NW000-S0107 NS159 INSTALLATION OF CABLES AND CONDUITS USING TRENCHLESS TECHNIQUES
ISSUE

For issue to all Ausgrid and Accredited Service Providers’ staff involved with the installation of underground cables and conduits by trenchless techniques 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Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document.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 fulfill 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.”).
This standard is limited to the scope identified below and provides controls for associated risks as listed below:

- This Network Standard applies to Trenchless Techniques used on Underground cable installations of all voltages
- Only Ausgrid may vary the standard requirements or impose additional requirements other than those in this standard
- References are provided to the important Codes of Practice.

This section describes the pre-design requirements of Trenchless Technique projects including:
- Site inspection and evaluation
- Service searches
- Geotechnical and other assessments
- Contestable projects
- System components such as drilling fluids, grouts, conduits, spacers, reducers and bore lining
- Shared underbores

Where to for more information?
Section 5.0

This section describes the design and construction requirements of Trenchless Technique projects including:
- Location of services
- Approvals and notifications
- Working near existing underground assets
- The electricity allocation in the pathway
- Marking of cable route
- Clearance from existing underground assets
- Depth of cover
- Cable easements
- Carriageway underbores
- Railway undertrack crossings
- Multiple conduits in a single bore
- Multiple bore hole separation
- Grouting of voids
- Frac out
- Waterway crossings
- Conduits/pipes
- Testing of conduits/pipes
- Reinstatement
- Permanent pits and other access chambers
- Unused bore holes
- Recording of location of conduits and/or cables

Where to for more information?
Section 6.0

Tools and Forms
Annexure A – Compliance Checklist

Where to for more information?
Sections 1.0, 2.0 and 3.0

Tools and Forms
Annexure A – Compliance Checklist
Network Standard
NS159
Installation of Cables and Conduits
Using Trenchless Techniques

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1.0 PURPOSE

Trenchless techniques provide an alternative method to open trenching for the installation of new underground utility services. Trenchless techniques minimise interference with existing features, facilities and traffic, therefore allowing uninterrupted access to property and the continued safe use of the road reserve during construction work.

Trenchless techniques are particularly useful for installing new services under railways, waterways, paved driveway crossings, footpaths, paved carriageways, areas of environmental sensitivity and street trees, resulting in reduced reinstatement work and minimal impact on the visual amenity.

2.0 SCOPE

This Network Standard is to be used for the installation of underground electric cables and conduits by trenchless techniques where such techniques are either specified by Ausgrid or have been requested by a third party and reviewed by Ausgrid on a project specific basis. This Network Standard covers underground cables of all voltages.

Trenchless techniques include, but are not limited to, micro-tunnelling, horizontal directional drilling (HDD), auger boring, guided boring, impact moling, rotary moling, rod pushing, pipe ramming, thrust boring and jacking. For the purpose of this Network Standard, tunnelling using road headers or tunnel boring machines falls outside the scope of this document.

This Network Standard shall be read in conjunction with the reference documents listed in Section 3.0. Particular attention shall be given to the Streets Opening Conference publication Guide to Codes and Practices for Streets Opening.

Any proposed deviation from this Network Standard shall be submitted to Ausgrid for approval.

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

- Company Form (Governance) - Network Document Endorsement and Approval
- Company Procedure (Governance) - Network Document Endorsement and Approval
- Company Procedure (Network) - Production / Review of Network Standards
- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- NS100 Field Recording of Network Assets
- NS104 Specification for Network Project Design Plans
- NS130 Specification for Laying of Underground Cables Up to and including 11kV
- NS156 Working Near or Around Underground Cables
- NS161 Specification for Testing of Underground Cables
- NS172 Design Requirements for Cable Jointing Pits and Vaults
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS212 Integrated Support Requirements for Ausgrid Network Assets
- NS261 Requirement for Design Compliance Framework for Network Standards
3.3 Other standards and documents

