

# TRANSPORT FOR NSW (TfNSW)

## QA SPECIFICATION R155

### DESIGN AND CONSTRUCTION OF UNDERGROUND CABLEWAYS

#### NOTICE

This document is a Transport for NSW QA Specification. It has been developed for use with roadworks and bridgeworks contracts let by Transport for NSW or by local councils in NSW. It is not suitable for any other purpose and must not be used for any other purpose or in any other context.

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#### REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 1/Rev 0		First issue.	GM, IC	01.08.12
Ed 1/Rev 1	Guide Notes 1.3.1, 2.3.2, 2.3.3, 3.2.2 2.5.1 3.3 4.8.1 Annex B Annex M	Notes added regarding conduits in bridge crossings. “Offset installation” changed to “offset branch”. Clause changed to require a direction by Principal for installation of safety barrier where minimum clearance between equipment housing and kerb cannot be achieved. Construction of equipment housing to include foundations. All exposed steel conduits to be earthed. Pay Item P6 – uncovering of and connecting on to existing conduits, included as part of scope for measurement and payment. Pay Item P8 – equipment housing foundations included as part of scope for measurement and payment. Drawing numbers for ITS Model Drawings changed.	GM, IC	29.08.12
Ed 1/Rev 2	Global	Model Drawing Nos updated.	GM, IC	11.02.13
Ed 1/Rev 3	Global Annex B	“Trenchless technologies” or “trenchless methods” replaced by “trenchless techniques”. Pay Item P2 – note added to clarify that payment for road crossing by open trenching to be made under this item.	GM, CPS	08.10.13
Ed 1/Rev 4	2.3.5	Required cover over conduits changed.	MCQ	19.10.18

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Ed 1/Rev 5	1.2.5	Wording for standard clause adopted.	DCS	28.03.19
	2.4.2	Pit locations intervals clarified.		
	3.1.7	New clause, including Hold Point, on submitting the certificate of conformity.		
	3.2.1	Clause reworded to require precast concrete pits to comply with spec R11.  Requirement to manufacture precast pit base units to suit the design conduit connection configuration added.		
	3.2.3	Clarification added that minimum pit depth of 950 mm applies only to pits of certain dimensions.  Previous sub-clauses 3.2.4 and 3.2.6 on pit wall thickness and pit risers deleted.  Subsequent sub-clauses renumbered.		
	3.2.5	Heading title changed.  Additional requirements inserted on individual-rung ladders.		
	3.4.1	Heading title changed.		
	3.4.2	Heading title changed.  Clause reworded adopting Select Fill terminology of spec R11.		
	3.4.3	New sub-clause incorporating backfill material requirements for conduits in road crossings previously in clause 4.7.4, and clarified to be controlled low strength flowable fill.  Previous sub-clause 4.6.4 on minimum depth of conduits deleted as it conflicts with clause 2.3.5.		
	4.7.5	Heading title changed.  Clause reworded to clarify compaction requirements for backfill material in trenches in road crossings, and in other than road crossings.		
	4.9.1	Clause reworded.		
	4.9.2	Clarified that pits installation to be in accordance with this spec, Drawing No. DS2012/000838 and the manufacturer's recommended practice.		
	4.11.2	Clause reworded to clarify that disposal of surplus material to be in accordance with spec R44.		
	Annex C1	Schedule of Hold Points updated.		

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Ed 1/Rev 5 (cont'd)	Annex C2 Annex E Annex L Annex M	Schedule of Identified Records updated. Previously Annex L. New annexure on Minimum Frequency of Testing. Reference Documents updated.		
Ed 1/Rev 6	Annex B	Pay Items P2 and P3 - Clarification added that no further payment will be made under R44 for disposal off site of surplus material.	MCQ	06.06.19
Ed 1/Rev 7	2.3.1 Annex M	Clause reference to spec SI/TCS/8 (withdrawn) replaced with spec TS101. Reference Documents updated.	MCQ	14.10.19
Ed 1/Rev 8	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively.	DCS	22.06.20

# **GUIDE NOTES**

(Not Part of Contract Document)

## **Using TfNSW R155**

This document sets out the requirements for the design and construction of underground cableways for carrying communications and electrical cables, as part of Transport for NSW (TfNSW) Intelligent Transport Systems (ITS).

## **Environmental Requirements**

Refer to Clause 2.1.3.

Where the Review of Environmental Factors (REF) and the Conditions of Approval for the project has imposed specific requirements that must be complied with during construction, additional to those stated in G36, insert either in Annexure A of this specification, or in G36, details of these requirements.

## **Principal's Concept Design**

Refer to Clause 2.1.1.

TfNSW Project Managers must provide a digital copy of the Principal's ITS cableway concept design drawings to the Contractor for preparation of the detailed design drawings in CAD format.

Check the Principal's concept design drawings against the TfNSW ITS Model Drawings. If they are in conflict, confirm with ITS Projects Section whether the concept design drawings take precedence and advise the Contractor accordingly.

## **Bridge Crossings – Conduits in Bridge Walkways or Parapets**

Refer to Clause 2.3.7.

If adequate number of conduits have already been installed in the bridge walkway or parapets, then the cableway works will only require connecting on to these existing conduits, and any necessary transitions required. When measuring up the quantities, the TfNSW Project Manager should be careful not to include the conduits that are already present in the bridge.

If, on the other hand, the cableway works are part of a road and bridgeworks contract, and the conduits are shown on the bridgeworks drawings, then the supply and installation of the conduits should be paid for under Pay Item R155P6, while the placing of the concrete, etc around the conduits be paid under the Bridgeworks Lump Sum.

## **Detailed Design Drawings and Design Report**

Refer to Clauses 2.6 and 2.7.

