

Network Standard

NETWORK

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NS205 TELECOMMUNICATIONS ROUTE MARKERS



ISSUE

For issue to all Ausgrid and Accredited Service Providers' staff involved with the design and installation of underground cables and conduits, and is for reference by field, technical and engineering staff.

Ausgrid maintains a copy of this and other Network Standards together with updates and amendments on www.ausgrid.com.au.

Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document.

DISCLAIMER

As Ausgrid's standards are subject to ongoing review, the information contained in this document may be amended by Ausgrid at any time. It is possible that conflict may exist between standard documents. In this event, the most recent standard shall prevail.

This document has been developed using information available from field and other sources and is suitable for most situations encountered in Ausgrid. Particular conditions, projects or localities may require special or different practices. It is the responsibility of the local manager, supervisor, assured quality contractor and the individuals involved to make sure that a safe system of work is employed and that statutory requirements are met.

Ausgrid disclaims any and all liability to any person or persons for any procedure, process or any other thing done or not done, as a result of this Standard.

All design work, and the associated supply of materials and equipment, must be undertaken in accordance with and consideration of relevant legislative and regulatory requirements, latest revision of Ausgrid's Network Standards and specifications and Australian Standards. Designs submitted shall be declared as fit for purpose. Where the designer wishes to include a variation to a network standard or an alternative material or equipment to that currently approved the designer must obtain authorisation from the Network Standard owner before incorporating a variation to a Network Standard in a design.

External designers including those authorised as Accredited Service Providers will seek approval through the approved process as outlined in NS181 Approval of Materials and Equipment and Network Standard Variations. Seeking approval will ensure Network Standards are appropriately updated and that a consistent interpretation of the legislative framework is employed.

Notes: 1. Compliance with this Network Standard does not automatically satisfy the requirements of a Designer Safety Report. The designer must comply with the provisions of the Workplace Health and Safety Regulation 2011 (NSW - Part 6.2 Duties of designer of structure and person who commissions construction work) which requires the designer to provide a written safety report to the person who commissioned the design. This report must be provided to Ausgrid in all instances, including where the design was commissioned by or on behalf of a person who proposes to connect premises to Ausgrid's network, and will form part of the Designer Safety Report which must also be presented to Ausgrid. Further information is provided in Network Standard (NS) 212 Integrated Support Requirements for Ausgrid Network Assets.

2. Where the procedural requirements of this document conflict with contestable project procedures, the contestable project procedures shall take precedent for the whole project or part thereof which is classified as contestable. Any external contact with Ausgrid for contestable works projects is to be made via the Ausgrid officer responsible for facilitating the contestable project. The Contestable Ausgrid officer will liaise with Ausgrid internal departments and specialists as necessary to fulfil the requirements of this standard. All other technical aspects of this document which are not procedural in nature shall apply to contestable works projects.

INTERPRETATION

In the event that any user of this Standard considers that any of its provisions is uncertain, ambiguous or otherwise in need of interpretation, the user should request Ausgrid to clarify the provision. Ausgrid's interpretation shall then apply as though it was included in the Standard, and is final and binding. No correspondence will be entered into with any person disputing the meaning of the provision published in the Standard or the accuracy of Ausgrid's interpretation.

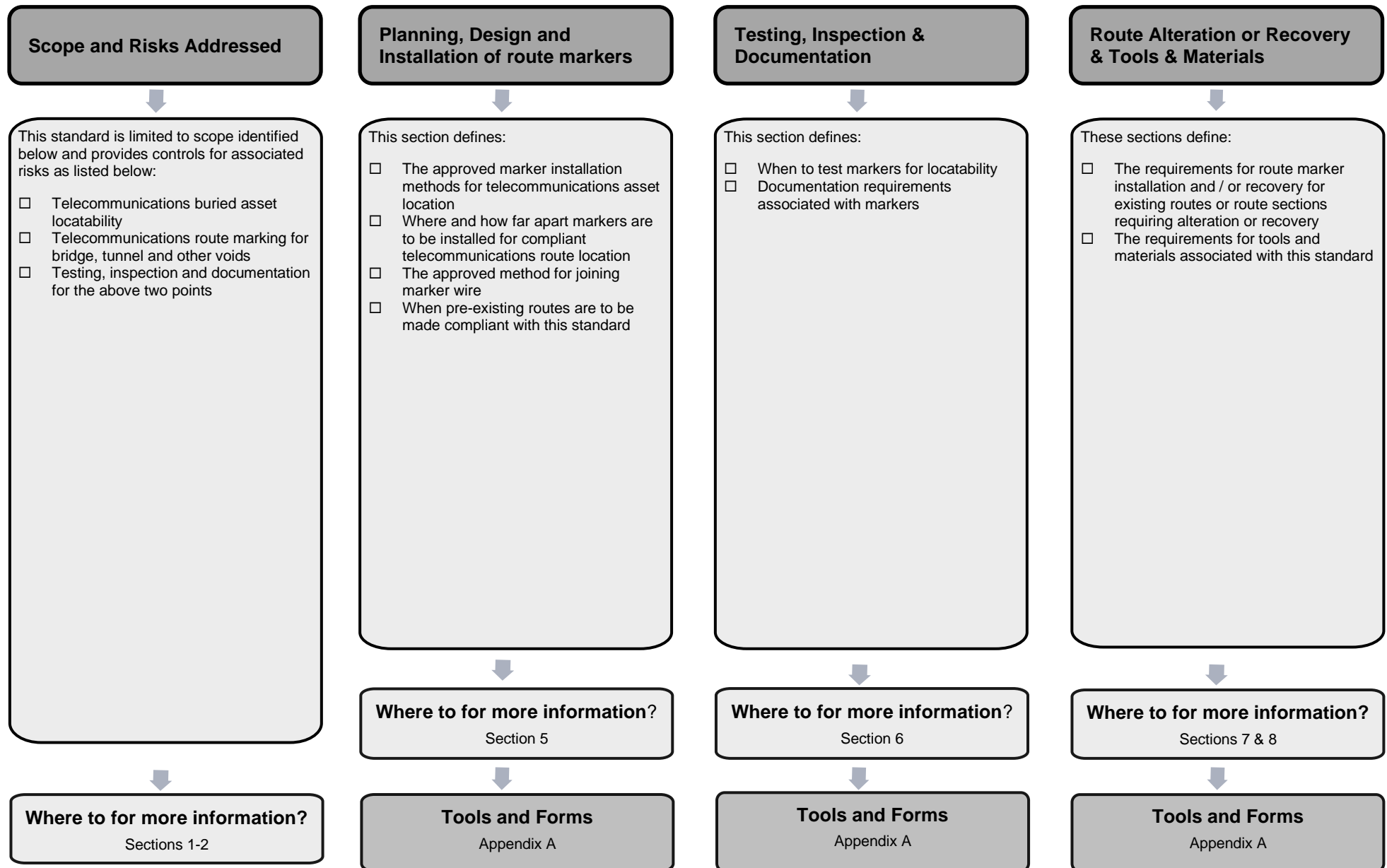
KEYPOINTS

This standard has a summary of content labelled "KEYPOINTS FOR THIS STANDARD". The inclusion or omission of items in this summary does not signify any specific importance or criticality to the items described. It is meant to simply provide the reader with a quick assessment of some of the major issues addressed by the standard. To fully appreciate the content and the requirements of the standard it must be read in its entirety.