- AS1742.3 Manual of uniform traffic control devices: Traffic control for works on roads
- AS/NZS 2053.2 Conduits and fittings for electrical installations: Rigid plain conduits and fittings of insulating material
- AS/NZS 4130 Polyethylene (PE) pipes for pressure applications
- AS 4799 Installation of underground utility services and pipelines within railway boundaries
- Master Access Deed for Railway Crossings 2002
- WorkCover Code of Practice, Tunnels Under Construction, 2006

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 2011

4.0 DEFINITIONS

**Accredited Service Provider (ASP)**
An individual or entity accredited by the NSW Government Trade & Investment in accordance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW).

**Approved**
Approved means authorised in writing by an Ausgrid Division, Group or Branch Manager or their delegate and notified in relevant Ausgrid documentation.

**ASP3**
Accredited Service Provider (Level 3).

**Authorised Person**
An authorised person is a trained and competent person approved to carry out specific duties relating to the supply of electricity.

A person authorised by another electricity network operator, organisation, high voltage customer or contractor is also a trained and competent person approved in writing by their employer, for work on their employer's network.

Authorised person includes accredited service providers and their employees who are approved by Ausgrid in accordance with Electrical Standard - Service Provider Authorisation (ES 4).

**Ausgrid Representative**
Ausgrid Compliance Officer - If it’s a Contestable Project and the work is carried out by an Accredited Service Provider.

**Carriageway**
That portion of a road or bridge devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes and heavy duty vehicular crossings.

**Business Management System (BMS)**
An Ausgrid internal integrated policy and procedure framework that contains the approved version of documents.

**Casing**
System of lining bores using Hobas, steel or concrete pipe sections to provide support to the surrounding soils, and in some cases, provide support for internal cable brackets. May also be used to restrict or control water ingress.

**Constructor**
The company or persons responsible for carrying out the construction work.
De-energised

De-energised mains and apparatus are not connected to an electrical supply source, however they are not necessarily isolated.

Designer

The designer is the nominated party responsible for the layout and design of the project under the overall direction of Ausgrid.

Document control

Ausgrid employees who work with printed copies of document must check the BMS regularly to monitor version control. Documents are considered “UNCONTROLLED IF PRINTED”, as indicated in the footer.

Earth / Earthed / Earthing

The terms earth/earthed/earthing refer to mains and apparatus electrically connected to the general mass of the earth.

Footpath

The paved section of a pathway

Frac-out

During normal drilling operations, drilling fluid escapes to the surrounding ground or surface. When the borehole becomes obstructed or the pressure becomes too great inside the borehole, the ground fractures and fluid escapes to the surface.

Isolate / Isolated

Mains and apparatus are isolated if they are disconnected from all possible sources of electrical energy by:

- opening switches;
- withdrawing circuit breakers;
- removing fuses, links or connections
- tying back bonds

and precautions such as locking and danger tagging have been taken to prevent the unauthorised or unintentional closure of the above items.

Pathway

That portion of a road or bridge reserved for the movement of pedestrians and manually propelled vehicles.

Network Standard

A document, including Network Planning Standards, that describes the Company’s minimum requirements for planning, design, construction, maintenance, technical specification, environmental, property and metering activities on the distribution and transmission network. These documents are stored in the Network Category of the BMS repository.

Review date

The review date displayed in the header of the document is the future date for review of a document. The default period is three years from the date of approval however a review may be mandated at any time where a need is identified. Potential needs for a review include changes in legislation, organisational changes, restructures, occurrence of an incident or changes in technology or work practice and/or identification of efficiency improvements.

Road Reserve

Any road that is used or dedicated as a public road, including both the carriageway and the pathway.

Service

Physical conduits or conductors within the Road Reserve for transferring products (e.g. water, electricity, telecommunication or gas). These conduits or conductors may consist of pipes, ducts, cables etc with associated apparatus, support, protection and location indication devices. Services comprise public utility and commercially provided services and property services.