TfNSW Project Managers upon receipt of the Contractor's detailed design drawings and design report must forward them to ITS Projects Section for review and checking, prior to release of the Hold Point.

## **Milestone Dates and Progress Reporting**

Refer to Clauses 4.1.1 and 4.12.

Where the cableway is to be constructed under a separate Minor Contract, and not part of a Major Contract, insert in Annexure R155/A any Milestone dates by which sections of the cableway work must be completed to allow other works to commence.

Insert in Annexure R155/A whether a separate monthly reporting of progress for the cableway works is required. This may be appropriate for cableways constructed under a separate Minor Contract. Otherwise, reporting for the cableway works may be included as part of the monthly report for the entire project.

### **Road or Waterway Crossings Using Trenchless Techniques**

Refer to Clause 4.6.

No particular method of trenchless techniques has been specified, to allow the Contractor the opportunity to choose whichever method is most appropriate for him.

### **Measurement and Payment**

#### **Pay Item R155P6 – Conduits**

The unit of measurement is per lineal metre of each type of conduit installed. In main backbone of the cableway, for example, there are 4 communications and 4 electrical conduits per metre of the cableway. The TfNSW Project Manager must check that, in measuring the quantities, due account has been taken of the multiple conduits present and remember to multiply the distance between pits by the appropriate factor.





Transport  
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QA SPECIFICATION R155

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# DESIGN AND CONSTRUCTION OF UNDERGROUND CABLEWAYS

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VERSION FOR: DATE:
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## FOREWORD

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### REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R155 Edition 1 Revision 7.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

### PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. *Additional Text*.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

## TfNSW QA SPECIFICATION R155

### DESIGN AND CONSTRUCTION OF UNDERGROUND CABLEWAYS

## 1 GENERAL

### 1.1 SCOPE

This specification sets out the requirements for the design and construction of cableways, which are mostly installed underground, for carrying communications and electrical cables, as part of Transport for NSW' (TfNSW) Intelligent Transport System (ITS).

The scope of work covered by this specification includes:

- (a) Survey of the cableway route.
- (b) Design of the cableway, to be used for carrying ITS communications and electrical cables.
- (c) Construction of the cableway, including cleaning up and restoration of the work sites.
- (d) Testing of installed conduits.
- (e) Preparation of work-as-executed drawings.

This specification does not cover the installation of conduits or pits for traffic signals, which are dealt with under other specifications.

### 1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

#### 1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure R155/A.

#### 1.2.2 Measurement and Payment

The method of measurement and payment is detailed in Annexure R155/B.

Acceptance of materials and work must be in accordance with Annexure R155/B.

#### 1.2.3 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure R155/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for the definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure R155/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

### **1.2.4 Planning Documents**

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R155/D and must be implemented.

In all cases where this Specification refers to the manufacturer's recommendations, these must be included in the PROJECT QUALITY PLAN.

### **1.2.5 Frequency of Testing**

The Inspection and Test Plan must nominate the proposed frequency of testing to verify conformity of the item, which must not be less than the frequency specified in Annexure R155/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Frequency of testing must conform to the requirements of TfNSW Q.

You may propose to the Principal a reduced minimum frequency of testing. The proposal must be supported by a statistical analysis verifying consistent process capability and product characteristics. The Principal may vary or restore the specified minimum frequency of testing, either provisionally or permanently, at any time.

### **1.2.6 Referenced Documents**

Unless otherwise specified, the applicable issue of a referenced document, other than a TfNSW Specification, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure R155/M.

## **1.3 DEFINITIONS AND ACRONYMS**

### **1.3.1 Definitions**

The terms "you" and "your" mean "the Contractor" and "the Contractor's" respectively.

The following definitions apply to this Specification:

<b>Cableway</b>	System of conduits, including conduit fittings, pits and equipment housing, but excluding the communication and electrical cables and equipment.
<b>Engineer</b>	Engineer(s) eligible for Corporate Membership of Engineers Australia and practicing in the relevant type of engineering work.
<b>Inadequate foundation material</b>	Material beneath or adjacent to the proposed cableway route which the Principal deems to be of insufficient strength to support the cableway loads, or material whose characteristics the Principal deems would adversely affect the performance or construction of the cableway.
<b>Main backbone</b>	The part of cableway in the longitudinal direction of its route, but excluding any transverse or longitudinal branching parts.
<b>TfNSW ITS CAD Standard</b>	CAD drawings submitted as a set of two (2) files as below: (a) one editable CAD file in ".dgn," ".dwg" or ".dxf" format of each design plan drawing, and

- (b) one portable file in “.pdf” format of the same design plan drawing in A3 size, drawn in accordance with AS 1100.401, AS 1102, AS 3000, AS 3008 and AS 4383, unless agreed otherwise in writing with the Principal.

**Offset branches** The parts of the cableway branching out from the main backbone in any direction.

**Ploughing** The process of laying conduits and cables while also installing sand bedding, padding and marker tape simultaneously using a particular type of a tractor.

**Regional Roads** A category of roads agreed with Councils for administrative purposes. They comprise the lesser trafficked classified roads which are not State Roads and some of the more important unclassified roads. They are managed by Councils with TfNSW providing significant funding assistance.

**State Roads** A category of roads agreed with Councils for administrative purposes. They form the primary arterial network of classified roads in the State and some special purpose classified roads. TfNSW manages State Roads and accepts responsibility for funding, priorities and outcomes.

### **1.3.2 Acronyms**

The following acronyms apply to this Specification:

<b>AISI</b>	American Iron and Steel Institute
<b>CAD</b>	Computer Aided Design
<b>DN</b>	Nominal size, referring to internal diameter of a pipe or fitting
<b>HD</b>	Heavy duty
<b>ITS</b>	Intelligent Transport Systems
<b>WAE</b>	Work-as-executed, referring to drawings of completed construction works

## **2 DESIGN REQUIREMENTS**

### **2.1 GENERAL**

#### **2.1.1 Concept and Detailed Design**

If the detailed design is to be carried out by the Contractor based on the Principal’s concept design, this will be specified in Annexure R155/A1.