AMENDMENTS TO THIS STANDARD

Where there are changes to this standard from the previously approved version, any previous shading is removed and the newly affected paragraphs are shaded with a grey background. Where the document changes exceed 25% of the document content, any grey background in the document is to be removed and the following words should be shown below the title block on the right hand side of the page in bold and italic, for example, Supersedes – document details (for example, "Supersedes Document Type (Category) Document No. Amendment No.").

KEY POINTS OF THIS STANDARD



NS205 Telecommunications Route Markers

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1.0 PURPOSE

Network Standard NS205 provides the specifications and guidelines for the installation of locatable markers over Ausgrid's telecommunications assets installed stand-alone (ie: independent of power cable routes), and the associated plans and documentation requirements.

The majority of Ausgrid's telecommunications underground asset works are for optical fibre cable installation. Optical fibre cable is dielectric, and hence the cable and conduit it is hauled through are not locatable by induction methods once installed underground. This standard was created to reduce the risk of damage to Ausgrid's telecommunications buried assets from subsequent civil works and to provide a form of accurate field asset location for designated underground asset information provider. The methods detailed in this standard facilitate the capture of buried asset GPS coordinate data to link through to Ausgrid's GIS system.

If any of the requirements in this document are ambiguous, the Proponent may refer to Ausgrid for clarification. Ausgrid's interpretation shall then apply as though it was included in the Standard, and is final and binding.

All local instructions must be made to comply with this standard and its related NS and NEG documents as referred to and available on Ausgrid's Balin and internet sites.

It is the responsibility of all Ausgrid staff, contractors, alliance partners and related support mechanisms who are involved with Ausgrid's telecommunications network, to apply this policy and related telecommunications standards and guides at all times.

2.0 SCOPE

This document details the requirements for Ausgrid's buried telecommunications assets installed stand-alone to be made locatable after installation and reinstatement works are complete. This standard defines asset location methods to be applied either at the time of new buried asset installation, or by retrofitting to pre-existing assets. NS205 also defines asset location requirements for Ausgrid telecommunications infrastructure installed through bridge and tunnel voids.

This standard does not apply to earthing, electrical or other utility underground infrastructure. Refer to clause 5.21 of this standard, and also NS235 Telecommunications UGOH Transition standard for instances where the underground infrastructure transitions to overhead installation.

3.0 REFERENCES

3.1 General

All work covered in this document shall conform to all relevant Legislation, Standards, Codes of Practice and Network Standards. Current Network Standards are available on Ausgrid's Internet site at www.ausgrid.com.au.

3.2 Ausgrid documents

- Be Safe 12 – Design;
- Company Form (Governance) - Network Document Endorsement and Approval;
- Company Procedure (Governance) - Network Document Endorsement and Approval;
- Company Procedure (Network) - Production / Review of Network Standards;
- Connection Policy – Connection Charges
- Electrical Safety Rules;
- ES4 Service Provider Authorisation;
- NEG EP01 Guidance Notes for Maintenance, Low Impact and Emergency Access to Existing Facilities within the Railway Corridor;
- NEG EP02 Guidance Notes for Construction of New Facilities Within the Railway Corridor;
- NEG EP05 Access to Private Property;
- NEG EP06 NRP0002 Procedure for Negotiating Mines Access;
- NEG OH01 Undergrounding Telecommunications Cables in Conjunction with Distribution Mains;
- NEG OH13 Guide to Dealing with Requests to Underground Parts of an Overhead Sub-transmission Line;
- NEG UG03 Guideline to Management of Work in Close Proximity to Underground Power Cables (NS156);
- NS100 Field Recording of Network Assets;
- NS104 Specification for Electrical Network Project Design Plans;
- NS130 Laying Underground Cables up to and Including 11kV;
- NS143 Easements, Leases and Rights of Way;
- NS156 Working Near or Around Underground Cables;
- NS159 Installation of Cables or Conduits using Trenchless Techniques;
- NS165 Safety Requirements for Non-Electrical Work in and Around Live Substations;
- NS168 Design and Construction of 33kV, 66kV and 132kV Underground Cables;
- NS174 Environmental Procedures;
- NS181 Approval of Materials and Equipment and Network Standard Variations;
- NS203 Telecommunications Network: Master Policy Document;
- NS204 Communication Pits – Specification and Installation;
- NS211 Working With Asbestos Products;
- NS212 Integrated Support Requirements for Ausgrid Network Assets;
- NS234 Telecommunications Underground Physical Plant Installation;
- NS235 Telecommunications UGOH Transition;
- NS245 Telecommunications Approved List of Materials;
- TS650 and NEG SE05 Safety Equipment – Care, Use and Inspection;
- TS1180 Mains Underground Control, Telephone and Pilot Cables and;
- TS5125 Plant and Tools – Pipe and Cable Locators.