Utility / Service Provider

A provider of services such as electricity, gas, water or telecommunications.
5.0 PLANNING AND SPECIFICATION

5.1 General
For larger scale projects, especially where the route is made complex by service congestion or variable ground conditions, careful design and specification of the contracted works (including selection of most appropriate technology) should be undertaken by suitably experienced persons. For example, it may be appropriate to engage consultants to assist in route and technology selection, so that it is easier for the Constructor to quote for the works, while ensuring that the installation achieves the key criteria of cable ratings, accessibility and constructability (for both drilling constructors and cable installers).

Issues for consideration in the planning, design and tender preparation stages include:

- Is the bore to be straight or are changes of direction required.
- Number and size of cables or conduits to be installed.
- Is the bore to be accessible (i.e. will people be expected to enter the bore to install cables or conduits, during construction, or at a later date).
- Service congestion – may determine which techniques are suitable for a project, and lead times for negotiations with other utilities, rail, etc.
- Ground conditions – will determine achievable cable ratings, need for lining, grouting, ability to adjust the bore route, etc.
- Approvals from affected asset owners such as utilities and property owners etc.

5.2 Site inspection and evaluation
The designer shall arrange a site visit in order to assess likely routes for a bore, suitable locations for send and receive pits (if necessary), and options for alternative solutions, such as attachment to existing or planned bridges over waterways, or use of existing road or service tunnels.

The presence of obstacles or hazards including waterway crossings, significant changes in ground levels or ground conditions should be noted.

5.3 Service searches
For all projects, as a minimum, preliminary enquiries shall be undertaken by the designer into the location of services and availability of geotechnical information for the proposed route, to assist bore constructors in preparing quotations for the works and to minimise the risk of unknown constraints.

If the proposed cable route involves close approach to high value assets such as high pressure gas mains, major telecommunications links or electrical transmission cables etc., the designer and/or bore constructor shall notify the Ausgrid Representative and provide documentation as to how the drilling process will incorporate the asset owner’s requirements to ensure its assets are protected from damage.

5.4 Geotechnical and other assessments
Depending on the size, complexity and location of the project, available geotechnical and contaminated land information for the route of the proposed bore shall be collected by the designer and reviewed for likely project risks. If the route involves areas of environmental significance or high risk assets such as crossings of major roads, railways and waterways, additional geotechnical information may be necessary. A desktop study may be sufficient to address these issues in most situations.
5.5 Detailed designs and requirements

The Designer shall provide a detailed design for all underbores that is deemed complex by the Ausgrid Representative. This includes larger scale projects (e.g. where the route is made complex by service congestion or variable ground conditions) and projects that require review from Ausgrid’s cable ratings section.

This detailed design shall be undertaken in consultation with a bore specialist and shall include a cross section showing the details of the conduits in the underbore, full longitudinal profile providing bore depths along the entire length, details of the entry and exit pits, and any other information considered necessary to minimise any unexpected issues and costs that may arise during the construction phase. For contestable works, this detailed design shall be provided during the design certification process.

5.6 System components

5.6.1 Drilling fluid

Drilling fluid is a fluid used to aid the drilling of bore holes. The main functions of drilling fluids include keeping the drill bit cool and clean during drilling, carrying out drill cuttings, and suspending the drill cuttings while drilling is paused and when the drilling assembly is brought in and out of the hole.

5.6.2 Grouts

5.6.2.1 Use and characteristics

Grout is used to minimise air voids between the conduits and the surrounding casing/soil. It is also used to achieve the required Thermal Resistivity (TR) value. Grout shall have the following characteristics:

- Nominal thermal resistivity of 1.1K.m/W or less fully dried (Note: some projects will require a lower TR value),
- Compressive strength to suit the ground conditions (typically 2 - 4MPa after 28 days of curing),
- High pumpability to ensure all air voids are filled, and
- Low heat of hydration that avoids the deformation of conduits/pipes.