The Principal’s concept design drawings show the indicative cableway route, suggested pit locations, and where appropriate, the under road and under waterway crossings, and equipment housing locations.

Using the Principal’s concept design and taking into account the other requirements stated in this specification, carry out a detailed design of the cableways.

Your design must provide for appropriate methods of conduit installation.

Where the Principal's concept design drawings are in conflict with the TfNSW model drawings listed in Annexure R155/M, the former takes precedence, unless directed otherwise by the Principal.

### **2.1.2 Cableway Route Location**

Locate the cableway within the road reserve and outside the area occupied by the road pavement, unless shown otherwise in the Principal's concept design or approved by the Principal. The route alignment must not result in any additional land acquisition.

Where the cableway passes through reinforced soil walls, the locations of the conduits must avoid the soil reinforcement components.

### **2.1.3 Environmental Considerations**

Address in the detailed design all environmental requirements stated in Annexure R155/A.

## **2.2 DETAILED SITE SURVEY**

Prior to commencing the detailed design, carry out a detailed site survey in accordance with Specification TfNSW G73 of the indicative cableway route, to be used in designing the actual cableway route.

The survey must identify the location of all significant features such as rock outcrops, rocky surfaces, existing cableway routes and pits, other existing utilities/services, access roads and easements or rights of way to be provided, and locations of any under road, under waterway or bridge crossings required.

Submit the detailed site survey to the Principal prior to the commencement of your detailed design.

## **2.3 CONDUITS**

### **2.3.1 Number of Conduits in Main Backbone**

Where the main backbone of the cableway runs along a State Road or Regional Road, provide 4 x 100 mm conduits for communications cables and 4 x 100 mm conduits for electrical cables, unless shown otherwise on the Drawings or directed by the Principal.

For all other roads, provide 2 x 100 mm electrical conduits and 2 x 100 mm communications conduits, unless shown otherwise on the Drawings or directed by the Principal.

This requirement takes precedence over any conflicting requirements stated in Specification TfNSW TS101.

### **2.3.2 Offset Branch at Intersections**

#### **(a) Signalised Intersections**

Where a new signalised intersection is being constructed, or an existing signalised intersection is being reconstructed as part of the Works, provide an offset branch comprising 2 x 100 mm communications conduits and 2 x 100 mm electrical conduits in accordance with Drawing No. DS2012/000830.

#### **(b) Unsignalised Intersections**

Where a new unsignalised intersection is being constructed, or an existing unsignalised intersection is being reconstructed as part of the Works, provide an offset branch comprising 1 x 100 mm communications conduit and 1 x 100 mm electrical conduit in accordance with Drawing No. DS2012/000834.

### **2.3.3 Offset Branches Between Intersections**

On roads that have intersections separated from each other by a distance of less than 2 km, provide an offset branch midway between the two intersections, where shown in the Principal's concept design.

On roads that have intersections separated from each other by a distance of more than or equal to 2 km, provide offset branches at 1 km intervals, where shown in the Principal's concept design.

For each offset branch installation, provide 1 x 100 mm communications conduit and 1 x 100 mm electrical conduit.

### **2.3.4 Separation Between Conduits**

Unless approved otherwise by the Principal, provide a separation gap of at least 100 mm between the communications and electrical conduits in the cableway, as shown on Drawing No DS2012/000836.

### **2.3.5 Depth of Conduits**

#### **(a) Under Pavements Subjected to Traffic Loads**

For cableways located under pavements which are subjected to traffic loads, provide a minimum cover of 1.2 m over the cableway conduits. This minimum cover may be reduced to 1.0 m where the cableway is encased within a concrete surround.

#### **(b) Under Footpaths or Grassed Areas**

For cableways located outside trafficked pavements, e.g. under footpaths or within grassed areas, provide a minimum cover of 0.6 m over the cableway conduits.

### **2.3.6 Obstructions In Cableway Route**

When an obstruction such as existing utilities or a rock outcrop lies in the path of the cableway, divert the cableway with bends to avoid the obstruction as shown on Drawing No. DS2012/000832.

Align the communications and electrical conduits in parallel and at the minimum clearance from the obstruction as shown on Drawing No. DS2012/000832. Maintain the minimum separation gap between the communications and electrical conduits specified in Clause 2.3.4.

Bends in conduits must not have angles greater than 30°, and must be smooth and free of irregularities.

### **2.3.7 Bridge Crossing**

Where conduits are provided within the bridge walkway or parapets, use these conduits as part of the cableway.

Where the conduits provided are insufficient or absent, run the conduits beneath the bridge deck, supported with galvanized steel brackets anchored into the bridge structure. Alternatively, install the conduits on a cable ladder anchored on to the bridge structure.

For box girder bridges, install conduits on cable ladders within the box girder in accordance with Drawing No. DS2012/000831.

### **2.3.8 Tunnels or Underpasses**

In tunnels and underpasses, install conduits in cable ladders fixed to the walls of the tunnel or underpass in accordance with Clause 3.1.5.

## **2.4 PITS**

### **2.4.1 Pit Dimensions**

Pit dimensions must comply with Clause 3.2.

### **2.4.2 Pit Locations**

Between intersections, provide pit locations at regular evenly spaced intervals where practical, with the distance between pit locations not greater than 250 m, along the main backbone of the cableway route, to enable pulling of the cable and allow connections with terminal equipment.

Where the road is on a curve, the Principal may direct that the minimum distance between pits be reduced to avoid excessive curvature.

For each pit location, provide a pair of pits comprising one communications pit and one electrical pit, in accordance with the configuration shown on Drawing No. DS2012/000838.