3.3 Other standards and documents

- AS1012 Methods of Testing Concrete;
- AS1141 Methods for Sampling and Testing Aggregates
- AS1289.5.1.1 Soil Compaction and Density Tests – Determination of the Dry Density / Moisture Content Relation of a soil using Standard Compactive Effort;
- AS1289.5.2.1 Soil Compaction and Density Tests – Determination of the Dry Density / Moisture Content Relation of a soil using Modified Compactive Effort;
- AS1289.5.6.1 Soil Compaction and Density Tests – Compaction Control Test – Density Index Method for Cohesion less Material;
- AS1345 Identification of the Contents of Pipes, Conduits and Ducts;
- AS1379 The Specification and Supply of Concrete;
- AS1742 Manual of Uniform Traffic Control Devices;
- AS2053.5 Rigid Plain Conduits and Fittings of Insulating Material;
- AS2124-1992 General Conditions of Contract;
- AS/NZS2648.1 Underground Marking Tape;
- AS2700 Colour Standards for General Purpose;
- AS2758.1 Aggregates and Rock for Engineering Purposes – Concrete Aggregates;
- AS/NZS3085.1 Telecommunications Installations – Administration of Communications Cabling Systems – Basic Requirements;
- AS3610 Formwork for Concrete;
- AS3798 Guidelines on Earthworks for Commercial and Residential Developments;
- AS4000-1997 General Conditions of Contract for Construction Contracts Issued Under Standing Order Deed;
- AS4275 Methods of Testing Underground Marking Tape;
- AS4671 Steel Reinforcing Materials;
- AS/NZS4702 Polymeric Cable Protection Covers;
- AS4902-2000 General Conditions of Contract for Design and Construct;
- AS4910-2002 General Conditions of Contract for the Supply of Equipment with Installation;
- Communications Alliance – Telecommunications in Road Reserves – Operational Guidelines for Installations;
- EA NSW Code of Practice Installation Safety Management;
- EA NSW-1999 NSW Service and Installation Rules;
- EA NSW-ISSC20-2001 Guidelines for the Management of Electricity Easements;
- Electrical Conduit, Conduit Fittings, Cable Protection Covers and Marker Tape;
- ENA D(b)37 Register of Plant Used for Underground Cable Installation;
- ENA Doc 001-2001⁹ National Electricity Network Safety Code;
- ENA NENS 10-2005 National Guidelines for Contractor Occupational Health and Safety Management;
- ESAA C(b)2-1989 Guide to the Installation of Cables Underground;
- MOU – Ausgrid, RMS and Department of Transport;
- Model Agreement for Local Councils and Utility / Service Providers;
- RMS – Guide – Traffic Control at Worksites;
- RMS – Road Occupancy Licence Conditions of Approval – Sydney East, Sydney North, Sydney South – Homebush, Sydney South – Oatley;
- RMS – Protocol for Exchange of GIS data and;
- SAA-HB102-1997 Coordination of Power and Telecommunications – Low Frequency Induction (LFI)
- Shared Trench Utility Agreement;
- WHS – Code of Practice: Excavation;
- WHS – Hazardous Manual Tasks: Code of Practice;
- WHS – Manual Handling Resource;
- WHS – Work Near Underground Assets – Guide.

3.4 Acts and regulations

- Electricity Supply (General) Regulation 2014 (NSW);
- Electricity Supply (Safety and Network Management) Regulation 2014;
- Work Health and Safety Act 2011 and Regulation 2017;
- Protection of the Environment Operations Act 1997;
- Roads Act – Seek Consent Under Section 138 of the Roads Act and.

4.0 DEFINITIONS

Refer to NS001 Glossary of Terms.

5.0 PLANNING, DESIGN AND INSTALLATION

5.1 General

All Ausgrid telecommunications conduits are to be made locatable by one of the methods detailed in this standard for the entire route end-to-end prior to hauling Ausgrid telecommunications cable through. Refer to clause 5.23 regarding route marker retrofit to pre-existing conduits.

The designer is responsible for consulting the Communications Engineering Planning Manager where clarification of the rules or variation from the rules is necessary, prior to progressing installation works. The constructor is responsible for consulting the designer in the same instance.

The Proponent is responsible for compliance with:

- Ausgrid's Be Safe system;
- Ausgrid's Safety in Design procedures (refer NS212);
- Ausgrid Electrical Safety Rules;
- WHS Act 2011 and associated Regulation and;
- NS174 and all relevant laws, rules, regulations and guides for environmental impact assessment.

The Proponent is responsible for assessing and recommending mitigation of risks associated with asbestos in the work place in accordance with Ausgrid's NS211 Working with Asbestos Products and all relevant laws, rules, regulations and guides.

5.2 Excavation and reinstatement

The following sections of NS130 are applicable to this standard with regards to excavation and reinstatement:

- NS130 section 5 regarding AUS-SPEC 1152 (Managed by NATSPEC) for road opening and restoration and;
- NS130 sections 6 – 10 and sections 16 - 18 regarding excavation and reinstatement requirements for instances where compliance with this standard deems retrofit of route markers above existing telecommunications buried assets is required.

Standard NS130, NS159 and NS168 are to be read in conjunction with this standard for telecommunications asset installations co-located with HV underground assets.

Refer to NS234 Telecommunications Underground Physical Plant Installation regarding the installation of stand-alone buried telecommunications conduit and the haul of telecommunications cables.

5.3 Telecommunications route markers

There are five approved methods for making Ausgrid’s telecommunications conduit assets locatable. Each must be installed directly above or attached to the telecommunications asset such that the asset is locatable after the route is reinstated.

The following table summarises the five methods for telecommunications route marking. **The following table is to be used as a guide only. Readers of this document must review the entire document to thoroughly appreciate circumstances under which each method shall apply.**

Table 1 - Ausgrid telecommunications conduit route marking matrix

Method	Description	General Application
1	Warning tape with continuous metallic trace wire	Stand alone telecommunications conduit trenched installation whereby no risk of induction into the trace wire is foreseen by proximity to or paralleling electrical infrastructure
2	Orange non-conductive omni directional frequency based marker devices (ordered pre-set to the telecommunications 101.4 kHz frequency) installed over the top of non-adhesive warning tape with no metallic components	Telecommunications conduit trenched installation whereby the potential foreseeable risk of induction into trace wire by proximity to or paralleling of electrical infrastructure presents a safety risk which can be eliminated by use of this method (2) *(Note 1)
3	Trace wire of min 2.5mm ² gauge hauled through conduit	Stand alone telecommunications conduit underbore installation whereby no risk of induction into the trace wire is foreseen by proximity to or paralleling electrical infrastructure
4	Orange non-conductive omni directional frequency based marker devices installed alone (ordered pre-set to the telecommunications 101.4 kHz frequency)	Telecommunications conduit underbore installation whereby the potential foreseeable risk of induction into trace wire by proximity to or paralleling of electrical infrastructure presents a safety risk which can be eliminated by use of this method (4)
5	Adhesive warning tape with no metallic trace wire	All telecommunications conduit install in bridge utility voids, other voids, enclosed areas, basements, buildings, cable chase, cavities and tunnels

Note 1: Warning tape with no metallic trace wire is to be used where the telecommunications conduit is installed separate to, but in close proximity to an existing or proposed HV feeder or other electrical asset for which induction into trace wire has the potential to present a safety risk, and/or where the trace wire cannot be made continuous between two locked comms pits for other reasons. Non-locatable marker tape over telecommunications conduit must be accompanied by frequency based marker devices.

All marker tapes used for telecommunications conduit as indicated in Table 1 above are to be printed with the following. Refer TDMS drawing 212401.

1/ Non-adhesive 100mm wide marker tape with or without trace wire and installed in the trench above telecommunications conduit shall read:

**AUSGRID FIBRE OPTIC COMMUNICATIONS ASSETS
BELOW CALL 02 8569 6999**

2/ Adhesive 25mm wide non-conductive marker tapes shall read:

**CAUTION
AUSGRID FIBRE OPTIC
COMMUNICATIONS
ASSETS
- DO NOT DISTURB -
CALL 02 8569 6999
FIBRE REF #**

The base colour for optical fibre and general telecommunications marker tapes shall be white. Marker tapes shall have black printing as per AS/NZS2648.1.