Ausgrid’s Approved Material List (AML) provides a list of suppliers of grout mixes and their product codes that have provisional approval. The Constructor shall provide the Ausgrid Representative a TR test report, Compressive Strength test report, evidence to indicate low heat of hydration and high pumpability, and any proposed additives to be used (see Clause 5.6.2.2) for review and final approval of a grout mix prior to proceeding. Grout mixes from other suppliers not listed in the AML can also be submitted to the Ausgrid Representative for approval.

The Constructor shall provide a copy of the grout delivery docket to the Ausgrid Representative for every batch of grout mix supplied to demonstrate compliance with approved mix recipe/formula.

5.6.2.2 Additives

Additives are used in grouts to modify their fluid and set characteristics. The ability to modify all fluid and set characteristics increases the durability, strength and penetrability of the grout.

Any additives proposed for use with the grout mix design shall meet the requirements of relevant Australian Standards and shall be submitted for approval in writing to Ausgrid.
5.6.3 Conduits, spacers and reducers

5.6.3.1 Use and characteristics
Spacers shall be selected and spaced appropriately to hold the conduits together and maintain spacing of the conduits for the full length of the bore, whilst at the same time allowing the easy flow of grout to fill the voids between conduits and wall of the bore. No metal spacers are permitted in Ausgrid’s underbore projects.

All spacer details shall be submitted to the Ausgrid Representative for review before installation.

Where applicable, a suitable reducer shall be installed to enable a smooth transition from a Polyethylene (PE) pipe to a PVC conduit at each end of a bore. Refer to Clause 6.10.

5.6.3.2 Horizontal directional drilling (HDD) bores
Polyethylene (PE) pipes are required for HDD bores and are to be selected in accordance with AS4130. Most common pressure pipe would be:

- DN180mm OD (min. 150.4mm ID) SDR 13.6 PE100 PN12.5 (orange)
- DN225mm OD (min. 188.2mm ID) SDR 13.6 PE100 PN12.5 (black)
- DN63mm OD (min 54.4mm ID) SDR 17 PE100 PN10 (orange)

Other pipe sizes, pressure ratings and colour may be required according to specific projects. It is the responsibility of the designer to specify the required conduit properties for review by Ausgrid.

5.6.3.3 Cased bores, micro tunnels, thrust bores and bed bores
Conduits for electrical installations are generally to be selected in accordance with the following requirements:

- 100mm Light Duty (LD) UPVC (orange) conduit to AS/NZS 2053.2
- 125mm Light Duty (LD) UPVC (orange) conduit to AS/NZS 2053.2
- 150mm Light Duty (LD) UPVC (orange) conduit to AS/NZS 2053.2
- 50mm Heavy Duty (HD) UPVC (orange) conduit to AS/NZS 2053.2

Other pipe sizes, wall thicknesses and construction may be required according to specific projects. It is the responsibility of the designer to specify the required conduit properties for review by Ausgrid.

5.6.4 Bore lining
Where the conditions require the ground to be supported during boring operations, a technique which incorporates the installation of a lining or casing shall be adopted. This would normally be appropriate where several conduits are to be installed in a single bore and the ground is not naturally self-supporting, or where loads above the bore require minimum standard of support (for example, under major roads or rail crossings).
5.6.5 Shared underbores
The following requirements shall be met for a shared underbore:

- All third party conduits should go left or right immediately after leaving the shared underbore (if possible) and proceed along their own separate alignment that is not shared with Ausgrid.
- All third party conduits should be located at the top of the underbore where possible, so that any access that is required has a minimum impact on Ausgrid’s conduits below. Note: As the bundle of pipes/conduits can rotate inside the bore, there can be no guarantee which conduit is on top over the full length of the underbore.
- Project design plans should state any and all third parties using the shared underbore and what type of conduit and cable will be installed.
- As the underbore is shared, written approval from all parties should state that separation distances do not need to be met as detailed in the SOCC Guide to Codes & Practices for Streets Opening and in AS/NZS3000.
- Sufficient spare conduits in the shared underbore should be allowed for Ausgrid’s future use if deemed necessary.
- The third party conduits and cables shall not affect Ausgrid’s cable ratings.
- All details for shared underbores are to be clearly recorded on Ausgrid’s Geographical Information System (GIS).

