the chamber.

b) Enter text, to identify the location of the duct plugs or other proprietary duct sealing systems.

15.43 On completion of cabling within chambers, including those installed by the TSP, ducts for roadside technology and communications that were previously sealed shall be re-sealed.

15.44 The use of expanding foam to seal ducts for roadside technology and communications shall not be permitted.

15.45 Longitudinal ducts for roadside technology and communications between chambers shall not require sealing, unless otherwise stated in TC 131/WSR/015.

SI.15.45 The location of longitudinal ducts for roadside technology and communications between chambers that require sealing as they are in areas subject to flooding or toxic gas shall be [enter free text].

Installation of communications duct joints for roadside technology and communications

15.46 The duct joints for roadside technology and communications shall not cause damage to cables when the cables are drawn through the duct.

15.47 The duct joint for roadside technology and communications shall not compromise the duct network ingress protection rating of IP47 in accordance with BS EN 60529 [Ref 10.N].

15.48 Duct joints for roadside technology and communications shall be installation in accordance with the manufacturer’s written instructions.

15.49 Duct joints for roadside technology and communications shall hold and maintain the ducts in axial alignment.

15.50 The duct joints for roadside technology and communications between consecutive lengths of duct shall prevent the ducts separating with changes in temperature.

15.51 The additional requirements for duct joints for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.51 The additional requirements of duct joints for roadside technology and communications shall be [enter free text].

Installation requirements for duct alignment for roadside technology and communications

15.52 Ducts for roadside technology and communications shall be laid at the levels and lines described in the drawings or 3D model.

15.53 For a duct laid in a trench for roadside technology and communications, the deviation in depth from a level shall not exceed 50 mm.

15.54 Ducts for roadside technology and communications between cabinets and chambers, and to end devices shall be at a level grade.

15.55 The transition from one duct or trough alignment to a surface mounted trough for roadside technology and communications shall not exceed 1:30 horizontally or 1:60 vertically in order to preserve the bend radius and to allow cables to be pulled through.

Installation requirements for duct internals for roadside technology and communications

15.56 The internal bore shall be smooth and even throughout the length of the duct for roadside technology and communications and the duct joints to ensure the outer sheath of the cable is not damaged during installation.

15.57 The internal bore of ducting for roadside technology and communications on longitudinal cable routes shall allow the continuous draw through of a mandrel to prove the duct.

15.58 Ducts for roadside technology and communications that do not present a smooth bore for the installation of cables shall not be used for longitudinal cable routes.

15.59 Ducts for roadside technology and communications shall not be bent or undulated to internal radius less than the duct manufacturer’s specifications.

15.60 The internal radius of installed ducts for roadside technology and communications shall not deform the duct such that the standard mandrel is stopped from going through it.

15.61 Ducts for roadside technology and communications shall not be bent or undulated to internal radius less than the bend radius of the cables to be housed within the duct.

Installation of duct trenches for roadside technology and communications

15.62 Excavations shall be carried out in accordance with excavation requirements in "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

15.63 Excavations shall be carried out in accordance with excavation requirements in "Chambers for drainage pipes" in Section 3 of CC 500 [Ref 14.N].

15.64 The backfill material of duct trenches for roadside technology and communications shall comply with "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

15.65 The installation of duct trenches for roadside technology and communications shall comply with "General earthworks construction" in Section 5 of CC 601 [Ref 15.N].

15.66 Topsoiling of duct trenches for roadside technology and communications shall comply with "Finishing and topsoiling of earthworks" in Section 8 of CC 601 [Ref 15.N].

15.67 Grass seeding and turfing of duct trenches for roadside technology and communications shall comply with "Grass seeding, wildflower seeding and turfing works" in Section 5 of LC 120 [Ref 29.N].

15.68 The bed and surround for ducts for roadside technology and communications shall be of a granular material in accordance with "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

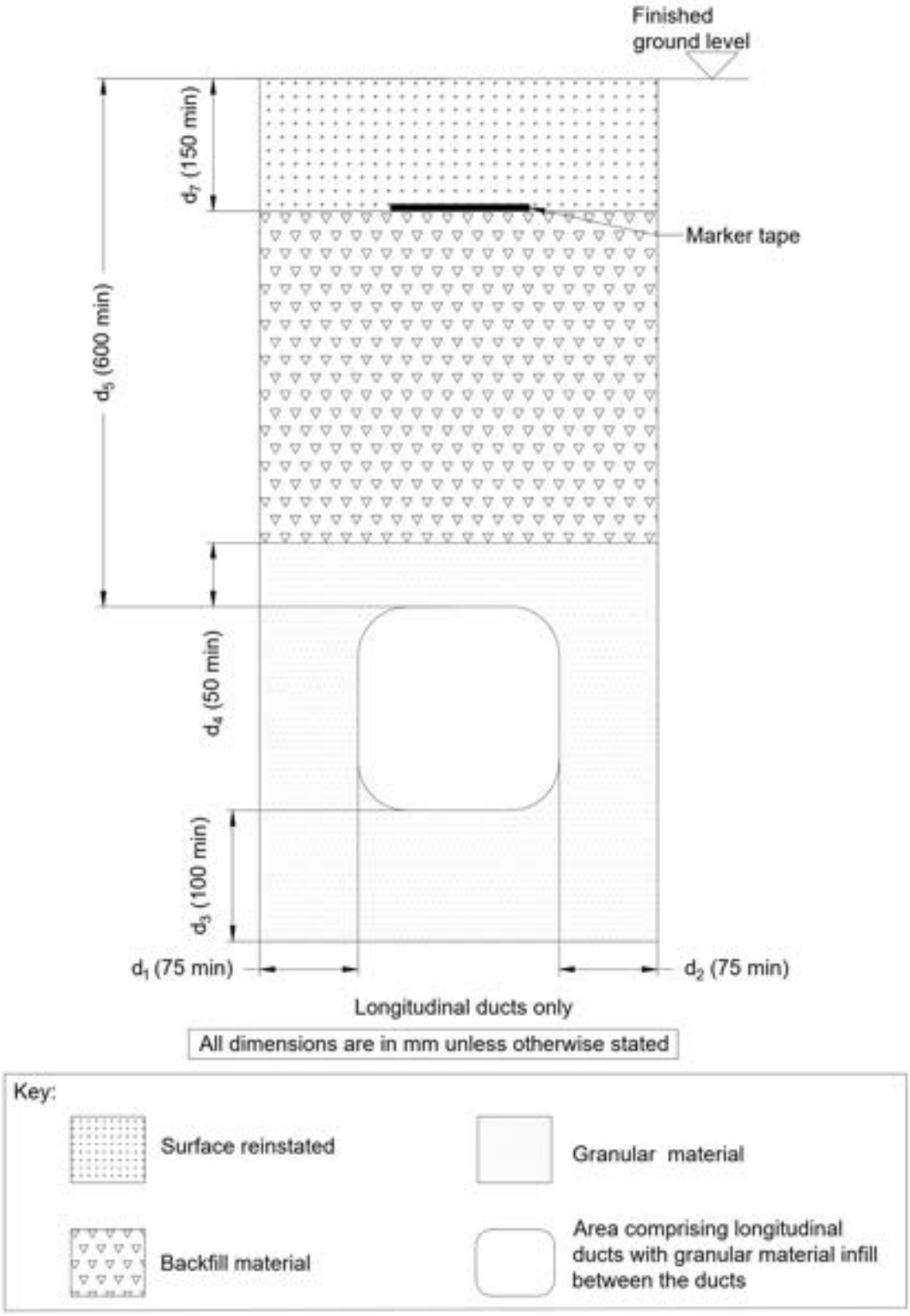
15.69 Immediately following the installation of the bedding material, ducts for roadside technology and communications shall be jointed and laid on the bedding material.

15.70 Ducts for roadside technology and communications shall be secured in its arrangement before backfilling the trench.

15.71 The trenches and the fill shall be such that compaction, during installation, does not damage the duct for roadside technology and communications or distort its route such that pulling a cable through it will damage the cabling.