Provide a pair of cableway pits (1 communications and 1 electrical) in the following situations:

- (i) at both ends of each under-road, under-waterway and bridge crossing;
- (ii) at an interface between different types of conduit; and
- (iii) where there is a 90° change in direction.

### **2.4.3 Clear Distance of Pit From Kerb Line**

Provide a clear distance for the pits from the kerb line of a carriageway or edge of a road in accordance with Table R155.1, unless otherwise specified or shown on the Drawings.

**Table R155.1 - Pit Clearance From Kerb Line**

<b>Speed zone</b>	<b>Minimum clearance</b>
< 80 km/hr	1.5 m
≥ 80 km/hr to ≤ 110 km/hr	3.0 m
> 110 km/hr	5.0 m

### **2.4.4 Safe Access for Inspections and Maintenance**

Ensure that your detailed design provide for safe access to, and sufficient space around all pits and equipment housings, for future inspection and maintenance activities.



## **2.5 EQUIPMENT HOUSINGS**

### **2.5.1 General**

Where shown in the Principal's concept design, provide equipment housings complying with Drawing No. DS2012/000835.

Provide clearance for the equipment housings from the kerb line equivalent to that specified for pits in Clause 2.4.3.

Where the minimum clearance cannot be achieved, notify the Principal and provide details of the site constraints. The Principal may direct that a safety barrier between the roadway and the equipment housing be installed, with a clearance of at least 1.5 m. Installation and payment for this safety barrier will be in accordance with Specification TfNSW R132.

In areas where an alternative route is proposed, due to the presence of rock etc, equipment housing additional to that shown on the Principal's concept design may be required.

### **2.5.2 Adjacent to Rock Faces**

Equipment housings adjacent to rock faces must be linked to the pits using galvanized steel conduits as shown on Drawing No. DS2012/000833.

## **2.6 DESIGN DRAWINGS**

### **2.6.1 Digital Format**

Design drawings must be done in a digital format, complying with TfNSW ITS CAD Standard, incorporating the TfNSW standard title block.

### **2.6.2 Details Required**

The detailed design drawings must be based on the Principal's concept design drawings and must show details of the following:

- (a) cableway route alignment and chainages along the route, with the areas where the cableway route crosses other utilities or obstructions highlighted;
- (b) locations of any under road, under waterway and/or bridge crossings;
- (c) number of each type of conduits, their configuration and their depth below the finished surface level, along the length of the cableway;
- (d) locations of cableway pits and any equipment housings;
- (e) details of the cableway pits and their lids, including dimensions, wall thicknesses, reinforcement details, and loading classes;
- (f) which of the pits require risers and pit access ladders;
- (g) details of any bends required;
- (h) details of any conduit transitions required at crossings of bridges or culverts;
- (i) proposed methods of support and attachment of the cableway to the bridge structure, retaining wall or rock face;
- (j) finished ground surface levels along the cableway route.

## **2.7 DESIGN REPORT**

Together with the detailed design drawings, provide a design report that includes the following information where relevant:

- (i) choice of cableway route, including reasons for any deviation from the indicative route shown in the Principal's concept design;
- (ii) reasons for choice of pit locations, orientation and configurations;
- (iii) locations where use of galvanized steel tubes for the conduits are proposed, and the reasons for their use;
- (iv) any site specific environmental requirements addressed in the design;
- (v) any obstruction along the cable route, and methods adopted to avoid the obstruction;
- (vi) proposed method(s) of construction, including those for under road, under waterway and bridge crossing;
- (vii) any differences between your design and the TfNSW model drawings or other requirements in this Specification and the reasons for this;
- (viii) materials to be used.

### **HOLD POINT**

Process Held:	Commencement of cableway construction.
Submission Details:	Detailed design drawings in TfNSW ITS CAD Standard, and associated design report, at least 10 working days before commencement of construction.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

## **3 MATERIALS**

### **3.1 CONDUITS AND ASSOCIATED ITEMS**

#### **3.1.1 Type and Class**

All conduits must have smooth internal surfaces.

##### **(a) Underground Conduits**

Conduits installed underground for carrying communications and electrical cables must be heavy duty rigid PVC (i.e. UPVC), conforming to AS/NZS 2053.2.

UPVC conduits for carrying communications and electrical cables must be in white and orange colour respectively.

##### **(b) Exposed Conduits**

All exposed conduits must be hot-dip galvanized steel tubes, unless directed otherwise by the Principal.

All steel tubes must be Medium pipe to AS 1074 and approved by the Principal. Hot-dip galvanizing must be in accordance with AS 4792, with a minimum average coating mass of 300 g/m<sup>2</sup>.

Clearly mark, using stencils, the words “Roads & Maritime Services Electrical” in orange colour, or “Roads & Maritime Services Communications” in white colour, on the external surface of the respective galvanized steel tubes, at 20 m intervals, as shown on Drawing No. DS2012/000833.

### **3.1.2 Conduit Joints**

Join conduits strictly in accordance with the manufacturer’s instructions.

Conduit surfaces to be joined must be clean and free from any foreign matter.

Glued joints must be watertight.

### **3.1.3 Draw Rope**

Install a draw rope made of synthetic cord approved by the Principal in each conduit for the purpose of cable pulling. The draw rope must be able to withstand a load of 90 kg. Anchor the draw rope securely at each end, leaving approximately 1 m of slack in each pit.

### **3.1.4 Marker Tape**

Marker tape must conform to AS 2648.1, be suitably identified with written warnings and contain a 0.7 mm stainless steel (AISI grade 316) conductor wire, laminated between the two layers of plastic comprising the marker tape, suitable for locating the marker tape with cable location equipment.

The marker tapes for electrical and communications conduits must be in orange and white colour respectively.