6.0 DESIGN AND CONSTRUCTION

6.1 Location of services
The latest services information from all relevant authorities shall be obtained throughout each stage of the project. Dial Before You Dig enquiries (phone 1100 or visit http://www.1100.com.au) shall be considered the minimum. These plans shall be taken into account when planning, designing and constructing the bore.

6.2 Approvals and notifications
Statutory approvals and notification shall be obtained prior to the construction of any works on site. Notification is required even if no open trenching is involved.

This notification is over and above any requirements for traffic management plans, and the information provided as part of the notification does not replace any of the requirements of AS1742.3 for traffic management.

6.3 Working near existing underground assets

6.3.1 Ausgrid assets
All works shall comply with NS156 Working Near or Around Underground Cables.

6.3.2 Other assets
Refer to the relevant Utility/Service Provider for specific requirements regarding close approach to other assets.

6.4 General requirements

6.4.1 The electricity allocation in the pathway
All bore holes for electric cables shall be contained within the agreed electricity allocation whenever possible, as detailed in NS130 Specification for Laying of Underground Cables up to and including 11kV. If it is necessary to occupy part of the pathway usually allocated to another Authority, or part of the roadway for laying cables, refer to the requirements of NS130.
6.4.2 Marking of cable route

6.4.2.1 Type and location
The cable route shall be “pegged” out, using temporary markers as the pilot hole is opened, and
the markers shall be left in place until the installation has been inspected and reviewed to ensure it
is in accordance with the proposed design.

At nominated high risk locations, Ausgrid may also require permanent markers along all or part of
the final cable route. The type and location of permanent markers shall be advised for each project.

6.4.2.2 Survey plan
Where cables are to be located on private property, a survey (lease/easement) plan (also known as
a Red Lined Plan) is required in order to establish easements or a lease to cover the electrical
works. A copy of this plan is to be provided to Ausgrid showing:

- The centreline of electricity cables (or cable conduits if used) with offsets to the easement
  boundaries.
- Signature by the Registered Surveyor with an accompanying statement to certify that the
  information shown has been accurately located to their satisfaction.

6.4.3 Clearances from existing underground assets
Undertaking boring works in the vicinity of existing electrical assets can be extremely hazardous.
Persons undertaking such activities shall complete sufficient risk assessments to ensure the task
can be carried out in a safe manner.

Adequate clearances for the safe installation and future maintenance of assets shall be maintained.
The designer/constructor shall undertake a risk assessment as to the location of existing utility
assets.

Where there is any concern as to the safe undertaking of the boring activities near existing
electricity assets, an electrical isolation of these assets may be necessary.

All existing cables that are required to be electrically isolated shall be tested before
commencement and after completion of the works to verify their integrity. The tests shall be carried
out in accordance with the requirements of NS161 Specification for Testing of Underground
Cables.

For further information on working near Ausgrid cables refer to NS156 Working Near or Around
Underground Cables.

6.4.4 Depth of cover

6.4.4.1 Cables and conduits laid predominantly by trenchless techniques
Generally projects involving electric cables and conduits that are laid by trenchless techniques shall
have a minimum depth of cover of one metre and a maximum depth of cover of 1.3 metres
wherever possible. The reason for the minimum cover requirement is the absence of cable
protection covers as it is not possible to lay these covers by trenchless techniques. The maximum
depth of cover requirement is designed to limit the extent of cable de-rating.