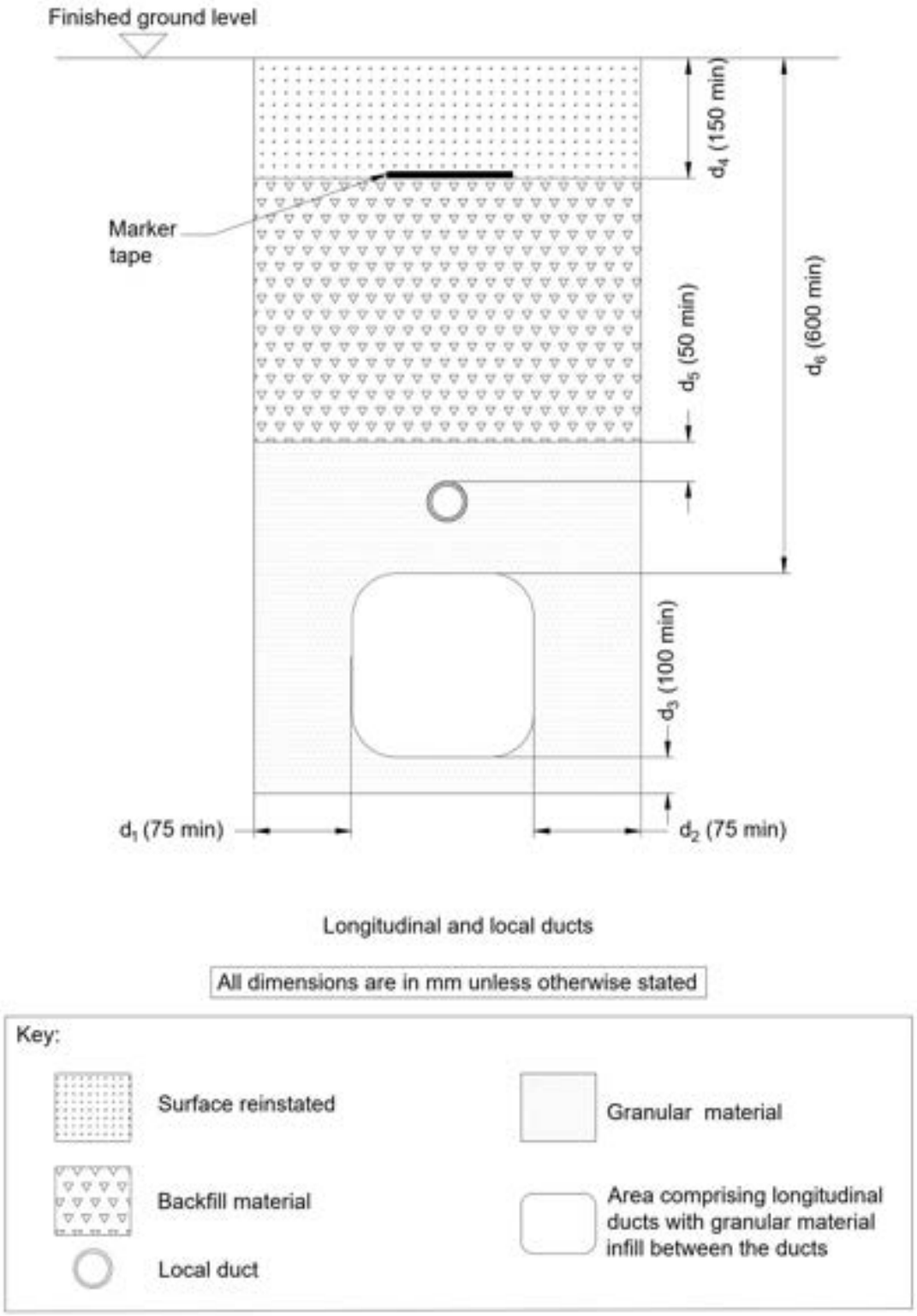
15.72 The backfill of the longitudinal duct trench for roadside technology and communications with longitudinal ducts only shall be as Figure 15.72.

Figure 15.72 Backfill of the longitudinal duct trench for roadside technology and communications with longitudinal ducts only



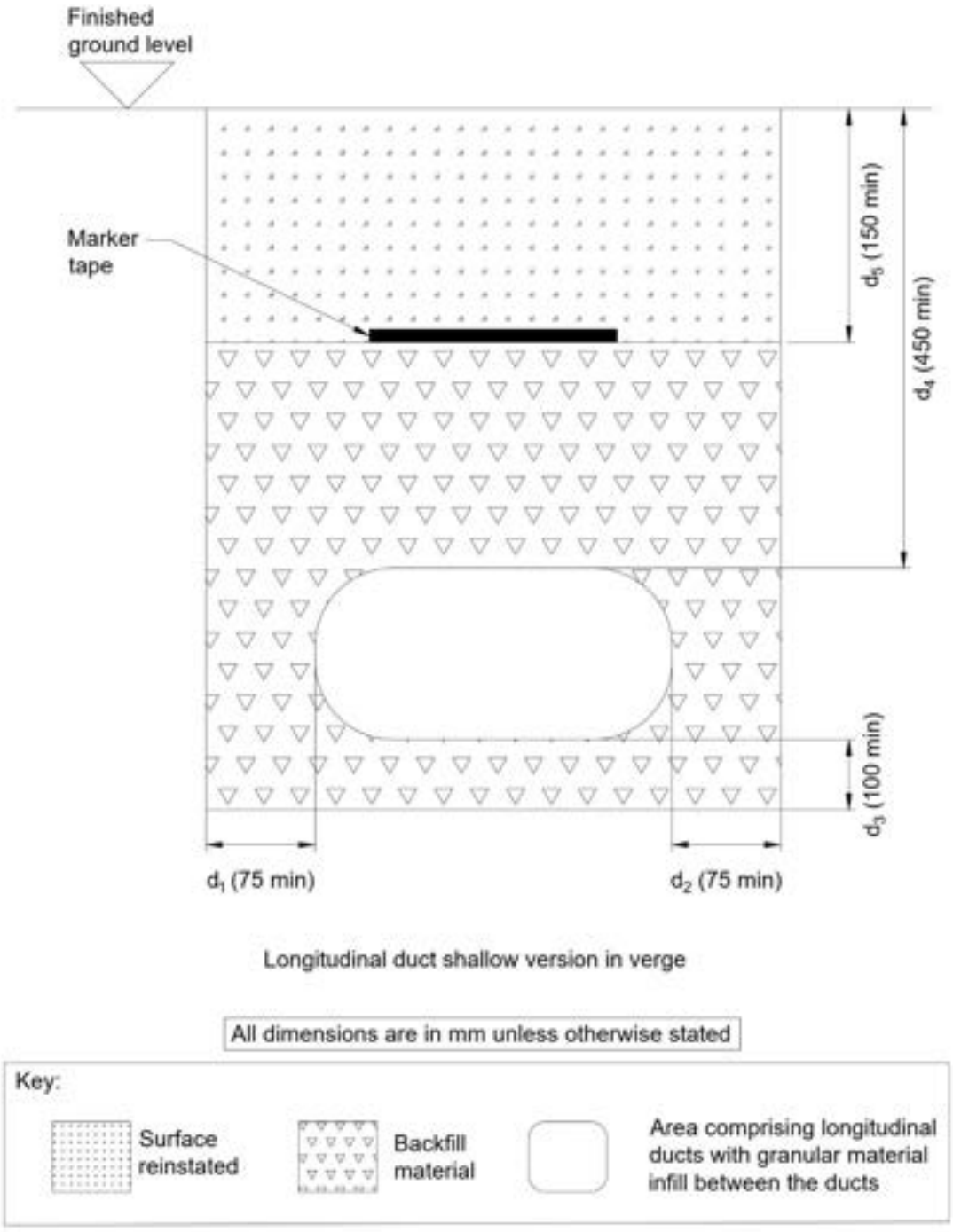
15.73 The backfill of the longitudinal duct trench for roadside technology and communications with longitudinal and local ducts shall be as Figure 15.73.

Figure 15.73 Backfill of the longitudinal duct trench for roadside technology and communications with longitudinal and local ducts



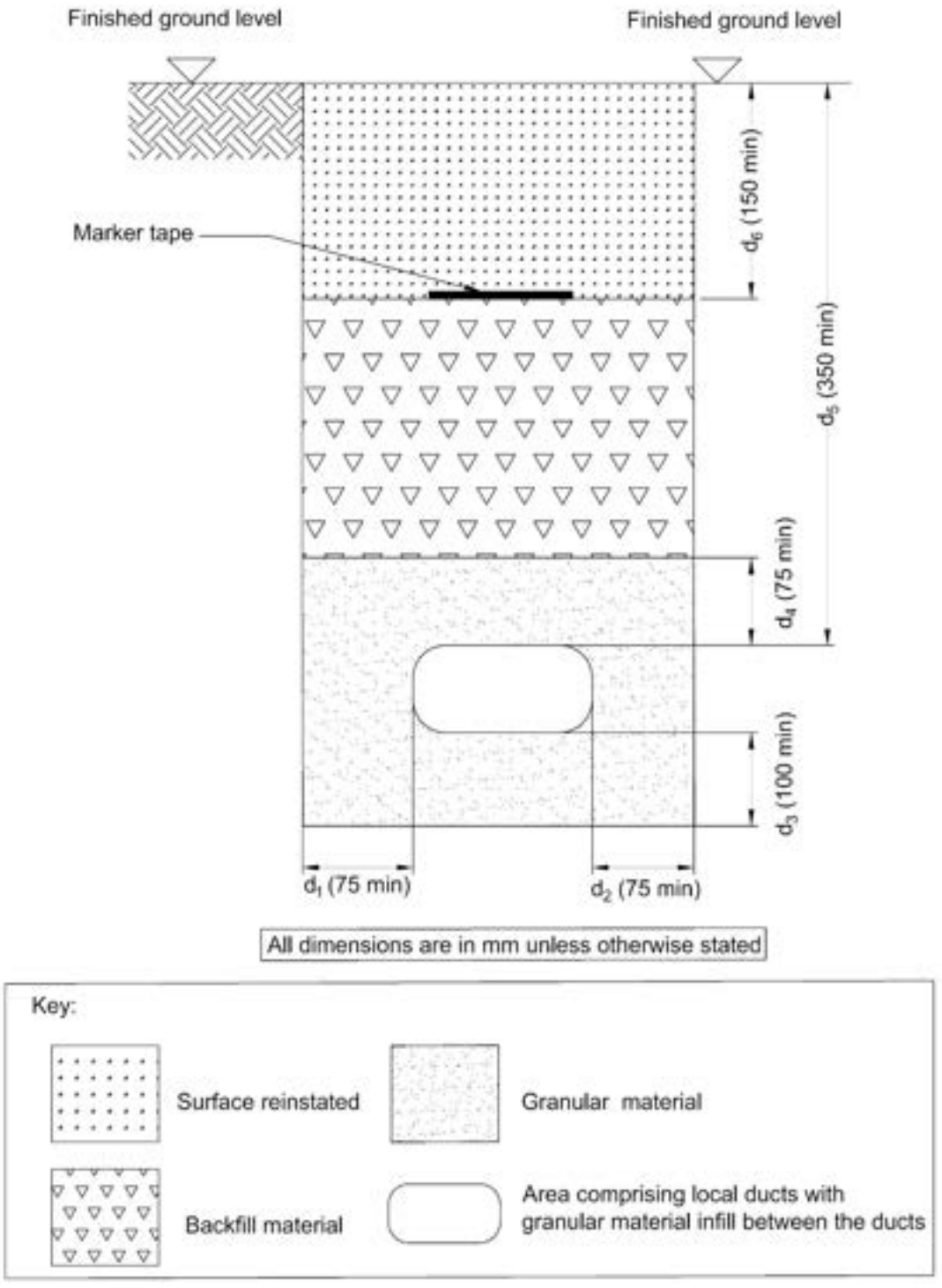
15.74 The backfill of the shallow depth longitudinal duct trench for roadside technology and communications shall be as Figure 15.74.