### **3.1.5 Cable Ladders**

Cable ladders and their support brackets must be of hot-dip galvanized steel unless specified otherwise.

Cable ladders and support brackets (including fixing devices) must be of adequate strength to support a loading of at least 150 kg/m, without permanent deflection.

### **3.1.6 Support Brackets for Conduits**

Support brackets, and associated anchor bolts and nuts, for exposed conduits such as those in bridge crossings or rock faces must be of galvanized steel.

### **3.1.7 Certificate of Conformity**

Prior to incorporating into the Works any supplied conduits and associated items including marker tape, provide the Principal with a signed certificate stating that the materials used and the finished product conform to the requirements of this Specification.

The certificate described above must describe the item and identify the inspection and test records that verify conformity of the item, and must be available for inspection as part of the Quality Records.

## **HOLD POINT**

Process Held:	Incorporation into the Works of any supplied conduits and associated items including marker tape.
Submission Details:	Certificate of conformity, at least 7 days prior to incorporation into the Works.
Release of Hold Point:	The Principal may inspect the Quality Records prior to authorising the release of the Hold Point.

## **3.2 PITS**

### **3.2.1 General**

All pits, including lids, must be of precast reinforced concrete complying with Specification TfNSW R11.

All precast base units must be manufactured specifically to suit the design configuration of the particular pit. Standard precast pit base units with thinned wall sections on all four sides are not acceptable.

Provide a certificate of conformity for the precast pits in accordance with TfNSW R11.

### **3.2.2 Pit Plan Dimensions**

The internal dimensions of pits in the main backbone of the cableway must be not less than 900 mm x 900 mm for communications pits and 600 mm x 600 mm for electrical pits as shown on Drawing No. DS2012/000838, unless approved otherwise in writing by the Principal.

Pits at the far end of offset branches, outside the main backbone, must have internal dimensions of not less than 450 mm x 450 mm.

Any pit with depth greater than 1200 mm must have internal dimensions of not less than 900 mm x 900 mm.

### **3.2.3 Pit Depth**

Pits of internal dimensions 600 mm x 600 mm or larger must have an internal depth of not less than 950 mm as shown on Drawing No. DS2012/000838 unless located in rock areas, where the pit depth is reduced to suit the reduced conduit depth specified in Clause 2.3.5.

### **3.2.4 Pit Opening**

The opening at the top of the pit which accommodates the lid must not be less than the internal dimensions of the pit.

The rim of the pit opening must be reinforced to prevent damage due to lateral forces on the lid, or chipping due to shock loads caused by passing vehicles or dropping of the lid.

### **3.2.5 Ladder**

For all pits which are deeper than 600 mm, install an individual-rung ladder (step irons) in accordance with AS 1657 on one internal wall for the full depth of the structure.

The top of the uppermost rung must not be more than 600 mm below the top of the pit. The top of the bottom rung must not be more than 500 mm or less than 300 mm above the invert of the pit. Rung spacings must be 300 mm  $\pm$  50 mm.

### **3.2.6 Pit Lid Labels**

Supply and install brass labels on the lid of both the communications and the electrical pits as shown on Drawing No. DS2012/000837.

Submit to the Principal for approval the layout of lettering on the labels, and the method of fixing them to the lids.

## **3.3 EQUIPMENT HOUSINGS**

Equipment housings and their foundations must comply with Drawing No. DS2012/000835.

Submit details of the equipment housing for approval by the Principal.

## **3.4 BEDDING AND BACKFILL MATERIAL**

### **3.4.1 Bedding Material for Conduits and Pits – General**

Bedding material for conduits and pits must be Type BH Select Fill (refer TfNSW R11). Type BH Select Fill must have the following properties:

- (a) a particle size distribution, determined by Test Method TfNSW T201, within the limits set out in Table 6 in AS 3725; and
- (b) a Plasticity Index, determined by Test Method TfNSW T109, of not more than 6.

### **3.4.2 Backfill Material Other Than Bedding Material – General**

Backfill material other than bedding material for conduits and pits must be Type SO Select Fill (refer TfNSW R11). Type SO Select Fill must have the following properties:

- (a) a maximum particle dimension of 53 mm; and
- (b) a Plasticity Index, as determined by Test Method TfNSW T109, of between 2 and 12.

### **3.4.3 Backfill Material for Road Crossings**

For trenches in road crossings, backfill material around and over the conduits up to the level of the underside of the road pavement must be controlled low strength flowable fill complying with AS/NZS 3725 Appendix A.

## **4 CONSTRUCTION**

### **4.1 GENERAL**

#### **4.1.1 Program**

If required in Annexure R155/A, complete the cableway works by the Milestone date(s) to allow construction without disruption or delay of associated new road pavements, kerb and/or gutter, median islands or concrete pathways.

#### **4.1.2 Work Health and Safety**

Implement Work Health and Safety measures, including preparation of Safe Work Method Statements, in accordance with Specification TfNSW G22.

#### **4.1.3 Traffic Management**

Provide traffic management in accordance with Specification TfNSW G10.

Maintain access to private properties and commercial premises.

### **4.2 ADDITIONAL SAFETY PRECAUTIONS**

#### **4.2.1 Protection of Completed Works and Existing Utilities**

Take all necessary precautions to protect other completed works and avoid interference with other existing surface and underground utility services during construction of the cableway.

Before commencing any excavation work, determine and mark on the ground the locations of all existing utility services adjacent to or intersecting the cableway route.

Where cathodic protection has been provided to existing metal conduits (for carrying drinking water, gas, sewage, etc) and metal armour on high voltage cables or other structures, use suitable excavation and installation methods to prevent any damage or disturbance to these installations.

#### **4.2.2 Installation of Conduits in High Voltage Areas**

Where conduits are to be installed in proximity to high voltage earthed locations such as substations, obtain written authorisation from the Principal before commencing installation.