All marker tapes are to be installed with the printed side facing up. Adhesive marker tapes must be applied to clean surfaces as per the manufacturer's recommendations for durable adhesion. Marker tapes "1" and "2" above must be installed along the conduit route, not around or across the conduit.

For more secure adhesion of option "2" above, in areas where there is a risk of the label falling off, cable zip ties may be used on top of the adhesive warning tape and around the conduit / subduct between the warning panels where it does not obstruct view of the text.

Refer NS245 Telecommunications Approved List of Materials regarding approved route marking materials.

The Proponent must refer to the Communications Engineering Planning Manager for guidance in all instances where the route location methods detailed in this standard cannot be applied to a particular Ausgrid underground telecommunications conduit installation.



Figure 1 - Example of a telecommunications omni-directional frequency based marker device

5.4 Copper pilot route markers

Ausgrid copper pilot cables are to be marked as per electrical cables with polymeric cable protection covers complying with AS 4702 and NS130 Specification for Laying of Underground Cables up to 11kV.

5.5 Marker depth

All telecommunications marker tapes and devices must be installed at no less than 500mm depth directly above the telecommunications conduit. Marker device installation at depths greater than 1000mm below the finished ground surface level must comply with the manufacturer's recommendation on choice of device and maximum depth of cover, to ensure that the underground asset is locatable after trench reinstatement.

5.6 Geographic considerations

Always position marker devices directly above the Ausgrid underground telecommunications assets, and where possible also near above ground structures such as poles, signs and posts, for future asset location. Route marker devices must be installed in direct line-of-sight to the next locatable device, unless the conduit travels under a solid fence structure. Marker devices must be placed directly above the position where Ausgrid telecommunications cables and conduits cross over or under other utility underground infrastructure.

5.7 Environmental considerations

The Proponent is responsible for compliance with NS 174, and all other laws, rules and regulations regarding environmental impact assessment prior to construction commencement.

All marker tapes and devices used for the location of Ausgrid telecommunications conduit must have a functional life span of at least as long as its co-located telecommunications asset.

Where corrosive soils are present, it is the "Proponents" responsibility to either consult the manufacturer for supply of a route marking product/s rated to withstand the nominated soil condition type, or for applying methods of mitigating the risk of marker corrosion ie: concrete encasement.

Marker devices must not contain environmentally hazardous fluids or substances that may leak into the surrounding soil causing pollution if the marker shell becomes damaged.

Adhesive tapes must not be made of combustible materials, or materials that may release noxious fumes in the event of fire.

5.8 Induction risk assessment

The Proponent is responsible for assessing the potential risk of existing or currently proposed parallel HV feeders or other electrical infrastructure inducing a current into trace wire, thereby presenting a safety hazard. Where there is a potential risk of induction into trace wire, or where trace wire cannot be made continuous between two comms pits, the route must be made locatable by use of methods 2 or 4 as indicated in table 1 above. Refer SAA-HB102-1997 regarding low frequency induction risk assessment.

Frequency based marker disks must be installed no greater than 5m apart and at every change in direction for stand alone telecommunications assets.

5.9 Co-location with HV feeders

Telecommunications conduit installed directly alongside a HV feeder cable and / or conduit, and within the same trench or underbore shall share the standard method of route marking as its co-located HV asset. Refer NS130 and NS168 regarding underground HV feeder installation. Refer also to standard construction drawing 212393 available on Ausgrid's TDMS system for standard methods of straying conduit away from HV feeder routes to a comms pit.

From the originating point that a telecommunications conduit begins to stray away from a HV feeder cable or conduit, the telecommunications conduit is regarded as "stand alone" and shall be made locatable by use of method 2 for marker installation.

5.10 Open trench installation – stand alone

Standalone telecommunications conduit installation by open trenching methods for the entire route between two locked comms pits must apply method 1 locatable marker tape installed above the conduit for the entire route between two pits unless the Proponent has reason to use another method ie: it's presence has the potential to cause safety hazards by proximity to existing or future electrical infrastructure inducing a current into the trace wire. The marker tape must be brought into each of the locked pits at either end of the route, and a length no less than 3m of marker tape coiled tightly inside each pit. Coils of marker tape must be attached to the end wall of the pit at a location which does not restrict existing or future cable and / or equipment installations. Marker tape must not be tied to cable or equipment housed within the pit. Refer clause 5.8 above regarding electrical induction risk assessment.

Telecommunications conduits that are not installed stand alone for the entire route between two pits must utilise method 2 conduit route marking for the entire portion of the conduit that is installed standalone. The minimum number of frequency marker devices installed above a section of standalone conduit less than 5m in length is two, to indicate the conduit direction.

Frequency based marker devices must be installed at intervals no greater than 5m, and at every change in direction for standalone telecommunications conduit.

Trenches that are to be filled with TSB (Thermally Stabilised Backfill) may require telecommunications markers to be anchored to the conduit by zip-ties or rope depending on the constitution of the TSB mix and the trench design. Anchoring marker devices to the asset prevents markers from floating on the surface of the TSB and keeps the marker aligned above the telecommunications asset. Markers floating on TSB may also be operationally voided if the minimum depth of cover is not achieved.

It is the "Proponents" responsibility to design and construct trench excavation and backfill with marker ties and anchors as appropriate to achieve the depth of cover recommended by the marker device manufacturer for optimal marker performance after installation and reinstatement.

Sections of telecommunications conduit installed and end-capped in the ground for future extension must have a frequency based marker device installed directly above the end cap. Examples are:

1. telecommunications conduits under rail lines alongside HV feeder installations, and end capped outside of rail land for future use (refer clause 5.12 below)

2. Spare telecommunications conduits heading out of substations alongside HV feeders and end capped for future use.

5.11 Trenchless techniques – stand alone

Stand alone telecommunications conduit installation by trenchless techniques must be made locatable by either of the following methods:

Method 3 - Min. 3m of the marker wire is to be coiled tightly in the pits at either end of the route and attached to the end wall of the pit at a location which does not restrict existing or future cable and / or equipment installations. Refer clause 5.8 regarding induction risk assessment.

Method 4 - by locating the conduit route during or after installation and potholing to retrofit frequency based marker disks above the conduit at no greater than 5m intervals and at every change in direction, with the only allowable exception to this rule being as described in clauses 5.9, 5.10, 5.12 and 5.14 of this standard.

5.12 Roadway crossings – stand alone

Due to the requirements of certain Roads Authorities (eg RMS and Local Councils), open trenching across certain roadways and other public thoroughfares may not be permitted without specific approval. In all instances, the Proponent shall comply with the requirements of the carriageway asset owner.