Figure 15.74 Backfill of the shallow depth longitudinal duct trench for roadside technology and communications



15.75 The backfill of the local duct trench for roadside technology and communications shall be as Figure 15.75.

Figure 15.75 Backfill of the local duct trench for roadside technology and communications



15.76 Longitudinal ducts for roadside technology and communications not at shallow depth shall be installed on a layer of granular material with a minimum depth of d_3 as illustrated in Figure 15.72 and Figure 15.73.

15.77 On longitudinal ducts for roadside technology and communications not at shallow depth, the minimum depth of cover to the uppermost duct shall be d_5 as illustrated in Figure 15.72 or d_6 in Figure 15.73.

15.78 Where the local duct for roadside technology and communications has a compression class of 450 N, the granular material shall be replaced with backfill material.

15.79 The backfill material used for local duct trenches for roadside technology and communications shall be Class 8 material in accordance with "Acceptable earthwork material classes, properties, and testing" in Section 3 of CC 601 [Ref 15.N].

15.80 Duct trenches for roadside technology and communications requiring surface reinstatement involving topsoiling, shall have topsoil and grass seed or turf placed in the top 150 mm of the duct trench, unless otherwise stated in TC 131/WSR/015.

SI.15.80a The alternative method of topsoiling the duct trenches for roadside technology and communications shall be [enter free text].

SI.15.80b The locations where the topsoiling of duct trenches for roadside technology and communications is shallower than 150 mm shall be [enter free text].

15.81 The alternative or additional requirements for bedding, haunching, surround, backfilling, surfacing or reinstatement for ducting for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.81 The alternative or additional requirements of bedding, haunching, surround, backfilling, surfacing or reinstatement for ducting for roadside technology and communications shall be [enter free text].

15.82 Backfilling shall be undertaken immediately after laying of the ducts for roadside technology and communications has been completed.

Installation requirements for alternative ducts for roadside technology and communications

15.83 The requirements for alternative duct installations for roadside technology and communications, or where the minimum cover cannot be achieved shall be as stated in TC 131/WSR/015.

SI.15.83 The requirements of alternative duct installations for roadside technology and communications, or where the minimum cover cannot be achieved shall be [enter free text].

15.84 The locations for the use of alternative duct installations for roadside technology and communications, or where the minimum cover cannot be achieved, shall be as stated in TC 131/WSR/015.

SI.15.84 The locations for the use of alternative duct installations for roadside technology and communications, or where the minimum cover cannot be achieved, shall be [enter free text].

Installation of cross carriageway ducts (CCD) for roadside technology and communications

15.85 Ducts used in the construction of CCDs for roadside technology and communications shall be securely bundled together and installed through the crossing with a minimum cover above the top of the combined bundle of 8 times the reamed diameter of the bored hole.

15.86 For shallow CCDs for roadside technology and communications with between 750 mm and 1200 mm cover, the fill above the ducts shall be GEN2 concrete, with a minimum depth of 150 mm above the ducts, in accordance with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 33.N].

15.87 The duct used in the construction of CCDs for roadside technology and communications shall have a minimum clearance of 150 mm below a drain and 100 mm clearance above a drain, taking into account the minimum depth requirement for the duct itself.

15.88 The use of duct spacers and strapping shall not be required for CCDs for roadside technology and communications installed using trenched techniques.

Installation of CCDs for roadside technology and communications using a trenchless technique

15.89 Ducts for roadside technology and communications installed using trenchless techniques beneath existing carriageways shall be installed by either:

1. using trenchless techniques with at least 300 mm clearance between the ducts and the road construction, comprising of a minimum of 4 x 100 mm ducts within a sleeve; or

2. a minimum four-duct bundle without a sleeve using directional drilling with the approval of the Overseeing Organisation.

15.90 CCDs for roadside technology and communications installed without a sleeve using trenchless techniques shall conform to the requirements of "Specification requirements for trenchless crossings" in Section 1 of CC 604 [Ref 92.N].

15.91 The additional requirements for CCDs for roadside technology and communications installed without a sleeve using trenchless techniques shall be as stated in TC 131/WSR/015.

SI.15.91 The additional requirements of CCDs for roadside technology and communications installed without a sleeve using trenchless techniques shall be [enter free text].

15.92 The CCDs for roadside technology and communications installed without a sleeve using directional drilling techniques shall consist of a minimum of 4 x 100 mm internal diameter medium density polyethylene (PE 80) pipes.

15.93 The pipe bores for CCDs for roadside technology and communications installed without a sleeve shall be terminated in a chamber at each end.

15.94 The pipe bores for CCDs for roadside technology and communications installed without a sleeve shall be smooth and even so as to not damage cables as they are pulled through.

Installation of CCDs for roadside technology and communications using trenched techniques

15.95 Trenched techniques for CCDs for roadside technology and communications shall use granular materials, in accordance with "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

15.96 The backfill for CCDs for roadside technology and communications constructed using trenched techniques shall be in accordance with "Drainage pipes" in Section 1 of CC 500 [Ref 14.N].

15.97 The installation requirements of trenched techniques for duct crossings of existing carriageways for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.97 The installation requirements of trenched techniques for duct crossings of existing carriageways for roadside technology and communications shall be [enter free text].

Installation of sub-ducts for roadside technology and communications

15.98 Sub-duct colours for roadside technology and communications shall follow a consistent orientation and pattern throughout.

15.99 The individual sub-ducts for roadside technology and communications, where exposed, shall be uniquely identifiable within chambers.

15.100 Sub-ducts for roadside technology and communications 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.

Installation of continuous sub-ducts for roadside technology and communications

15.101 Continuous sub-ducts for roadside technology and communications within an outer main duct shall be fixed to prevent the misalignment of sub-ducts with outer main duct and inner sub-duct seals.

15.102 Continuous sub-ducts for roadside technology and communications within an outer main duct shall be sealed to provide protection to at least IP47 in accordance with BS EN 60529 [Ref 10.N].

15.103 The continuous high density polyethylene (HDPE) sub-ducts for roadside technology and communications shall have a standard dimension ratio (SDR) of 11 or less installed between chambers.

15.104 Welded or mechanical couplers used to join sub-ducts for roadside technology and communications 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.

Installation of sectional sub-ducts for roadside technology and communications

15.105 Sectional HDPE or unplasticised polyvinyl chloride (uPVC) sub-ducts pre-installed into HDPE or uPVC outer main ducts as a modular arrangement for roadside technology and communications shall prevent the misalignment of sub-ducts and preserve their colour coding between chambers.

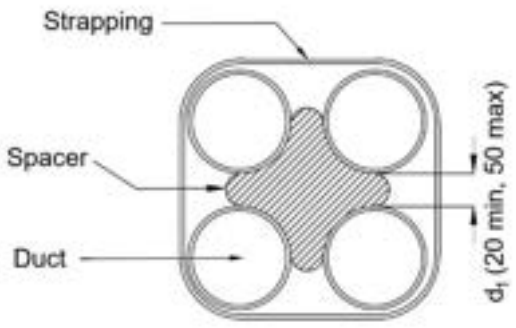
15.106 Sectional HDPE sub-ducts for roadside technology and communications moulded directly within an outer main duct with keyed coupler arrangements and duct sealing shall provide protection to at least IP47 in accordance with BS EN 60529 [Ref 10.N] for the sub-duct.

15.107 Welded or mechanical couplers used to join sectional HDPE sub-ducts for roadside technology and communications 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.

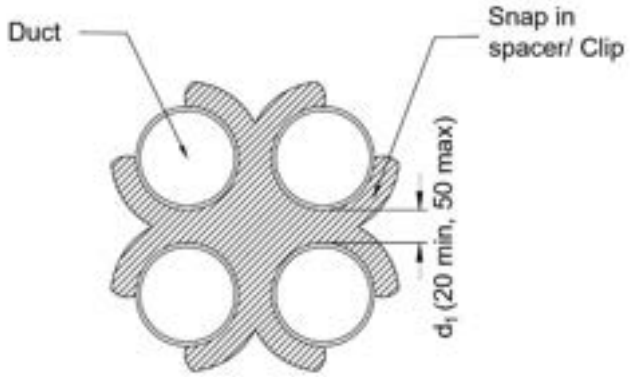
Installation of duct spacing and strapping for roadside technology and communications

15.108 Ducts for roadside technology and communications shall be retained in place by using duct spacers or an equivalent alternative system as shown in Figure 15.108.

Figure 15.108 Duct spacing for longitudinal duct arrangements and an alternative spacer/slip arrangement for roadside technology and



Section through longitudinal duct arrangement



Alternative snap in spacer / clip arrangement

All dimensions are in mm unless otherwise stated

communications.

15.109 The use of duct spacers and strapping for roadside technology and communications shall not be required for ducts through gantry foundations.

15.110 The duct spacers and strapping for roadside technology and communications shall be installed in accordance with the manufacturer’s specifications.