Do not disturb existing high voltage earthing arrangements under any circumstances.

### **4.3 ENVIRONMENTAL PROTECTION**

Implement and monitor appropriate environmental control measures during construction in accordance with Specification TfNSW G36, and Specification TfNSW G38.

Do not remove any trees or shrubs without the written approval of the Principal and/or the relevant Statutory Authority.

Do not stockpile excavated material in locations where it could obstruct stormwater or road drainage, or be washed onto roadways or into watercourses by rain.

## **4.4 SETTING OUT**

Set out the cableway as shown on the approved detailed design drawings in sufficient detail to identify:

- (a) the locations, lengths and levels of the conduits;
- (b) the locations and levels of cableway pits;
- (c) the locations, lengths and levels of all under road, under waterway and bridge crossings.

### **HOLD POINT**

Process Held: Commencement of excavation.

Submission Details: Notification:  
- that the cableway route, including locations of pits, has been set out; and  
- of any changes to the design proposed by you.

Release of Hold Point: The Principal will inspect the set out, including any changes proposed and, if necessary, amend the design to suit actual site conditions prior to authorising the release of the Hold Point.

The final location of each under road crossing must be approved by the Principal.

## **4.5 OPEN TRENCHING**

### **4.5.1 Safety Considerations**

Carry out the trenching and associated backfilling progressively so that trenches are open for the minimum practicable time. Do not leave trenches open overnight unless approved specifically by the Principal.

Shore up the sides of trenches securely to prevent collapse, particularly where excavation is in proximity to buildings or other structures.

Erect suitable barricades around the excavation and cover the excavation where access is required across them.

### **4.5.2 Road Crossings By Open Trenching**

If crossings at roads, where daytime traffic flow must be maintained, are done by open trenching, carry out any excavation and backfilling as night work.

Lay steel plates complying with Specification TfNSW 3368 over the open trenches if the road is to be open to traffic during daytime.

### **4.5.3 Base of Trenches or Excavations**

The bottom of trenches or excavations must be of even gradient, and free from stones, sharp objects and other foreign material.

#### **4.5.4 Inadequate Foundation Material**

Notify the Principal of any area within the cableway route which contains material that is inadequate to support the cableway conduits or pits. If the Principal agrees that the material is inadequate foundation material, or any areas of the foundations are so deemed by the Principal, the Principal may direct the removal and replacement of this material. Dispose of such material in accordance with Specification TfNSW R44.

##### **HOLD POINT**

Process Held:	Replacement of inadequate foundation material.
Submission Details:	Notification that inadequate foundation material has been excavated to the extent directed.
Release of Hold Point:	The Principal will inspect the excavation and may direct further excavation prior to authorising the release of the Hold Point.

Replace inadequate foundation material with materials from cuttings, or with other material acceptable to the Principal, and compacted in accordance with Clause 4.7.5.

Payment for all costs of removal, disposal and replacement of the inadequate foundation material will be made under Pay Item R155P3.

#### **4.5.5 Ploughing**

Where appropriate, you may use ploughing as a method of cableway installation.

### **4.6 CROSSINGS USING TRENCHLESS TECHNIQUES**

#### **4.6.1 General**

Where trenching is not appropriate for use in road or waterway crossings, you may use trenchless techniques involving boring or drilling for the cableway construction.

#### **4.6.2 Work Method Statement**

Prior to the commencement of any such work, provide a Work Method Statement to the Principal giving full details of how you intend to carry out the boring or drilling without damaging or otherwise disturbing the road pavement or any adjacent installations, and including details of any traffic control or environmental protection measures required.

##### **HOLD POINT**

Process Held:	Commencement of under road or under waterway boring using trenchless techniques.
Submission Details:	Work Method Statement, at least 5 working days prior to the commencement of the work.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.



Perform all work required, including excavation and shoring of the entry and exit pits, in accordance with the approved Work Method Statement.

### **4.6.3 Outer Casing**

The outer casing for carrying the individual communications and electrical conduits, installed by trenchless techniques, must be of sufficient strength to carry the traffic and overburden loads without collapse.

## **4.7 CONDUIT INSTALLATION IN TRENCHES**

### **4.7.1 Conduit Surround in Trenches**

Place bedding material around the conduits with a minimum thickness of 100 mm above and below the conduits, for the full width of the trench, as shown on Drawing No. DS2012/000836.

### **4.7.2 Laying of Conduits**

Lay conduits in the trenches in accordance with your detailed design. Underground conduits must be continuous between pits.

### **4.7.3 Marker Tapes Over Conduits**

Lay white and orange marker tapes over communications and electrical conduits respectively (matching the respective colour of the conduits) as shown on Drawing No. DS2012/000836.

For trenches in earth, lay marker tapes on conduits within the backfill approximately 300 mm below the finished surface level. For road crossing trenches, lay the tapes above the conduits at the top surface of the bedding material surrounding the conduits.

For trenches in rock, lay marker tapes for the conduits approximately 150 mm below the finished surface level, unless specified otherwise.

Marker tapes are not necessary over conduits inside casings installed by trenchless techniques (refer Clause 4.6)

### **4.7.4 Backfilling**

Material for bedding and backfilling must be in accordance with Clause 3.4.

Notify the Principal of your intention to backfill over, and cover up, the conduits or marker tapes in any trench or excavation.

## **HOLD POINT**

Process Held:	Backfilling over conduits or marker tapes in trenches.
Submission Details:	Notification that the conduits or marker tapes have been installed, at least four hours before backfilling is scheduled to commence.
Release of Hold Point:	The Principal will inspect the conduit or marker tape installation prior to authorising the release of the Hold Point.

This Hold Point applies to either of the two stages; viz backfilling over the conduits, and backfilling over the marker tapes.