The Proponent is responsible for assessing the likelihood of standard road grading and compaction methods damaging the chosen telecommunications marker method. Where there is no risk of damage to the chosen route marking method, open trenching of roadways for stand-alone telecommunications conduit installation shall be treated the same as if it were trenched roadside in terms of route marking.

Road underbores for stand-alone telecommunications conduit installation shall utilise method 3 where there is no induction risk to the trace wire, and where the trace wire can be made continuous between comms pits. Where method 3 cannot be used for the carriageway section, the route must have a minimum of two frequency based marker devices installed directly above the conduit either side of the carriageway and no greater than 2m apart indicating the conduit route direction under the road. Where a road island exists in the middle of the carriageways, the telecommunications conduit route is to be located on the island and frequency based marker devices are to be installed where possible and so long as marker placement is agreeable with the road authority.

Road widening projects must ensure that this standard is applied to existing and new telecommunications conduits travelling under the new carriageway section/s.

5.13 Path and driveway crossings

Telecommunications conduit routes crossing formed concrete, tarred or paved driveways or paths, shall take special precautions to ensure minimal damage to the tarred area, concrete and / or paving. Refer clause 5.8 above regarding trenchless techniques.

Frequency based marker devices must be placed either side of the path or driveway crossing to indicate the telecommunications conduit direction between. Industrial and / or commercial driveways exceeding 10m width must have a minimum of two frequency based marker disks placed either side of the driveway and no more than 2m apart to indicate the conduit direction between.

5.14 Parking lot crossings

Telecommunications conduits crossing tarred, concrete or paved parking lots by trenchless methods must have the conduit located during or after installation, and potholed to install frequency based marker devices at intervals no greater than 5m, and at every change in direction. Marker placement in these cases must minimise impact on car park users, and must not block or obstruct vehicular or pedestrian exits. These rules are subject to agreement with the car park authority.

5.15 Railway crossings

All telecommunications conduit and associated marker installations crossing under railways shall be arranged and approved in accordance with the Master Access Deed between Ausgrid and Rail. Ausgrid's Representative will co-ordinate approval. Approval to proceed with the work shall be obtained before the commencement of any work.

All new telecommunications conduit crossings under railways must extend the ends of the conduit to outside of the rail property boundary at the time of installation. At either side of the rail corridor, two frequency based marker disks are to be placed no more than 2m apart to indicate the conduit direction under the rail line. If the telecommunications conduit is not going to be extended further away from the rail underbore at the time of installation, then the conduit ends are to be securely capped, and frequency based marker devices are to be installed directly above the end caps to enable future conduit location and extension.

Marker devices are not to be installed within rail property. Trace wire may be hauled through telecommunications conduits installed under rail lines where there is no potential risk of induction from other electrical assets, each end of the conduit enters a locked comms pit, and provided the Proponent has received all necessary approvals from the rail authority to perform the work. Refer clause 5.8 regarding induction risk assessment.

5.16 Pits

The vast majority of Ausgrid telecommunications pits are installed with the lids and upper pit surface made flush with the surrounding ground surface. Refer to NS204.2.1 Communication Pits: Specification and Installation Guidelines" regarding Ausgrid J8 protection telecommunications pits.

Ausgrid prefer protection fibre pits installed with the upper lids made flush with the surrounding ground surface, however, where burying pits is unavoidable, design and construction must not proceed until approval to do so has been given by the Communications Engineering Planning Manager. Buried pits must have one flat uni marker disk glued to the top of each pit lid. Markers must not be attached to the underside of the pit lid, as this reduces the locatability of the buried pit. Buried pits must have their type and GPS coordinates uploaded to Ausgrid's GIS.

5.17 Bridge attachment and tunnels

All telecommunications cable installations via conduit attached to bridge structures, through tunnels, or through bridge utility voids must comply with the requirements of the bridge or tunnel asset owner. Where bridge or tunnel asset owners require conduit and route marking methods that contradict this section, the Proponent must refer to the Communications Engineering Planning Manager for guidance.

Conduit that will be attached to external surfaces of a bridge must be marked as per the appropriate choice out of methods 1-4 on approach to the bridge structure up to the point where it exits the ground. Where the conduit exits the ground to an unenclosed exposed area it is to be mechanically protected and unmarked for the entire exposed area, and its location on the bridge recorded descriptively and accurately on as built drawings submitted to Ausgrid for storage. This includes drawings of the bridge structure showing the conduit attachment.

Telecommunications cable or conduit installed through an enclosed bridge utility void or tunnel must be marked with a complete written section of adhesive non-conductive warning tape (method 5) attached at intervals no greater than 5m, with the label installed on the top of the cable or conduit, or on the most visible exposed side if there are obstructions. Cables and conduits must be cleaned prior to attachment of adhesive tape for a strong and durable adhesion, as per the tape manufacturer's recommendation.

Refer NS234 Telecommunications Underground Physical Plant Installation regarding bridge and tunnel telecommunications conduit and cabling.

5.18 Waterways crossings

Telecommunications conduits installed by trenchless methods across a water way shall typically be co-located with a HV feeder, and therefore share the HV feeder route marking methods. Refer NS130 and NS168.

Stand-alone telecommunications conduits will most likely not be installed by trenchless methods across a waterway. If there is a need for this type of installation, refer to the Communications Engineering Planning Manager for guidance on route marking.

5.19 Telecommunications conduit entering HV substations

Stand-alone telecommunications conduits approaching a substation must stop all conductive trace wire a minimum of 50m from the boundary / earth grid or in compliance with earth potential rise and induction assessment which is to be conducted by the Proponent. Trace wire must not be brought into any substations or buildings associated with the substation on the same substation earth grid. Refer Australian Standard SAA-HB102-1997 "Coordination of Power and Telecommunications – Low Frequency Induction (LFI)".

Stand-alone telecommunications conduits approaching substations are to enter a locked communications pit to be installed a minimum of 50m from the substation fence line. This pit is an ideal strategic location to transition from the method 3 trace wire route marking method to method 2 frequency based marker devices on the substation side, as it will provide sufficient clearance in relation to Earth Potential Rise (EPR) for the approach of most subtransmission substations in the Ausgrid franchise area. Frequency based marker devices are to be installed no more than 5m apart and at every change in direction.

Telecommunications conduits installed alongside HV feeders through to a substation basement shall share the route marking methods of the co-located HV feeder – refer NS130 and NS168.

Refer NS219 Telecommunications Cabling in Ausgrid Premises for standard labelling of fibre cables, conduits and subducts internal to buildings required in addition to the conduit marking methods detailed in this specification.