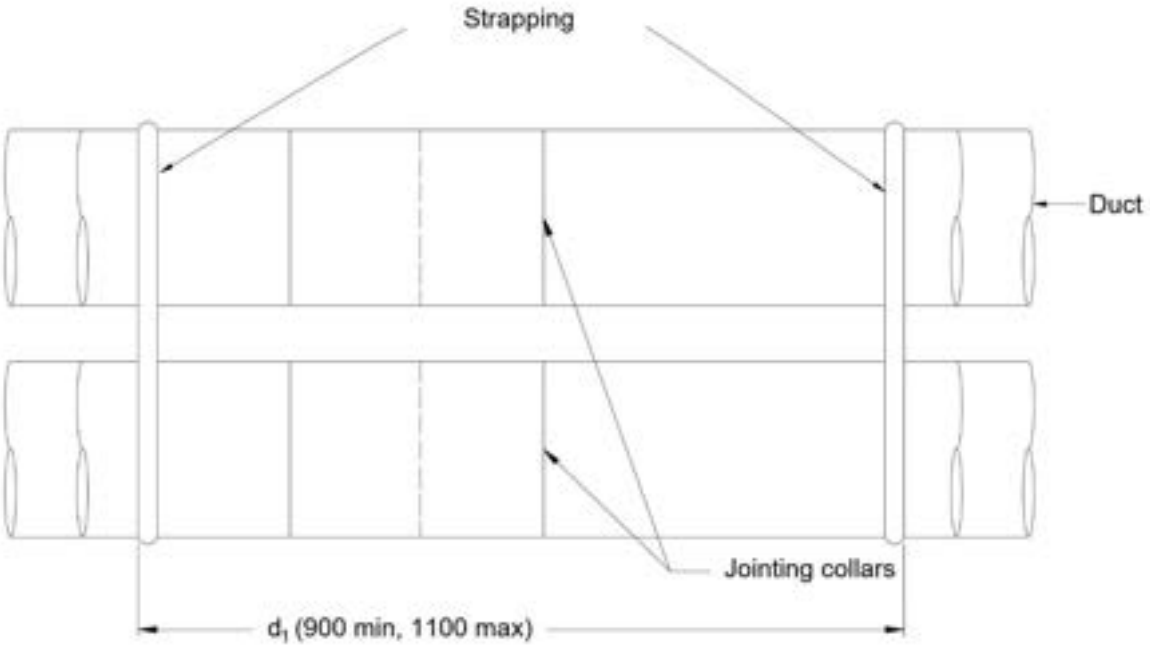
15.111 The ducts for roadside technology and communications shall be separated by spacers to ensure that there is sufficient room for jointing collars.

15.112 The duct spacers for roadside technology and communications shall not cause damage to ducts, either during installation or in service.

15.113 Duct spacers for roadside technology and communications shall allow for the use of excavated material, provided the excavated material does not cause damage to the ducts.

15.114 Strapping for roadside technology and communications shall be installed at intervals d_1 as shown in Figure 15.114, to ensure the duct is kept straight, allowing for backfilling and compaction around rigid ducts.

Figure 15.114 Strapping on ducts for roadside technology and communications



All dimensions are in mm unless otherwise stated

15.115 The strapping used in ducts for roadside technology and communications shall bind the ducts tightly during installation, backfilling and for the whole operational life of the duct.

15.116 The fixing of ducts to chamber walls for roadside technology and communications shall be completed using the manufacturer's fixing kits so as to prevent rotation or twisting during installation.

Installation requirements for marker tape for roadside technology and communications

15.117 The marker tape for roadside technology and communications shall be marked with the wording “CAUTION COMMUNICATIONS/ POWER CABLES BELOW” in addition to the markings stated in BS EN 12613 [Ref 38.N].

15.118 Marker tape for roadside technology and communications used to indicate the position of cables and ducts shall be laid in all trenched ducts at a depth of 150 mm or at the Class 8 topsoil interface whichever is the greater depth, as a warning for workers excavating.

15.119 Marker tape for roadside technology and communications shall be yellow in colour, with wording in black.

15.120 Marker tape for roadside technology and communications shall incorporate a detectable metallic trace wire.

Installation requirements for mechanical duct plugs for roadside technology and communications

15.121 A blanking insert shall be installed for each unused cable port for roadside technology and communications.

15.122 All installed mechanical duct plugs for roadside technology and communications shall have an ingress rating of IP47 in accordance with BS EN 60529 [Ref 10.N].

15.123 Inserts shall be provided for each mechanical duct plug for roadside technology and communications to fit in the cable ports to accommodate the cables.

15.124 The mechanical duct plug for roadside technology and communications shall not hold cables captive.

15.125 The draw cord shall be attached to the rear of the mechanical duct plug for roadside technology and communications to aid future cable installations.

Installation of stub ducts for roadside technology and communications

15.126 The inclusion of stub ducts in chamber construction for roadside technology and communications shall be as specified in the drawings.

15.127 Verification shall be undertaken for each duct section by visual inspection to ensure the stub ducts for roadside technology and communications have been installed in accordance with the specification, with the results recorded on the as-built drawings for that duct section.

15.128 The frequency of the visual inspection of the stub ducts for roadside technology and communications in each duct section shall be once upon completion of installation of all stub ducts in that section prior to backfilling the trench.

15.129 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the visual inspection of the stub ducts in each duct section for roadside technology and communications.

15.130 Stub ducts for roadside technology and communications shall be sealed to prevent ingress of water to IP47 in accordance with BS EN 60529 [Ref 10.N].

15.131 Stub ducts for roadside technology and communications shall be installed in accordance with the manufacturer's instructions.

Requirements for existing ducts for roadside technology and communications

15.132 The re-use of existing ducts for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.132 The drawing or 3D model showing the re-use of existing ducts for roadside technology and communications shall be [enter free text].

15.133 The suitability of existing ducts for roadside technology and communications shall be determined through:

1. use of a mandrel test;

2. visual inspection where the presence of visible sharp edges or discontinuities along the length of the duct is deemed unsuitable.

15.134 An existing duct for roadside technology and communications shall be sleeved or sub-ducted if there is presence of sharp edges or visible discontinuities along the length of the duct, in accordance with the requirements under the sub-heading of 'Installation of sub-ducts for roadside technology and communications' in Section 15 of this document.

15.135 An existing duct for roadside technology and communications deemed to have failed shall be sleeved or sub-ducted with a single HDPE continuous sub-duct acting as a sleeve for the installation of multiple cables or multiple HDPE continuous sub-ducts, with one sub-duct for each cable.

15.136 Duct sealing systems for roadside technology and communications shall retain the sub-duct(s) to the outer duct at each chamber.

Installation of sacrificial ducting for cables for roadside technology and communications

15.137 The requirements for the installation of sacrificial ducting for roadside technology and communications to facilitate the installation of armoured cables installed by the TSP or others shall be as stated in TC 131/WSR/015.

SI.15.137 The requirements for the installation of sacrificial ducting for roadside technology and communications to facilitate the installation of armoured cables installed by the TSP or others shall be [enter free text].

15.138 Sacrificial ducts for roadside technology and communications shall be fit for purpose enabling the TSP or others (where applicable) to correctly install the armoured cable.

Testing of ducts for roadside technology and communications

Mandrel tests

15.139 Verification shall be undertaken for each longitudinal and CCD duct in a duct section for roadside technology and communications, to prove the duct to be viable for cables by drawing a mandrel of 150 mm length, with a diameter of 10 % less than the internal bore of the duct, with the results recorded in the mandrel test certificate for that duct section.

15.140 The frequency of the mandrel test for each longitudinal and cross carriageway duct in a duct section for roadside technology and communications shall be once upon completion of the installation of each duct after the trench has been backfilled.

15.141 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the mandrel test for each longitudinal and cross carriageway duct in a duct section for roadside technology and communications.

15.142 Verification shall be undertaken for each local duct from chambers to cabinets for roadside technology and communications to prove the duct to be viable for cables by drawing through a spherical mandrel of diameter of 10 % less than the internal bore of the duct, with the results recorded in the mandrel test certificate for that duct section.

15.143 The frequency of the mandrel test for each local duct from chambers to cabinets for roadside technology and communications shall be once upon completion of the installation of each length of duct prior to backfilling the trench.

15.144 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the mandrel test for each local duct from chambers to cabinets for roadside technology and communications.

15.145 Verification shall be undertaken for the integrity, in respect of diameter and air-tightness, of each continuous section of duct and sub-duct for roadside technology and communications by blowing a close fitting foam plug (29 mm diameter or the sub-duct internal diameter plus 5 %) or similar arrangement in a single operation, with the results recorded in the mandrel test certificate for that duct section.

15.146 The frequency of the mandrel test for each continuous section of duct and sub-duct for roadside technology and communications shall be once upon completion of the installation of each length of duct and sub-duct prior to backfilling the trench.

15.147 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the mandrel test for each continuous section of duct and sub-duct for roadside technology and communications.

15.148 On successful completion of each mandrel test, when air testing is not required, the duct for roadside technology and communications shall be immediately sealed in accordance with the requirements under the sub-heading of 'Installation of duct plugs or duct sealing for roadside technology and communications' in Section 15 of this document.

Air tests

15.149 Verification shall be undertaken for each new duct chamber-to-chamber for roadside technology and communications, by ensuring the air pressure does not fall to less than 75 mm head of water during a period of 5 minutes without further pumping, after an initial period to allow for stabilisation, when subject to a stable pressure of 100 mm head of water during the air test, with the results recorded in the air test certificate.

15.150 The frequency of the air testing of each new duct section for roadside technology and communications shall be once prior to sealing the duct.

15.151 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the air testing of each new duct section for roadside technology and communications.

15.152 On successful completion of each air test, the duct for roadside technology and communications shall immediately sealed in accordance with the requirements under the sub-heading of 'Installation of duct plugs or duct sealing for roadside technology and communications' in Section 15 of this document.

Other testing

15.153 The requirements for the preparation and proving of new or existing ducts and sub-ducts for roadside technology and communications for the installation of cables by the TSP shall be as stated in TC 131/WSR/015.

SI.15.153 The requirements for the preparation and proving of new or existing ducts and sub-ducts for roadside technology and communications for the installation of cables by the TSP shall be [enter free text].

15.154 The additional requirements for the proving and testing of ducts and sub-ducts for roadside technology and communications shall be as stated in TC 131/WSR/015.

SI.15.154 The additional requirements for the proving and testing of ducts and sub-ducts for roadside technology and communications shall be [enter free text].

Documentation requirements for ducts for roadside technology and communications

Product compliance documentation for ducts for roadside technology and communications

15.155 The Documentation for product specification of ducts for roadside technology and communications located adjacent to filter drains shall be a certificate of compliance with the standard as stated in TC 131/WSR/015.

SI.15.155 The standard for the product specification of ducts for roadside technology and communications located adjacent to filter drains shall be [enter free text].