#### **4.7.5 Placing and Compaction**

For trenches in road crossings, place and compact the controlled low strength flowable fill complying with Clause 3.4.3 and AS/NZS 3725 Appendix A.

For trenches in other than road crossings, place and compact the bedding and other backfill material in layers not exceeding 150 mm thick after compaction.

Compact carefully the first 150 mm of backfill over the conduits to ensure that no conduits are displaced or damaged. Submit a Work Method Statement to the Principal detailing how you would place and compact the backfill without damaging or disturbing the conduits.

### **4.8 CONDUIT INSTALLATION ON CONCRETE OR ROCK FACES**

#### **4.8.1 General**

Where you propose to install support brackets for carrying the steel conduits along concrete or rock faces, carry out a structural design and provide certification by an Engineer for the supports, including anchorage requirements into the concrete or rock face. The spacing of brackets must be such that there is no sagging of the conduits.

Use only chemical anchors for anchoring into the concrete or rock face. Do not use expanding masonry anchors.

Provide a minimum distance of 25 mm between the conduits and the mounting surface (concrete or rock).

The Principal will review the design prior to construction.

Provide earthing to all exposed steel conduits.

#### **HOLD POINT**

Process Held:	Installation of supports for steel conduits or any other fixing proposal on concrete or rock faces.
Submission Details:	Design details and certification by Engineer of conduit support brackets, at least three working days before installation.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

Fit the bolts holding the steel brackets with an approved locking device.

Do not core or drill into existing concrete structures without written approval from the Principal. Prior to any such coring or drilling, determine the presence and locations of any steel reinforcement bars or other cast-in items to avoid damaging them.

## **4.8.2 Bridge Crossings**

For conduits in bridge crossings, provide suitable jointing of the conduits and conduit support system to accommodate expansion/contraction of the bridge without causing unacceptable stresses in the conduits. Submit details of the jointing to the Principal for approval.

Where shown on the Principal's concept drawings or are otherwise necessary, you may use cable ladders for carrying the conduits.

## **4.8.3 Rock Faces or Retaining Walls**

For conduits running along rock faces or retaining walls, the bottom of the lowest conduit must be at least 500 mm above ground surface level, unless approved otherwise by the Principal.

## **4.9 PITS**

### **4.9.1 Pit Foundation**

Provide a bedding layer below the pit comprising Type BH Select Fill of not less than 100 mm thick as shown on Drawing No. DS2012/000838.

The top of the bedding layer must be level.

### **4.9.2 Installation of Pits**

Install cableway pits in accordance with this Specification, Drawing No. DS2012/000838 and the manufacturer's recommended practice.

Submit for approval the lifting methods including the lifting points, lifting devices and certification of their suitability by an Engineer. Use only approved methods for lifting and lowering precast pits in place to prevent damage during installation.

Coat the rim of the pit with an approved sealing compound so that, when the lid is placed over the pit, an airtight seal is achieved and ingress of water and dust into the pit is prevented.

The exposed face of each pit lid must be flush with the surrounding ground surface, and must not be a trip hazard to any pedestrians.

### **4.9.3 Conduit Connections With Pits**

Provide bell-mouth fittings at conduit entries into pits. Remove sharp, rough or jagged edges from conduit internal surfaces. Seal any annular gaps between the conduit and the pit wall with mortar or cementitious grout to prevent ingress of water.

The height at which the conduits enter the pits must not be less than 150 mm from the pit floor.

## **4.10 TOLERANCES**

Tolerances on the plan positions, levels of conduits and pits and thicknesses, must be in accordance with Table R155.2, unless shown otherwise on the Drawings.

**Table R155.2 - Dimensional Tolerances for Cableway Components**

<b>Item</b>	<b>Tolerance (mm)</b>
<b>Conduits:</b>	
Departure from plan position in any direction	±50
Level of top of conduit at any location between pits	±50
<b>Pits:</b>	
Thickness of DGB20 bedding layer	±10
Departure from plan position in any direction	±100

**Note:** The above tolerances are with reference to the plan positions and levels shown in the Contractor's approved design.

## **4.11 CLEAN UP AND RESTORATION**

### **4.11.1 Cleaning Up**

Clean up and clear all pits of debris at completion of the Works.

### **4.11.2 Disposal of Surplus Material**

Dispose of as spoil any surplus excavated material in accordance with TfNSW R44.

All costs for backfilling and disposal of surplus material from trench excavation are deemed to be included under Pay Item R155P2.

### **4.11.3 Restoration of Work Areas**

On completion of backfilling and cleaning up, restore the work area to the same condition prior to commencement of the Works.

Where trenches have been dug across sealed roads or concrete footpath, restore the pavement layer similar to that of the existing pavement, unless specified otherwise.

Replacement landscaping must be in accordance with the Landscape Drawings, or match the surrounding landscaping where no Landscape Drawings are available.

## **4.12 PROGRESS REPORTING**

If specified in Annexure R155/A, provide a written progress report to the Principal at monthly intervals during the construction of the cableway. This report must be accompanied by an updated Contract Program showing the expected date(s) for completion of the cableway works.

## **5 TESTING AND ACCEPTANCE**

### **5.1 TESTING OF CABLEWAY CONDUITS**

Carry out testing of all installed conduits by drawing a test mandrel through each conduit after the trenches or excavation have been backfilled and pits installed.

Use a 240 mm long test mandrel with a diameter 90% of the nominal internal diameter of the conduit.

If installed conduits are found to have been damaged, report the damage to the Principal and replace the damaged section without delay.

#### **WITNESS POINT**

Process Witnessed: Testing of installed conduits.

Submission Details: Notification to the Principal that the conduits and pits are installed and ready for testing, at least 1 working day prior to the date of testing.