The depth of cover requirements may be varied in order to overcome underground obstructions
such as large drainage pipes and similar structures subject to the prior approval of Ausgrid.

Where the requirements for the minimum depth of cover as stated above cannot be met, then that
portion of the cable route which does not satisfy the above requirements shall be laid by
conventional open trenching techniques and shall incorporate cable protection covers in
accordance with the requirements of NS130 Specification for Laying of Underground Cables up to
and including 11kV.
For some projects the depth of cover will depend on the nature of the route. For example:

- Rail underbore depths of cover will be determined by rail specifications and presence of existing or planned services.
- Water crossings may involve depths greater than 10 metres.

Where the required depth of cover exceeds 1.3 metres, a review of the cable ratings by Ausgrid’s Reliability Supply Quality and Ratings will be required. Cable ratings and depth will need to be reviewed at both the design phase and prior to construction.

6.4.4.2 Cables and conduits laid predominantly by conventional open trenching techniques

For electric cable and/or conduit runs that are laid by conventional open trenching techniques but involve underboring of driveway crossings, the minimum depth of cover of the underbores shall be consistent with the depth of cover of the associated open trenches and the requirements of NS130.

6.4.5 Cable easements – private and public properties

Any cables or conduits installed by trenchless techniques in easements shall comply with the same requirements as any other cable or conduit installed in easements. Easements can be over public or private properties, car parks, and special places of interest. Usually easements are not readily identified as such without consulting the relevant plans.

If an easement does not already exist through private property along the route of cables or conduits installed by trenchless techniques, one shall be established and registered prior to work commencing. Refer to Clause 6.4.2.2.

6.4.6 Carriageway underbores

All carriageway crossings where distribution cables are to be installed shall be perpendicular to the carriageway unless specifically approved by Ausgrid.

For sub-transmission cables, carriageway crossings may not be perpendicular to the carriageway.

6.4.7 Railway undertrack crossings

All proposed rail under track crossings undertaken by Ausgrid shall be completed in accordance with the Master Access Deed for Railway Crossings. This Deed governs all work undertaken by Ausgrid and its subcontractors on or near rail infrastructure.

All contestable work involving rail crossings shall be negotiated by the ASP3 with the owner of the rail corridor.

6.5 Multiple conduits in a single bore

All bores with multiple conduits shall have spacers as per Clause 5.6.3, unless indicated otherwise in the project specification.

For specific details of spacing between conduits refer to NS130 and/or the project specification and construction drawings.

6.6 Multiple bore hole separation

Where it is necessary to bore more than one hole along a cable route, a minimum separation of 500mm from the outer edges of the bore shall be maintained between different bore holes (sandy soil may need a greater separation). Every bore hole must be regarded as a new hole and independent of any other adjacent bore holes for the purpose of compliance with the requirements of this Network Standard.
6.7 Grouting of voids
All bores shall be grouted **unless indicated otherwise in the project specification.**

Grout is essential to keep conduits in position, ensure heat generated by the cables is effectively transferred to the walls of the bore and in some cases, to provide additional support to the surrounding ground. Refer to Clause 5.6.2.

**Note:** Bentonite slurries are frequently required to provide lubrication for the boring head. For short single shot bores only (e.g. short driveway crossings) bentonite may be used as the grout, provided that it suitably fills the air voids and meets the requirements of Clause 5.6.2.

6.8 Frac-out
Where underboring is used, there is a risk that “frac-out” can occur at locations where the ground conditions are weak, fractured or otherwise unsuitable. A risk assessment should be considered based on the site and environmental conditions.

Where frac-out is identified as a risk, a containment procedure shall be put in place and made available at the site for implementation. In particular, this applies where there is a risk that bentonite slurry or grout could frack out and enter a gutter, drain, waterway or other sensitive environmental area.

6.9 Waterway crossings
Where cables are to cross waterways such as rivers, creeks or bays, a number of options are available, including direct laying on the riverbed, buried within the riverbed, or underboring.