15.156 The Documentation for product specification of ducts for roadside technology and communications to be used by the TSP shall be a certificate of compliance with the standard as stated in TC 131/WSR/015.

SI.15.156 The standard for the product specification of ducts for roadside technology and communications to be used by the TSP shall be [enter free text].

15.157 The following Documentation shall be submitted for marker tape prior to the commencement of the installation of the marker tape for roadside technology and communications: test report demonstrating compliance with BS EN 12613 [Ref 38.N].

Test documentation for ducts for roadside technology and communications

15.158 The following Documentation shall be submitted for mandrel and air tests for roadside technology and communications prior to the commencement of the cable pulling as part of the TSP works: mandrel and air test certificates.

15.159 Documentation mandrel and air tests for roadside technology and communications shall be submitted prior to the commencement of cable pulling.

15.160 The following Documentation for proving and testing the duct works for roadside technology and communications shall be submitted as continuous records: a register of mandrel and air test certificates.

15.161 The requirements of "Records" in Section 3 of GC 101 [Ref 21.N] shall apply to the register of mandrel and air test certificates for roadside technology and communications.

15.162 The following Documentation shall be submitted for all ducts prior to the commencement of commissioning: duct handover certificate for roadside technology and communications in accordance with GG 182 [Ref 31.N].

15.163 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the duct handover certificate for roadside technology and communications.

15.164 The following Documentation shall be submitted for all ducts prior to the commencement of commissioning: duct handover documentation for roadside technology and communications in accordance with GG 182 [Ref 31.N].

15.165 The requirements for "Documentation" in Section 2 of GC 101 [Ref 21.N] shall apply to the duct handover documentation for roadside technology and communications.

16. Labels for roadside technology and communications

Product requirements of labels for roadside technology and communications

16.1 The tolerance of label dimensions for roadside technology and communications shall be as stated in TC 131/WSR/016.

SI.16.1 The tolerance of label dimensions for roadside technology and communications shall be [enter free text].

16.2 Vinyl labels for roadside technology and communications shall be edge sealed with clear varnish.

16.3 Labels for roadside technology and communications and their method of fixing shall be able to withstand an atmospheric corrosivity category of C5 (very high corrosivity) in accordance with BS EN ISO 12944-2 [Ref 36.N]for 20 years.

16.4 Communications asset bar code labels for roadside technology and communications shall be compliant with SE 1199 [Ref 66.N].

16.5 Cable markers for roadside technology and communications shall be compliant with BS 3858 [Ref 59.N].

16.6 Labels for ERTs for roadside technology and communications shall be in accordance with MCX 1049 [Ref 88.N].

Product requirements for hazard warning and electrical safety labels for roadside technology and communications

16.7 Electrical symbols for hazard warning labels on roadside technology and communications shall be in accordance with BS EN ISO 7010 [Ref 23.N] with the functional reference number W012 - Warning; Electricity.

16.8 Laser symbols for hazard warning labels on roadside technology and communications shall be in accordance with BS EN ISO 7010 [Ref 23.N]with the functional reference number W004 Warning; Laser beam.

16.9 Gas warning symbols for hazard warning labels mandating the use of a gas detector shall be in accordance with BS EN ISO 7010 [Ref 23.N] with the functional reference number M048, Mandatory action sign; Use gas detector.

16.10 Gas hazard warning symbol for hazard warning labels for roadside technology and communications shall be in accordance with BS EN ISO

7010 [Ref 23.N] with the functional reference number W041 Warning; Asphyxiating atmosphere.

16.11 General prohibition symbols for hazard warning labels for roadside technology and communications shall be in accordance with BS EN ISO 7010 [Ref 23.N] with the functional reference number P001 Prohibition; General prohibition.

16.12 Type A enclosure cover replacement hazard warning labels shall be in accordance with the supplementary signs as described in BS ISO 3864-1 [Ref 22.N] with geometric shape - rectangle, safety colour - yellow, contrast colour to background colour - black.

16.13 Type B isolation elsewhere hazard warning labels shall be in accordance with the supplementary signs as described in BS ISO 3864-1 [Ref 22.N] with geometric shape - rectangle, safety colour - yellow, contrast colour to background colour - black..

16.14 Type D electrical safety labels for roadside technology and communications shall be in accordance with the supplementary signs as described in BS ISO 3864-1 [Ref 22.N]with geometric shape - rectangle, safety colour - white, contrast colour to background colour - black.

16.15 Hazard warning labels for roadside technology and communications shall be as stated in Table 16.15.

Table 16.15 Performance characteristics for hazard warning labels for roadside technology and communications

Performance characteristic	Value
Label material	Polyester, plastic or vinyl
Label thickness	0.13 mm minimum
Label corners	Radiused
Label finish	Gloss
Label print	As specified for each type of label
Adhesive	Low surface energy, high temperature acrylic
Surface type to be adhered to	Aluminium, steel, painted or plastic
Environmental conditions	Outdoors, temperature range -15°C to +70° C

Product requirements for equipment identification labels for roadside technology and communications

16.16 The proportion and forms of letters for Type I motorway gantry labels for roadside technology and communications shall be in accordance with UKSI 2016/362 (TSRGD) [Ref 91.N] proportion and forms of letters, schedule 17, Part 1.

16.17 The proportion and forms of letters for Type II labels for roadside technology and communications shall be in accordance with UKSI 2016/362 (TSRGD) [Ref 91.N] proportion and forms of letters, schedule 17, Part 2.

16.18 The proportion and forms of letters for Type V labels for roadside technology and communications shall be in accordance with UKSI 2016/362 (TSRGD) [Ref 91.N] proportion and forms of letters, schedule 17, Part 2.

16.19 The proportion and forms of letters for Type VI labels for roadside technology and communications shall be in accordance with UKSI 2016/362 (TSRGD) [Ref 91.N] proportion and forms of letters, schedule 17, Part 2.

Installation of labels for roadside technology and communications

16.20 Cabinets and enclosures containing power distribution and control equipment shall be labelled to indicate the source of supply, destination and user where there is a third party, circuit arrangements and test details.

16.21 Labels for roadside technology and communications shall be fitted so as not to compromise the IP rating of the cabinet or enclosure.

16.22 Surfaces of roadside technology equipment shall be prepared in accordance with the label manufacturer's instructions before the installation of the label.

16.23 Labels for roadside technology and communications shall be applied in accordance with the label manufacturer's instructions.

16.24 The fitting and replacing of labels when existing cabinets have been modified shall be as stated in TC 131/WSR/016.

The fitting and replacing of labels when existing cabinets have been modified			
Cabinet reference	**Market post**	**Existing cabinet label reference**	**New cabinet label reference**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to identify the cabinet.

b) Enter text, to identify the marker post location of the cabinet.

c) Enter text, to identify the existing cabinet label.

d) Enter text, to identify the new cabinet label.

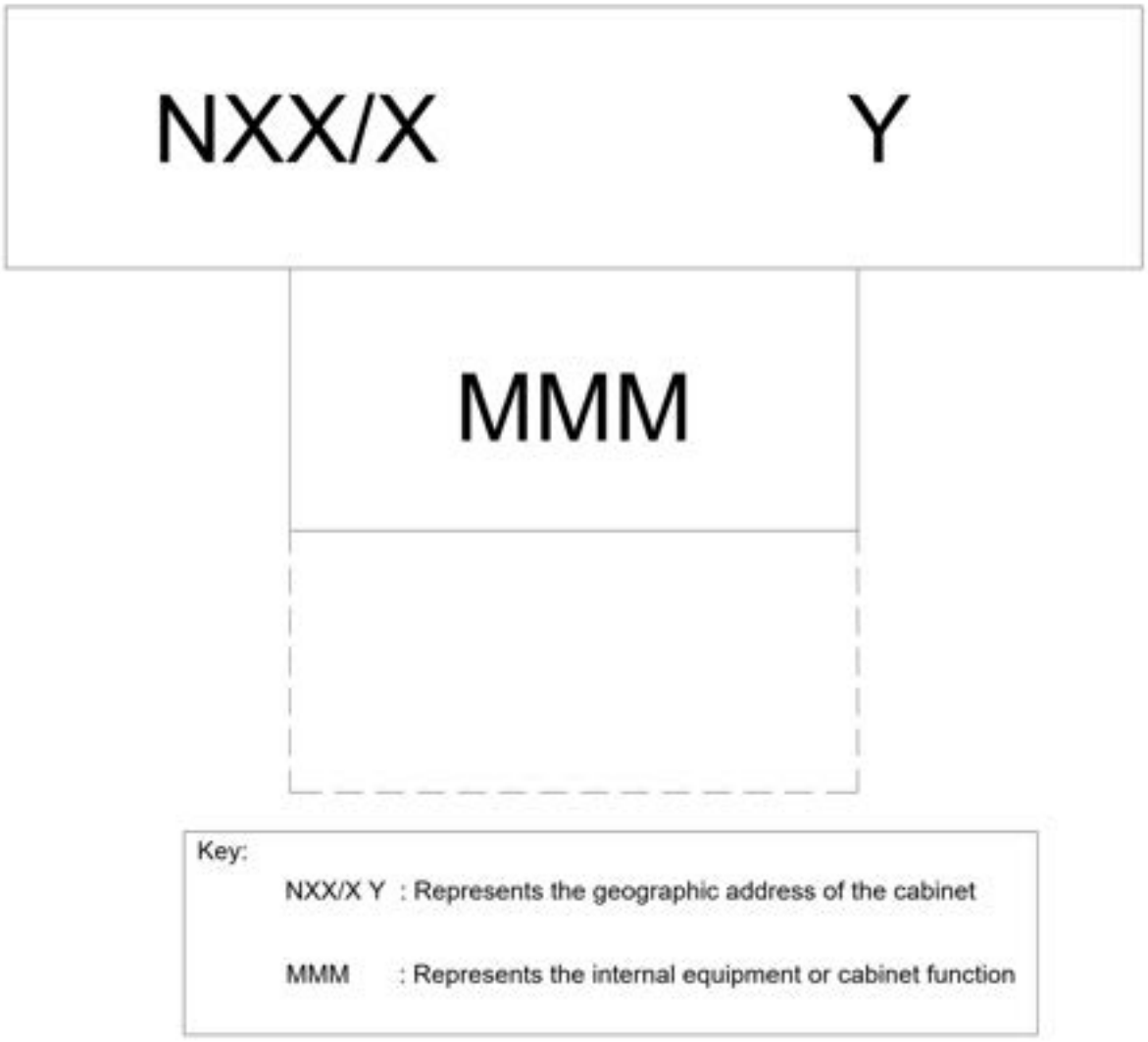
16.25 External labels for roadside technology and communications equipment shall be installed facing the carriageway.