5.20 Approaching other building structures

Telecommunications conduit approaching other buildings including, but not limited to, Ausgrid depots, offices and fibre marshalling kiosks shall comply with the route marking standards set out in this document. Trace wire must not be brought into any building or part thereof.

5.21 Underground to overhead transition points

Fibre Underground to Overhead Transitions (UGOH) are to utilise method 2 for telecommunications conduit route marking between the UGOH pole and the nearest locked comms pit. Refer drawing 212836 available on Ausgrid's TDMS system.

Fibre UGOH transitions within 50m of a substation fence line are to utilise method 2 for telecommunications conduit route marking heading towards the substation up to the cable chase, basement, fibre marshalling shelter or building entry point.

5.22 Joining marker wire and marker tape

Marker wire hauled through conduit (method 3) must be in a continuous length with no joins between comms pits.

Marker tape installed over telecommunications conduit (method 1) may be joined mid-way between pits, so long as the ends of the conductive wire are clamped together, and a protective sheath completely covers the join such that no part of the metallic wire is exposed. The non-conductive warning component of the tape is to continue through under the join with min. 500mm overlap. This rule also applies to marker tape damages and breakages.

Non-adhesive marker tape with no metallic components installed in a trench over telecommunications conduit (method 2) must have min. 500mm overlap for joins. This rule also applies to marker tape damages and breakages.

5.23 Locatability of existing conduits

Ausgrid has existing spare telecommunications conduits as part of its underground infrastructure. Prior to the release of this document, the majority of telecommunications conduits will not have been fitted with route markers in compliance with this standard for stand-alone sections.

It is the “Proponents” responsibility to assess existing conduits for their locatability and also to make the conduits locatable by one of the methods described in this document for the following two scenarios:

- prior to the haul of new Ausgrid telecommunications cable through an existing unoccupied telecommunications conduit
- prior to the haul of a second or subsequent Ausgrid telecommunications cable in an existing occupied telecommunications conduit.

The Proponent must make existing telecommunications conduits locatable in compliance with this standard for the entire length of conduit proposed for fibre cable haul, prior to the fibre cable haul.

5.24 Co-location with LV cables

New installations of Ausgrid telecommunications conduits in shared trench arrangement with LV cables will be required occasionally. The Communications Engineering Planning Manager shall advise the project manager and / or designer when this arrangement is required. Where co-location with new LV installation is required, the telecommunications conduit route must have frequency based marker devices installed over the conduit in compliance with this standard following the same principles as for “stand alone” conduit.

Ausgrid also has existing telecommunications conduits and cables installed in shared trench arrangement with LV cables which may not be fitted with frequency based marker devices. If the co-located LV cable is disconnected and proven isolated, then frequency based marker devices must be installed over the telecommunications conduit in compliance with this standard prior to the haul of any new telecommunications cable, with the exception of the Sydney CBD. Refer to the Communications Engineering Planning Manager for guidance with atypical circumstances.

5.25 Recoverable and contestable works

The Proponent is responsible for applying this standard to the design and construction of all Ausgrid owned underground telecommunications infrastructure for all projects including but not limited to recoverable and contestable works projects.

5.26 Shared trenching agreements

It is the “Proponents” responsibility to mandate that telecommunications conduit installed in shared trench arrangement with telecommunications carrier or other non-electrical utility infrastructure are to comply with this standard in terms of route marking methods regardless of whether the carrier has their own route marking method.

It is the “Proponents” responsibility to mandate that telecommunications conduit installed in shared trench arrangement with assets belonging to an external electrical entity are to also comply with this standard regardless of whether the entity has their own route marking method.

Refer to NS130, NS168 and clause 5.9 of this document regarding telecommunications conduit installed in shared trench arrangement with Ausgrid electrical infrastructure.

Project records shall clearly define the start and finish points of the shared trench, its dimensions, and the service utilities involved (sectionalised if necessary to indicate the presence or absence of certain utilities).

Where trenches are shared with other utilities, the Proponent is responsible for coordinating Ausgrid works with the laying of other utilities' services.

5.27 Marker posts

Above ground marker posts must NOT be used for telecommunications conduit route marking.

5.28 Omni marker separation

Omni markers must have min 203mm separation from any large metallic object including but not limited to HV or LV cables.

5.29 DTS

DTS cables and / or conduits may occasionally stray away from HV feeder routes to enter pits for calibration and hauling purposes. The Designer should apply this standard for the DTS cables and / or conduits where this is the case.

Refer to the Communications Engineering Planning Manager for guidance with atypical circumstances.

6.0 TESTING, INSPECTION AND DOCUMENTATION

6.1 Marker testing

Once an installation is completed including surface restoration, all marker tapes and / or frequency based marker devices must be tested by the Proponent for the entire installation route. All marker tapes and frequency based marker devices that are not able to be detected from the appropriate inductive or frequency location device held above the finished ground surface level are therefore deemed to be either defective or incorrectly installed. Defective items must be relocated, repaired and / or replaced by the Proponent at the "Proponents" expense, prior to asset acceptance and project completion, and prior to telecommunications cable haul.

As built documentation must include marker test results along with the time and date of the test, and also the printed name and signature of the individual who performed the test.

6.2 Inspection by Ausgrid

Ausgrid may perform site inspection and audits at any time through the project works in accordance with NS243 Telecommunications Roles, Responsibilities, Training Requirements, Auditing and Quality Assurance Acceptance.

Unforeseen site conditions requiring a telecommunications conduit marker design change must comply with this standard for the new marker placements. All changes from the original design are to be documented on as built plans and submitted to Ausgrid for GIS upload and records storage.

Design changes to route marking methods that cannot for some reason adhere to this standard must not proceed until written approval has been received to do so from the Communications Engineering Planning Manager, and documented in the Appendix A checklist associated with this standard. The Communications Engineering Planning Manager may require further investigation before direction can be given to proceed. Investigation may include but is not limited to site inspection and audits.

Note: Ausgrid inspections are at the "Proponents" expense (refer to publication Connection Policy – Connection Charges for details).

6.3 Design documentation

Design documentation must detail compliance with the relevant clauses of this standard.

The Designer is responsible for gaining Ausgrid's written approval of their designs prior to construction issue.

6.4 Provision of 'As Built' drawings and survey plans by the proponent

Installation of marker tapes and devices does not negate the need for accurate recording of Ausgrid's underground telecommunications network assets. The accuracy of plans and documentation is to support the future field location of Ausgrid's assets, thereby protecting the optical fibre cable from inadvertent damage, considering that other carriers may also use the same frequency based marker asset location methods. Post installation location of these assets shall be by GPS coordinates obtained from GIS combined with field location by either induction into trace wire, or by use of a frequency device location tool.