All major waterway crossings using HDD bores shall be tested in accordance with Clause 6.11.

For underboring of waterways, there is a risk of frac-out which could have significant environmental implications. The designer/constructor shall carry out a risk assessment on each project.

Where frac-out has been identified as a risk, a containment procedure shall be put in place and made available at the site for implementation. Refer to Clause 6.8.

For specific cable design requirements refer to NS130.

6.10 Conduits/pipes
All PE pipe joints shall be de-beaded and made smooth to the internal and external walls, and shall be watertight after installation.

At the ends of all bores where PE pipe has been used, a PE pipe to PVC conduit reducer shall be installed. A minimum length of one metre PVC conduit must be installed and capped.

The ends of all conduits shall be securely capped to protect them against ingress of foreign matter. Details of conduit plugs approved by Ausgrid are provided in NS130.

**Note:** The Australian Standard for PE pressure pipes (AS4130) differs from the PVC Standard (AS2053) in that it nominates pipe sizes by the external diameter rather than the internal diameter.

If a project calls for conduit to AS2053, any section of the job to be bored using PE pipe must use pipe selected so that the internal diameter is no less than the ID of the specified PVC conduit.

For example, a job calling for 150mm PVC conduit (ID 150.4-152.1 mm) would require the use of 180mm PE pipe (Pressure rating, PN12.5 and Standard Dimension Ratio (SDR), 13.6).
6.11 Testing of conduits/pipes
All conduits shall be thoroughly cleaned and mandrelled in accordance with NS130. CCTV cameras may be required on significant bores and copies of all recordings shall be referred to the Ausgrid Representative.

Hydrostatic or low pressure air testing of PE pipe shall be carried out for all major waterway crossings and critical HDD bores (as determined by the Ausgrid Representative) to demonstrate any welds are air tight. Testing shall be undertaken before installation on the surface and post installation once installed by the HDD Constructor. Any excess water shall be removed from the pipes prior to final capping. Mechanical compression seals shall be installed at each end to ensure the pipes remain dry.

6.12 Reinstatement
Temporary site excavations (e.g. sending and receiving pits) shall be backfilled, compacted, and the surface reinstated in accordance with the requirements of Network Standard NS130.

6.13 Permanent pits and other access chambers
All permanent pits and other structures that are associated with the underbores shall be constructed in accordance with NS172 Design Requirements for Cable Jointing Pits and Vaults and shall comply with the details of the project specification.

6.14 Unused bore holes
Dead holes such as trial holes and unsuccessful bore holes shall be filled with a suitable sand/cement mix or slurry mix to eliminate the risk of subsidence and roadway paving failures.

6.15 Recording of location of conduits and/or cables
On completion of the work, a detailed survey of the actual cable route, including the ends of the bore, depth profile, plan drawing and bore logs shall be provided to the Ausgrid Representative.

Details of the installation including bore logs, the number and type of conduits and cables, and any third party conduits are to be provided to Ausgrid in accordance with the requirements of NS100 Field Recording of Network Assets.

Details shall also be provided of any service crossings that were exposed during the operation, and the separations between all power cables, conduits and any other services at these crossing points.

Bore logs and detailed surveys are generally not required for simple bed bores (e.g. minor roads and driveways).

All relevant information shall be forwarded to Ausgrid Data Maintenance Regional Team Leader, or gis@ausgrid.com.au (External contractors) in accordance with the requirements of NS100 Field Recording of Network Assets.
7.0 RECORDKEEPING

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

<table>
<thead>
<tr>
<th>Type of Record</th>
<th>Storage Location</th>
<th>Retention Period*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved copy of the network standard</td>
<td>BMS Network sub process Standard – Company</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Draft Copies of the network standard during amendment/creation</td>
<td>TRIM Work Folder for Network Standards (Trim ref. 2014/21250/228)</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Working documents (emails, memos, impact assessment reports, etc.)</td>
<td>TRIM Work Folder for Network Standards (Trim ref. 2014/21250/228)</td>
<td>Unlimited</td>
</tr>
</tbody>
</table>

* 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.