Installation of cabinet identification labels (Type II)

16.26 Cabinet identification labels (Type II) for roadside technology and communications shall be installed on all cabinets for roadside technology and communications with the top edge of the label 50 mm below the top of the cabinet.

NI/16.27 Cabinet identification labels for roadside technology and communications shall contain details of the geographic address (marker post number), carriageway designation letter and internal equipment, or cabinet function as shown in Figure 16.27.

Figure 16.27 Type II cabinet identification labels.



16.28 Numerals and letters for Type II labels for roadside technology and communications shall be 40 mm high in upper case.

16.29 The Type II label for roadside technology and communications shall have a white background with a minimum border width of 12 mm surrounding the letters and numbers.

16.30 The lettering and numbers for the cabinet labels for roadside technology and communications shall be as stated in TC 131/WSR/016.

The lettering and numbers for the cabinet labels for roadside technology and communications					
Local power cabinet or communication cabinet reference	**Local power cabinet or communication cabinet geographic address**	**Local power cabinet or communication cabinet identification**	**EI cabinet reference**	**EI cabinet geographic address**	**EI cabinet identification**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the local power cabinet or communication cabinet for the label to be applied to.

b) Enter text, to identify the geographic address for the local power cabinet or communication cabinet.

c) Enter text, to detail the identification text for the cabinet label which represents the equipment held within that cabinet.

d) Enter a unique reference, to identify the EI cabinet for the label to be applied to.

e) Enter text, to identify the geographic address of the EI cabinet.

f) Enter text, to detail the identification text for the cabinet label which represents the equipment held within that cabinet.

16.31 Verification shall be undertaken for each Type II label for roadside technology and communications by comparing the marker post at the cabinet location with the geographic address on the Type II label to ensure they are the same.

16.32 The frequency of the comparison of the marker post at the cabinet location with the geographic address on the Type II label shall be once prior to the installation of the Type II label.

16.33 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the comparison of the marker post at the cabinet location with the geographic address on the Type II label.

16.34 Cabinet identification references shall be consistent across a scheme, and with references used within record information and drawings.

16.35 Cabinet identification labels on EI cabinets shall be fitted on each cabinet door due to the orientation of the cabinet in the fence line.

16.36 Cabinet identification labels shall be fitted to the cabinet using the fixings provided as part of the cabinet.

Installation of hazard warning labels for roadside technology and communications

16.37 Electrical symbol and laser symbol labels for roadside technology and communications shall be sized to 120 mm vertical height when mounted externally.

16.38 Electrical symbol and laser symbol labels for roadside technology and communications shall be sized to 60 mm vertical height when mounted internally.

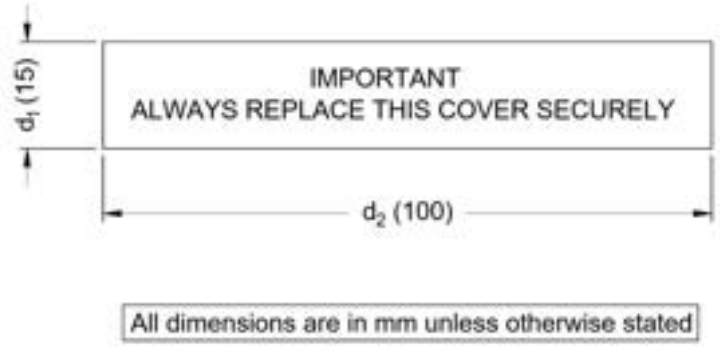
16.39 The location and type of hazard warning labels other than electrical and laser hazards installed on roadside technology shall be as stated in TC 131/WSR/016.

SI.16.39 The location and type of hazard warning labels other than electrical and laser hazards installed on roadside technology shall be [enter free text].

16.40 Type A enclosure cover replacement hazard warning labels shall be installed in power cabinets for roadside technology and communications in accordance with MCX 0164 [Ref 13.N], MCX 0165 [Ref 42.N] and MCX 0170 [Ref 19.N].

16.41 Type A enclosure cover replacement hazard warning labels for roadside technology and communications shall be in accordance with Figure 16.41.

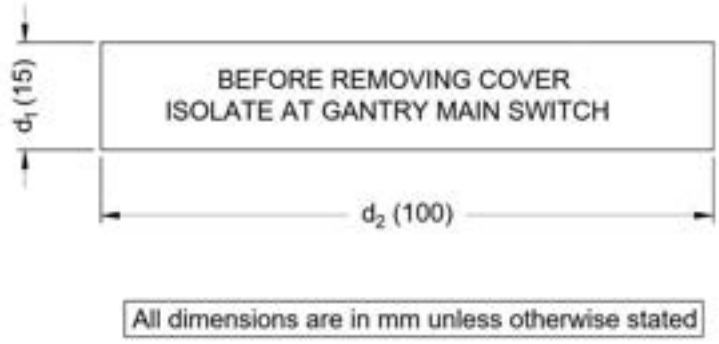
Figure 16.41 Type A enclosure cover replacement warning labels for roadside technology and communications



16.42 Type B isolation elsewhere hazard warning label roadside technology and communications shall be installed in power cabinets for roadside technology and communications in accordance with MCX 0164 [Ref 13.N] , MCX 0165 [Ref 42.N] and MCX 0170 [Ref 19.N].

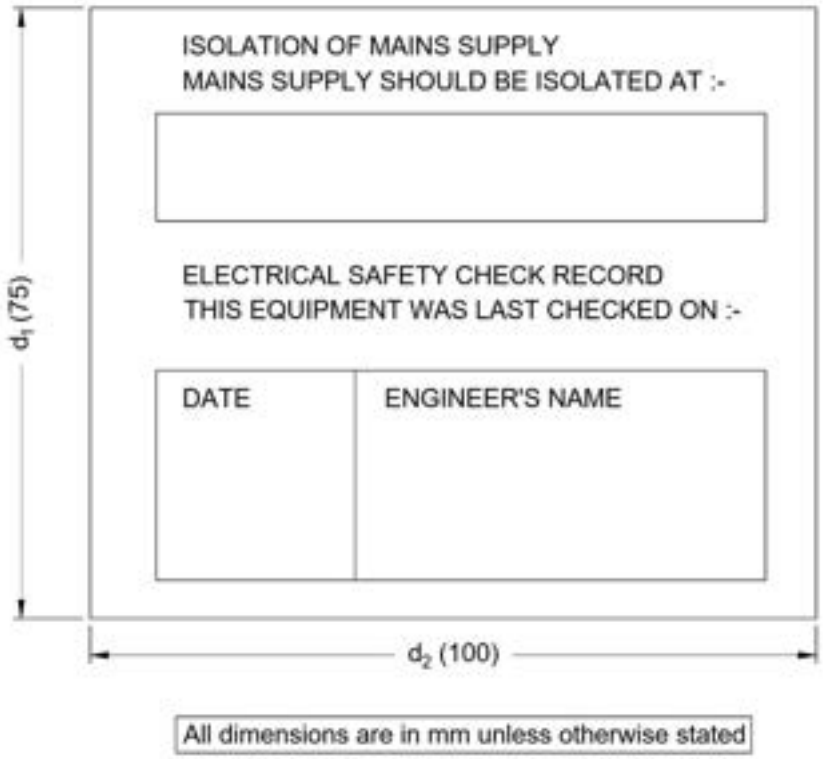
16.43 Type B isolation elsewhere hazard warning labels roadside technology and communications shall be in accordance with Figure 16.43.

Figure 16.43 Type B isolation elsewhere hazard warning labels roadside technology and communications



16.44 Type D electrical safety labels for roadside technology and communications shall be in accordance with Figure 16.44.

Figure 16.44 Electrical safety labels for roadside technology and

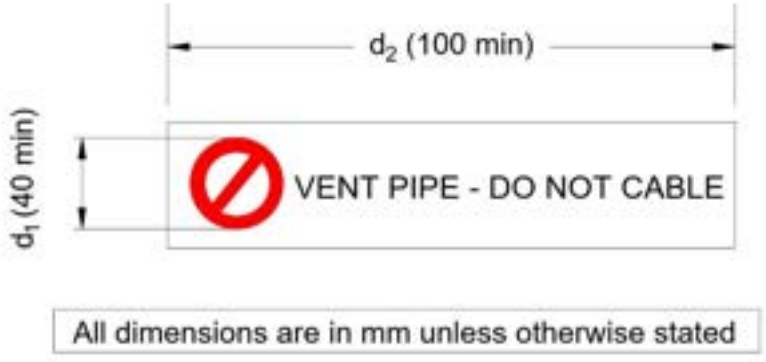


communications

16.45 Type D electrical safety labels for roadside technology and communications shall be fitted inside electrical cabinets and enclosures for roadside technology and communications, in a central location at the top of the cabinet or enclosure door.

16.46 Gas vent hazard warning labels for roadside technology and communications shall be in accordance with the Figure 16.46.