The Proponent is responsible for providing detailed records of works carried out on Ausgrid's network in the form of 'as built' drawings in accordance with this standard and the requirements of NS100 – Field Recording of Network Assets as well as NS104 Specification for Electrical Network Project Design Plans.

The 'as built' drawings must include GPS coordinates for each marker device, trace wire and conductive marker tapes to permit the related telecommunications asset's location to be accurately recorded in Ausgrid's Geographical Information System (GIS).

As built drawings must also clearly show the presence and location of telecommunications conduits attached to bridge structures, travelling through bridge voids and cable vaults, under rail ways, waterways and roadways or travelling through tunnels. Bridge crossing plans must show topographical and side elevation views, and any other cross sections as necessary to depict the telecommunications conduit path travelling along and / or through each section and changes in direction.

Refer NS234 Telecommunications: Underground Physical Plant Installation regarding telecommunications conduit installation and the related as built recording required including but not limited to, depth of cover over any conduit or cable installation, details of conduit bedding or encasement, conduit sizes and their location relative to property boundaries and other structures.

Final approval and acceptance of completed asset installation works will not be granted unless all underground installations affected by the works have been recorded to the satisfaction of Ausgrid.

7.0 ROUTE ALTERATION OR RECOVERY

The Proponent is responsible for testing the existing telecommunications route location status prior to commencing alteration works. This may include, but is not limited to testing the inductive capability of marker wire or marker tape between pits. Faults with existing telecommunications route location devices and tapes must be reported to Ausgrid's Communications Engineering Manager prior to works commencing.

Buried telecommunications routes, or route sections which are being recovered shall have frequency based marker devices and marker wire recovered where the following conditions all apply:

- i. the route or route section shall not be used again by Ausgrid
- ii. the route or route section has frequency based route marker devices installed

The above conditions apply to route sections being altered, relocated or replaced. All new sections of conduit shall have route marking installed compliant with this standard regardless of the pre-existing route location condition.

Routes or route sections containing the marker wire of *method 3* for which the above two conditions apply shall have the wire recovered from the conduit prior to route retirement.

Remaining underground conduit sections that are not continuous shall be end capped with a frequency based marker device placed directly over the end cap.

Sections of conduit marked by method 1 which are being relocated, shall have the existing marker wire joined to the new marker wire at either end of new route section and made continuous. These sections shall then be tested pit to pit to ensure continuance of the conductive marker wire prior to asset acceptance. If the test fails, the Proponent is then responsible for rectifying the fault at the "Proponents" expense.

Sections of telecommunications conduit marked by method 1 which are being recovered, and whereby the conductive marker tape will no longer be continuous between pits, shall have method 4 marker devices installed over the ends of the conduit either side of the section being recovered, and GPS co-ordinates of the marker devices relayed back to Ausgrid for GIS upload.

Direction for telecommunications route or route section alteration, relocation, replacement or retirement shall be advised in writing by the Communications Engineering Planning Manager (or nominated representative).

8.0 TOOLS AND MATERIALS

The Proponent is responsible for supplying all tools including but not limited to procuring induction based and / or frequency based marker location tools as necessary to fulfil the requirements of this standard.

Unless prior written approval is received from Ausgrid's Telecommunications Planning Group, all materials used to form Ausgrid's telecommunications network must be new and approved in accordance with NS 181 Approval of Materials and Equipment and Network Standard Variations and also NS245 Telecommunications Approved List of Materials standard.

9.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Table 2 – Recordkeeping

Type of Record	Storage Location	Retention Period*
Approved copy of the network standard	Document repository Network sub process Standard – Company	Unlimited
Draft Copies of the network standard during amendment/creation	Work Folder for Network Standards (Trim ref. 2014/21250/161)	Unlimited
Working documents (emails, memos, impact assessment reports, etc.)	Records management systems Work Folder for Network Standards (Trim ref. 2014/21250/161)	Unlimited

* The following retention periods are subject to change eg if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the Records Manager.

10.0 AUTHORITIES AND RESPONSIBILITIES

For this network standard the authorities and responsibilities of Ausgrid employees and managers in relation to content, management and document control of this network standard can be obtained from the Company Procedure (Network) – Production/Review of Network Standards. The responsibilities of persons for the design or construction work detailed in this network standard are identified throughout this standard in the context of the requirements to which they apply.

11.0 DOCUMENT CONTROL

Content Coordinator : Control & Protection Engineering Manager

Distribution Coordinator : Manager Asset Standards

Annexure A – Sample Design and Construction Compliance Checklists

This section is used to identify compliance checks that when applied to the work associated with this Network Standard will satisfy an audit process to establish that the requirements of the standard have been followed. Where non-compliance is the result of specific site conditions or design decisions this needs to be identified in the “variations to standard materials and/or Network Standards” section of the forms. Should additional information be available to document non-compliance decisions, these can be attached to the checklist forms. The checklist and any attached explanatory notes should be saved in the project document repository.



Network Standard Design Checklist Form

NS205 Telecommunications: Route Markers

Project Identification:	
Prepared by: <Name & Position Title>	Date:

This checklist is for internal Ausgrid use only and does not apply to ASPs or contractors who have specific compliance requirements in relation to Contestable project works. The checklist is unique for each network standard and is available within BALIN and the BMS as a separate form that can be amended as required, completed and saved in TRIM with the other project documentation.

This section is used to identify compliance checks that when applied to the work associated with this Network Standard will satisfy an audit process to establish that the requirements of the standard have been followed. It is expected that applicable items would normally be checked as Comply (Yes) as non-compliance is generally not tolerated.

Where non-compliance is the result of specific site conditions or design decisions this needs to be identified in the notes section of the form for each non-compliance and approval sought from an appropriately authorised Ausgrid manager responsible for design approval per NS261 Compliance Framework for Network Standards.

Should additional information be available to document non-compliance decisions, these can be attached to the checklist form. The checklist and any attached explanatory notes should be saved in the project document repository.

For asset compliance and acceptance, the design and construction checklists must be completed and submitted for each project installing or amending infrastructure for which the NS205 standard applies. NS205 covers Ausgrid telecommunications route marker installation. This checklist does not negate the responsibility for the Proponent to review the full NS205 standard for compliance. Clause references will be updated when NS205 is published.