8.0 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.

9.0 DOCUMENT CONTROL

Content Coordinator : Manager – Transmission & Dist Mains Eng
Distribution Coordinator : Snr Engineer Guidelines Policies and Standards
Annexure A – Sample Compliance Checklist

Network Standard Checklist Form

NS159 Installation of Cables and Conduits using Trenchless Techniques

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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Refer Clause</th>
<th>Completed/Actioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Specifies installation of underground electric cables and conduits by trenchless techniques</td>
<td>5.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>Shall be read in conjunction with the reference documents listed in Section 3. Particular attention shall be given to the Streets Opening Conference publication Guide to Codes and Practices for Streets Opening</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Any proposed deviation from this Network Standard must be submitted to Ausgrid for approval.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning and Specification</td>
<td>1 Bore is accessible</td>
<td>5.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>2 Service congestion exist</td>
<td>5.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>3 Approvals from affected asset owners such as utilities and property owners obtained</td>
<td>5.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td>4 Site inspection carried out</td>
<td>5.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Refer Clause</td>
<td>Completed/Actioned</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>5</td>
<td>Service searches carried out</td>
<td>5.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>6</td>
<td>Geotechnical assessments done</td>
<td>5.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>7</td>
<td>The route involves areas of environmental significance or high risk assets</td>
<td>5.4</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>8</td>
<td>Detailed design required</td>
<td>5.5</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>9</td>
<td>Grout meets the requirements given in Clause 5.6.2</td>
<td>5.6.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>10</td>
<td>Proposed grout mix design and characteristics submitted to Ausgrid</td>
<td>5.6.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>11</td>
<td>Any additives proposed for use with the grout mix design meets the requirements of relevant Australian Standards</td>
<td>5.6.2.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>12</td>
<td>Any additives proposed for use with the grout mix design are submitted for approval in writing to Ausgrid</td>
<td>5.6.2.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>13</td>
<td>All spacer details are submitted to Ausgrid’s Representative for review before installation</td>
<td>5.6.3</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>14</td>
<td>Shared underbore requirements met</td>
<td>5.6.5</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td></td>
<td><strong>Design and Construction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Statutory approvals and notification are obtained prior to the construction of any works on site</td>
<td>6.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>16</td>
<td>All works shall comply with NS156, Working Near or Around Underground Cables.</td>
<td>6.3.1</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>17</td>
<td>Marking of cable route carried out</td>
<td>6.4.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>18</td>
<td>Survey plan submitted</td>
<td>6.4.2.2</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>19</td>
<td>Cable easements created</td>
<td>6.4.5</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>20</td>
<td>Carriageway crossings where distribution cables are to be installed are perpendicular to the carriageway</td>
<td>6.4.6</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>21</td>
<td>Multiple bore hole separation - minimum 500mm from the outer edges of the bore is kept</td>
<td>6.6</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>22</td>
<td>All bores grouted unless approved otherwise by Ausgrid</td>
<td>6.7</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>23</td>
<td>Risk containment procedure is available</td>
<td>6.8</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>24</td>
<td>All conduits/PE pipes are cleaned, mandrelled and air tight after capping ends</td>
<td>6.11</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>25</td>
<td>All unused bore holes are filled with sand/cement mix or slurry mix</td>
<td>6.14</td>
<td>Yes/No/NA</td>
</tr>
<tr>
<td>26</td>
<td>Details of bore installation including bore logs are submitted to Ausgrid’s GIS section</td>
<td>6.15</td>
<td>Yes/No/NA</td>
</tr>
</tbody>
</table>

Notes: …………………………………………………………………………………………………………………….
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