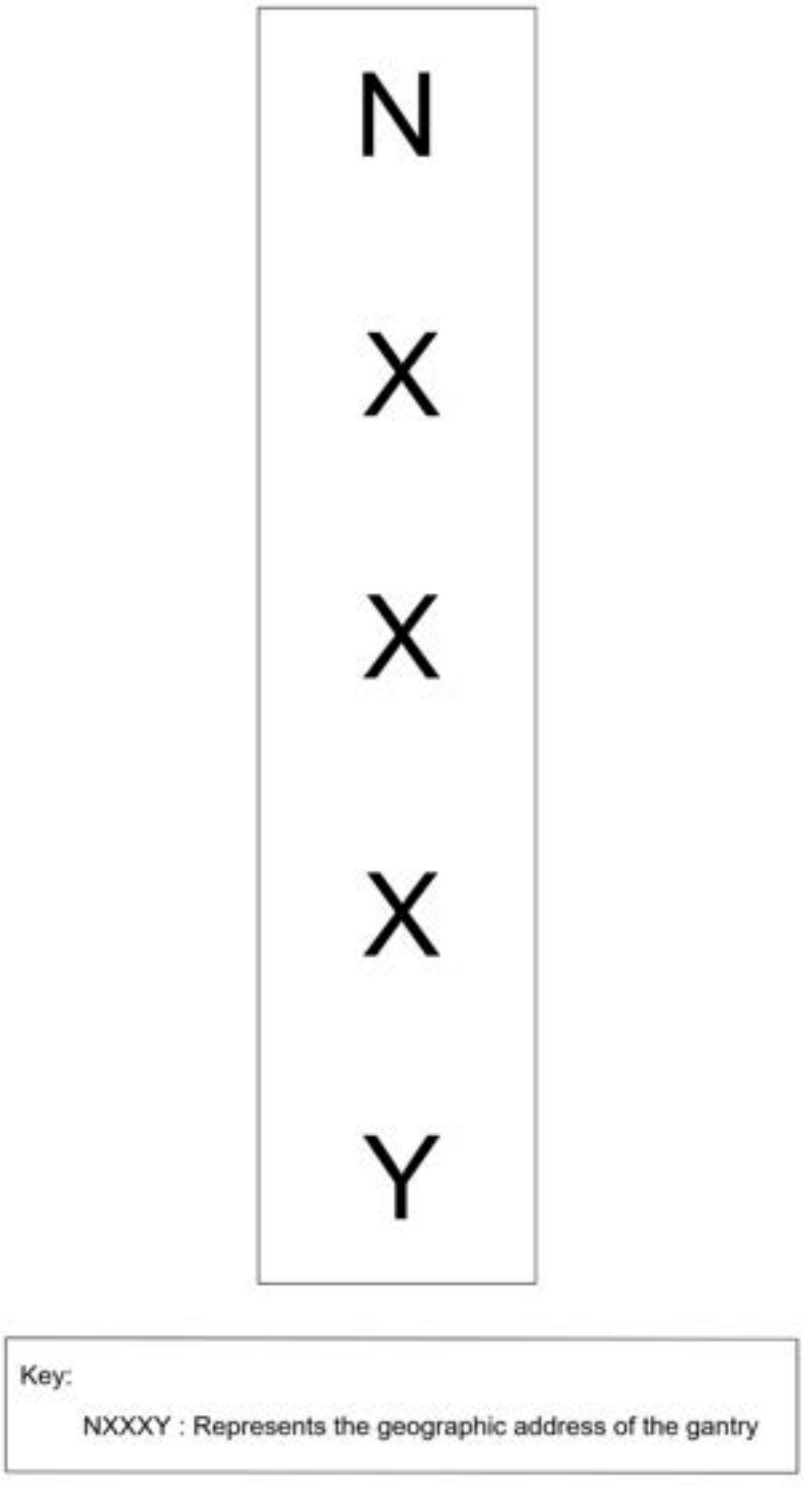
Figure 16.46 Gas vent warning label



Installation of Type I motorway gantry labels

16.47 Type I motorway gantry labels shall be in accordance with Figure 16.47.

Figure 16.47 Type I motorway gantry label.



16.48 The installed height to the bottom of the Type I motorway gantry label shall be a minimum of 2 m above the carriageway level.

16.49 The Type I motorway gantry label shall be installed on the gantry leg facing the traffic.

16.50 100 mm high upper case letters/numerals shall be used for Type I motorway gantry labels.

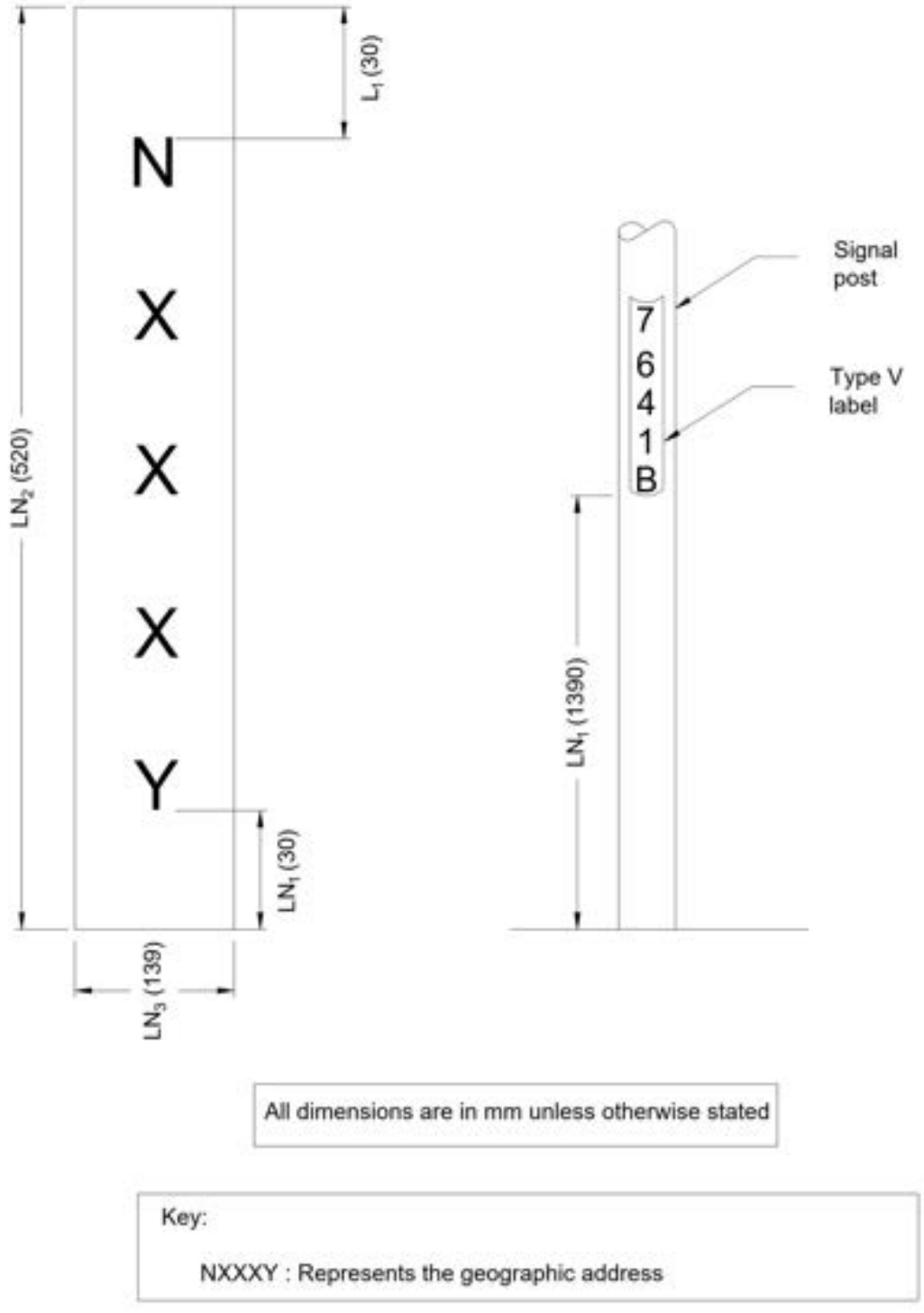
16.51 The minimum white background border for surrounding the letters/numerals on Type I motorway gantry labels shall be 25 mm.

16.52 All surfaces shall be thoroughly cleaned of dirt and grease before vinyl labels are applied to motorway gantries.

Installation of Type V labels for roadside technology and communications

16.53 Type V labels for roadside technology and communications shall be in accordance with Figure 16.53.

Figure 16.53 Type V labels for roadside technology and communications.



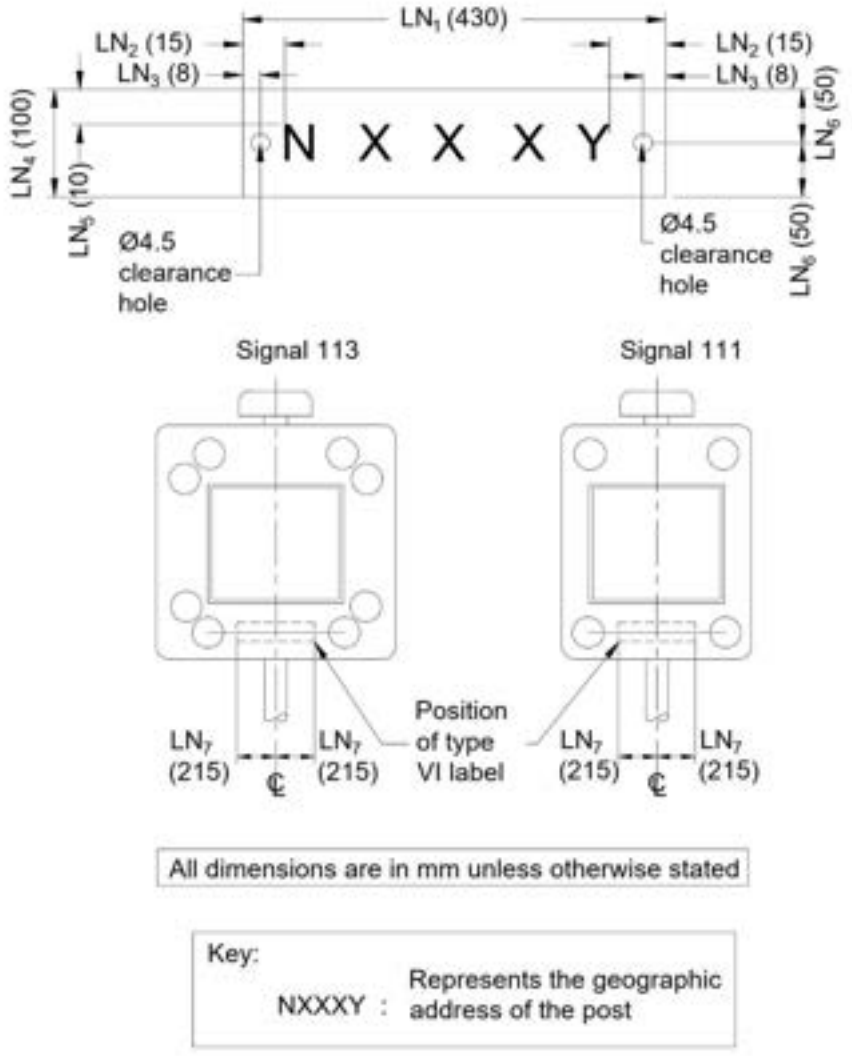
16.54 Numerals and letters for Type V labels for roadside technology and communications shall be 80 mm high.