Item	Description	Refer Clause	Completed/ Actioned
	Design Check list		
1.	Design compliance with Ausgrid Electrical Safety Rules as well as WHS Act 2011 and associated Regulation	5.1	Yes/No/NA
2.	Design compliance with NS174 and all relevant laws, rules, regulations and guides for environmental impact assessment	5.1	Yes/No/NA
3.	Design assesses and recommends mitigation of risks associated with asbestos in the work place in accordance with Ausgrid's NS211 Working With Asbestos Products and all relevant laws, rules, regulations and guides	5.1	Yes/No/NA
4.	Designed method/s of route marking complies with NS205 table 1	5.3	Yes/No/NA
5.	Design specifies orange omni-directional frequency based passive devices set to the telecommunications frequency	5.3	Yes/No/NA
6.	Frequency based markers are designed to be installed at no more than 5m intervals and at every change in direction for 'stand alone' telecommunications conduit	5.8,5.9, 5.10, 5.14 and 5.19	

Item	Description	Refer Clause	Completed/ Actioned
7.	Design specifies telecommunications markers for all sections of Ausgrid telecommunications protection fiber conduit installed "stand alone"	4, 5.1	
8.	Design does not specify telecommunications frequency based markers for trench sections that contain electrical assets in shared trench arrangement	5.9	
9.	Design specifies marker tape in accordance with NS205	5.3	
10.	Design specifies trace wire in accordance with NS205	5.3	
11.	Design specifies marker depth between 500mm and 1000mm depth of cover with markers directly above the telecommunications asset		
12.	Design completed an induction risk assessment where trace wire was considered a route marking option		
13.	Design specifies frequency marker installation above the end caps of telecommunications conduit sections not continuing through to a pit	5.10 5.15, 7.0	
14.	Design specifies frequency markers either side of crossings to indicate route direction at road, rail, path and driveway crossings	5.12 5.15	
15.	Design specifies marker tape installation for exposed bridge and void sections at no greater than 5m intervals	5.17	
16.	Design does not specify marker post installation	5.27	
17.	Designs for new Ausgrid telecommunications cable haul assess the existing route/s (occupied or unoccupied) through which the cable will travel to ensure compliance with NS205. Where non-compliances are found, corrective works must be designed as part of the project hauling the new cable	5.23	
18.	Design documentation is sent to Ausgrid for review prior to construction release	6.3	
19.	Design documentation details all of the above compliances	6.3	

All checklist items marked 'x' above shall be referenced and submitted for approval in the below variation table along with supporting documentation, prior to design release.

Design variations to standard materials and/or Network Standards	Signature
Cross reference to checklist and explanation of non-conformance	Name: _____ Title: _____ Signature: _____ Date: _____
Cross reference to checklist and explanation of non-conformance	Name: _____ Title: _____ Signature: _____ Date: _____
Cross reference to checklist and explanation of non-conformance	Name: _____ Title: _____ Signature: _____ Date: _____

Design variations to NS205 must be submitted to Ausgrid's Senior Engineer responsible for Telecommunications Area Planning for approval and signature prior to construction release.

Design checklist verified and approved by: _____

Signature: _____ Date: _____



Network Standard Construction Checklist Form

NS205 Telecommunications: Route Markers

Project Identification:	
Prepared by: <Name & Position Title>	Date:

This checklist is for internal Ausgrid use only and does not apply to ASPs or contractors who have specific compliance requirements in relation to Contestable project works. The checklist is unique for each network standard and is available within BALIN and the BMS as a separate form that can be amended as required, completed and saved in TRIM with the other project documentation.

This section is used to identify compliance checks that when applied to the work associated with this Network Standard will satisfy an audit process to establish that the requirements of the standard have been followed. It is expected that applicable items would normally be checked as Comply (Yes) as non-compliance is generally not tolerated.

Where non-compliance is the result of specific site conditions or design decisions this needs to be identified in the notes section of the form for each non-compliance and approval sought from an appropriately authorised Ausgrid manager responsible for design approval per NS261 Compliance Framework for Network Standards.

Should additional information be available to document non-compliance decisions, these can be attached to the checklist form. The checklist and any attached explanatory notes should be saved in the project document repository.

For asset compliance and acceptance, the construction checklist must be completed and submitted for each project installing or amending infrastructure for which the NS205 standard applies. NS205 covers Ausgrid telecommunications route marker installation. This checklist does not negate the responsibility for the Proponent to review the full NS205 standard for compliance. Clause references will be updated when NS205 is published.

Item	Description	Refer Clause	Completed/ Actioned
Construction Requirements			
1.	Construction compliance with WHS Act 2011 and associated Regulation as well as Ausgrid Electrical Safety Rules	5.1	Yes/No/NA
2.	Construction compliance with NS174 and all relevant laws, rules, regulations and guides for environmental impact assessment	5.1	Yes/No/NA
3.	Construction assesses and mitigates risks associated with asbestos in the work place in accordance with Ausgrid's NS211 Working With Asbestos Products and all relevant laws, rules, regulations and guides	5.1	Yes/No/NA
4.	Markers procured are orange frequency based passive devices set to the telecommunications frequency	5.3	Yes/No/NA

Item	Description	Refer Clause	Completed/ Actioned
5.	Omni-directional frequency based markers are installed as per the design or at no more than 5m intervals and at every change in direction	5.8, 5.9, 5.10.5.14 and 5.19	Yes/No/NA
6.	Marker tape and / or trace wire procured complies with NS205 clause 5.2	5.3	Yes/No/NA
7.	Marker tape or devices are installed directly above the related telecommunications asset	5.5	
8.	Markers are installed between 500mm and 1000mm depth of cover	5.5	
9.	Joins for trace wire or marker tape with metallic trace are insulated as per NS205 clause 5.21	5.22	
10.	Existing conduits through which a new protection fiber is to be hauled are made locatable prior to the cable haul taking place	5.23	
11.	Construction included frequency marker device installation above end caps of telecommunications conduit sections which are not continuing through to a pit	5.10, 5.15, 7	
12.	Frequency markers are installed to indicate route direction at road, rail, path and driveway crossings	5.12 5.15	
13.	Marker tape is installed for exposed bridge and void sections at no more than 5m intervals	5.17	
14.	Markers are tested and pass for locatability after both the backfill and surface reinstatement works are complete	6.1	
15.	Telecommunications infrastructure "as built" documentation is in compliance with NS100 and NS104 and includes GPS coordinates for each marker which are sent to Ausgrid at the earliest possible convenience and no more than one week from construction completion, whereby acceptance of the 'as built' infrastructure will be assessed by Ausgrid	6.4	

All checklist items marked 'x' above shall be referenced and submitted for approval in the below variation table along with supporting documentation, prior to design release.

Construction variations to standard materials and/or Network Standards	Signature
Cross reference to checklist and explanation of non-conformance	Name: _____ Title: _____ Signature: _____ Date: _____
Cross reference to checklist and explanation of non-conformance	Name: _____ Title: _____ Signature: _____ Date: _____
Cross reference to checklist and explanation of non-conformance	Name: _____ Title: _____ Signature: _____ Date: _____

Construct variations to NS245 must be submitted to Ausgrid’s Senior Engineer responsible for Telecommunications Area Planning for approval and signature prior to construction commencement.

Construction checklist verified and approved by: _____

Signature: _____ **Date:** _____