16.55 Numerals and letters for Type V labels for roadside technology and communications shall be engraved to a minimum depth of 0.3 mm.

Installation of Type VI labels for roadside technology and communications

16.56 Type VI labels for roadside technology and communications shall be in accordance with Figure 16.56.

Figure 16.56 Type VI label for roadside technology and communications.



16.57 Type VI labels for roadside technology and communications shall be compliant with BS 3757 [Ref 62.N].

16.58 The Type VI labels for roadside technology and communications shall meet the following performance characteristics: Type A1, 3 mm thickness.

16.59 Numerals and letters for Type VI labels for roadside technology and communications shall be engraved to a minimum depth of 0.6 mm.

Installation of communications asset bar code labels

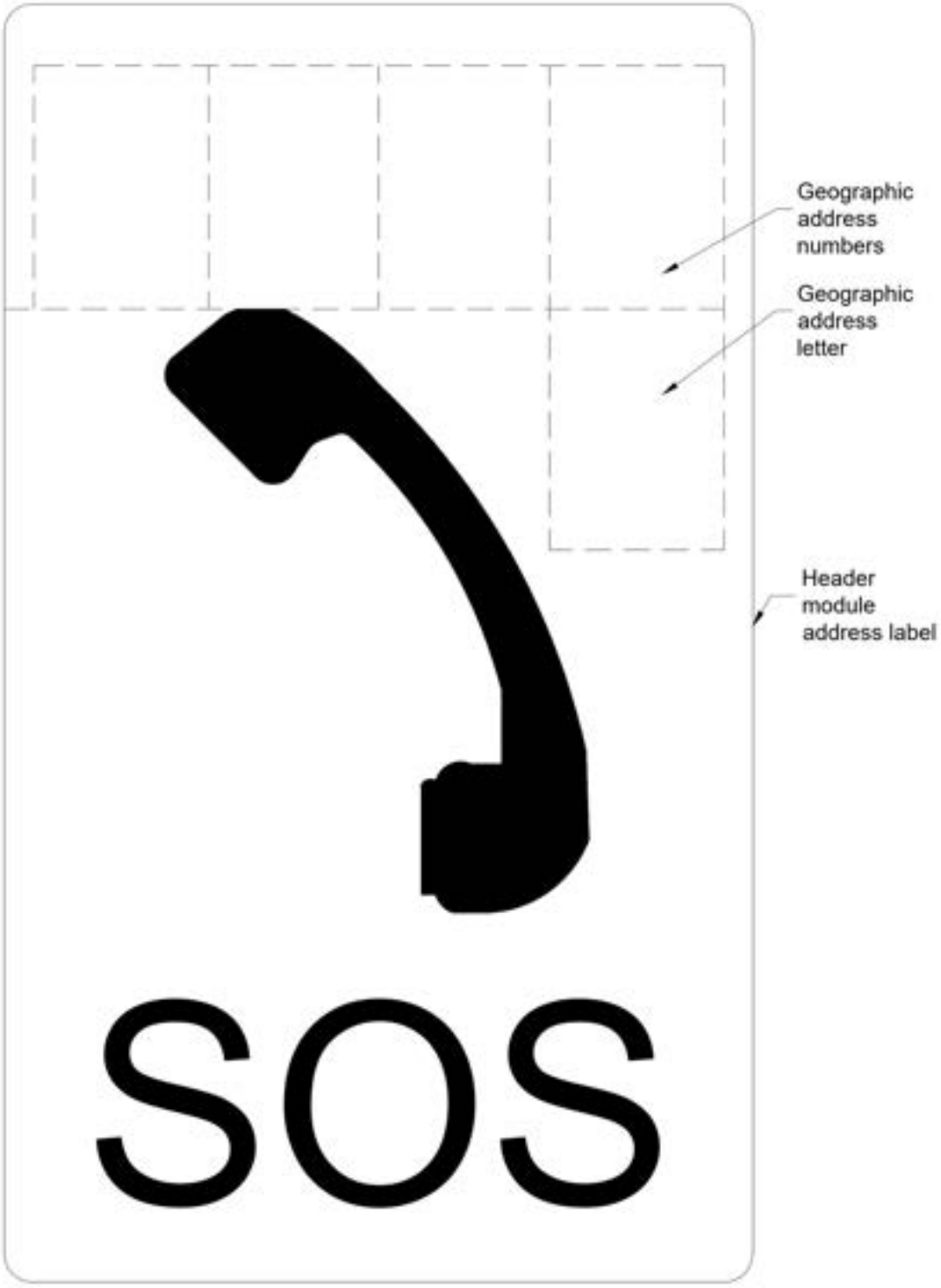
NI/16.60 Communications asset bar code labels shall be installed in accordance with PL 1166 [Ref 43.N].

NI/16.61 Type A communications asset bar code label shall be affixed to the communications chamber mounting plate on the chamber apron.

Installation of labels for ERTs

16.62 The installation of geographic address labels for ERTs shall be in accordance with Figure 16.62.

Figure 16.62 Location of geographic address label for ERT.



Verification requirements for label products for roadside technology and communications

16.63 Verification shall be undertaken for each box of cable markers to inspect the packaging for reference to BS 3858 [Ref 59.N].

16.64 The frequency of the inspection of the packaging for each box of cable markers shall be once upon receipt of the box of cable markers.

16.65 The requirements for "Verification" in Section 14 of GC 101 [Ref 21.N] shall apply to the inspection of the packaging for each box of cable markers.

Documentation requirements of labels for roadside technology and communications

Product compliance documentation for labels for roadside technology and communications

16.66 The following Documentation shall be submitted for electrical symbols for hazard warning labels prior to the commencement of the installation of the electrical hazard warning label: manufacturer's data sheet showing compliance with BS EN ISO 7010 [Ref 23.N] and performance characteristics detailed in Table 16.15.

16.67 The following Documentation shall be submitted for laser symbols for hazard warning labels prior to the commencement of the installation of the laser hazard warning label: manufacturer's data sheet showing compliance with BS EN ISO 7010 [Ref 23.N] and performance characteristics detailed in Table 16.15.

16.68 The following Documentation shall be submitted for gas hazard warning labels prior to the commencement of the installation of the gas hazard warning label: manufacturer's data sheet showing compliance with BS EN ISO 7010 [Ref 23.N] and performance characteristics detailed in Table 16.15.

16.69 The following Documentation shall be submitted for Type I, Type II, Type V and Type VI labels prior to the commencement of the installation of the label: certificate of compliance with UKSI 2016/362 (TSRGD) [Ref 91.N].

16.70 The following Documentation shall be submitted for communications asset bar code labels prior to the commencement of the installation of the label: build standard qualification certificate showing that the product conforms with the Overseeing Organisation's product requirements in accordance with RG 1110 [Ref 54.N].

17. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref.	Document
Ref 1.N	BSI. BS EN 12620, 'Aggregates for concrete (Designated Standard - CPR)'
Ref 2.N	National Highways. OTSL. MCX 1092, 'Cabinet 600 Mk6 Cabinet Body'
Ref 3.N	National Highways. OTSL. MCX 1103, 'Cabinet 600 Mk6 Mini-lacing and IDC frame'
Ref 4.N	National Highways. OTSL. MCX 1032, 'Cabinet 600 Security Strap'
Ref 5.N	National Highways. OTSL. MCX 0991, 'Cabinet 609 Security Strap'
Ref 6.N	National Highways. OTSL. MCH 1652, 'Communications Records Drawings - Computer Aided Drawings Standard'
Ref 7.N	BSI. BS EN 61238-1, 'Compression and mechanical connectors for power cables for rated voltages up to 36 kV (Um = 42 kV). Test methods and requirements'
Ref 8.N	BSI. BS EN 60228, 'Conductors of insulated cables (Designated Standard - LVD)'
Ref 9.N	BSI. BS EN 61386-24, 'Conduit systems for cable management. Particular requirements. Conduit systems buried underground (Designated Standard - LVD)'
Ref 10.N	BSI. BS EN 60529, 'Degrees of protection provided by enclosures (IP code). (Designated Standard - LVD)'
Ref 11.N	National Highways. TD 133, 'Design of cabinets, ducts and chambers for roadside technology and communications'
Ref 12.N	National Highways. OTSL. MCH 2636, 'Detection Technology (Detection on the motorway and trunk road)'
Ref 13.N	National Highways. OTSL. MCX 0164, 'DNO Interface cabinet layout'
Ref 14.N	National Highways. CC 500 'Drainage'
Ref 15.N	National Highways. CC 601 'Earthworks (Series 600)'

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