### **5.2 FINAL INSPECTION**

Provide inspection reports for all pits and conduits installed under the Contract.

After conduits have been tested in accordance with Clause 5.1 and prior to notifying the Principal for final inspection, inspect all backfilled trenches and excavation, and refill any depressions caused by settlement or erosion of the backfilling. If erosion of the backfilled trenches or excavation occurs, undertake remedial work using methods approved by the Principal to repair erosion and to prevent future occurrence.

Ensure that the cableway as installed satisfies the acceptance criterion listed in the Final Inspection Acceptance Checklist in Annexure R155/E, prior to notifying the Principal for the final inspection.

Arrange for all pits to be opened for the final inspection by the Principal.

### **5.3 COMPLETION REPORT AND WORK-AS-EXECUTED DRAWINGS**

Provide the following to the Principal on completion of the cableway construction.

#### **5.3.1 Completion Report**

The completion report must include a close-up colour photograph of the interior of each pit and/or equipment housing, and another photo of the pit or equipment housing set against the surrounding background to allow for easy identification of the location of the pit or equipment housing.

Show against the photos of each pit the date that the photo was taken, its pit identification number and its GPS coordinates.

#### **5.3.2 Work-As-Executed (WAE) Drawings**

In addition to the requirements of Specification TfNSW G2, all WAE drawings prepared for the cableway must comply with the TfNSW ITS CAD Standard based on the approved detailed design

drawings (refer to Clause 2.6). WAE plans must show GPS coordinates for each asset listed below, as applicable:

- (a) Pits
- (b) Equipment housing

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text before issue of Tender Documents)*

*Insert any further requirements below, such as outlet for permanent VMS, VLSL or CCTV camera*

**ANNEXURE R155/A – PROJECT SPECIFIC REQUIREMENTS**

*Complete the table below by filling in the required details.*

*Where “Yes / No” options are shown below, delete whichever is not applicable.*

**A1 DETAILED DESIGN FROM CONCEPT DESIGN**

<b>Clause</b>	<b>Description</b>	<b>Requirement</b>
2.1.1	Contractor to carry out detailed design based on Principal’s concept design:	Yes / No

**A2 ROAD CATEGORY**

Refer to Clause 2.3.1.

<b>Name of Road</b>	<b>Category *</b>

\* Either State/Regional Road or Local Road

**A3 ENVIRONMENTAL REQUIREMENTS**

Refer to Clause 2.1.3.

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text before issue of Tender Documents)*

*Insert here any environmental requirements that must be addressed in the detailed design.*

**A4 MILESTONE DATE(S)**

Refer to Clause 4.1.1.

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text before issue of Tender Documents)*

*Insert here any Milestone dates for completion of the cableway works.*

**A5 PROGRESS REPORTING**

<b>Clause</b>	<b>Description</b>	<b>Requirement</b>
4.12	Monthly progress report for cableway works required:	Yes / No

## **ANNEXURE R155/B – MEASUREMENT AND PAYMENT**

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the following Pay Items.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract.

Unless specified otherwise, a lump sum price for any of these items will not be accepted.

### **Pay Item R155P1 – Design of Cableway**

This is a Lump Sum item.

The Lump Sum covers all costs associated with design of the cableway in accordance with this Specification, including detailed site survey, preparation of design output, and any design verification/certification required.

### **Pay Item R155P2 – Excavation and Backfill of Cableway Trench**

The unit of measurement is the “cubic metre”, measured as the bank volume of excavation in all types of material, where the cableway is not located with other utilities and where separate excavation of the cableway trench is required.

Payment for cableway road crossing by open trenching will be made under this Pay Item.

The volume is determined by multiplying the actual length of the trench, by the design depth of the trench, by the minimum trench width as shown on the Drawings, unless otherwise approved by the Principal.

The rate includes excavation, supply and placement of marker tape, backfilling and disposal of all surplus material. No further payment will be made under TfNSW R44 for the disposal off site of any surplus material.

No payment will be made for any additional material or work required as a result of over-excavation.

### **Pay Item R155P3 – Inadequate Foundation Material Under Conduits and Pit Bases**

The schedule quantity is a provisional quantity.

The unit of measurement is the “cubic metre”, measured as the volume of material which is directed by the Principal to be removed, disposed of and replaced.

The rate includes excavation, removal and disposal of inadequate foundation material (including any off site disposal), and its replacement with adequate foundation material, in accordance with Clause 4.5.4. No further payment will be made under TfNSW R44 for the disposal off site of any surplus material.

### **Pay Item R155P4 – Under Road or Waterway Crossing by Trenchless Techniques**

#### **R155P4.1 – Under Road Crossing by Trenchless Techniques**

- R155P4.1.1** Crossing to house 4 x 100 mm communications and 4 x 100 mm electrical conduits



**R155P4.1.2** Crossing to house 2 x 100 mm communications and 2 x 100 mm electrical conduits

**R155P4.1.3** Crossing to house 1 x 100 mm communications and 1 x 100 mm electrical conduits

**R155P4.2 – Under Waterway Crossing by Trenchless Techniques**

**R155P4.2.1** Crossing to house 4 x 100 mm communications and 4 x 100 mm electrical conduits

The unit of measurement is the “lineal metre” of under road or waterway crossing for the various conduit configurations.

Where two separate bores, one to house the communications conduits and the other to house the electrical conduits, are carried out for the same crossing, the work will be measured as a single crossing.

The rate covers all costs associated with the installation of the outer casing by boring, and the entry and exit pits.

Supply and installation of the conduits within the outer casing are paid separately under Pay Item R155P6.

**Pay Item R155P5 – Bridge Crossings**

**R155P5.1 – Bridge crossing using steel brackets supports attached to bridge structure**

The unit of measurement is the “lineal metre” of each bridge crossing. The actual number of steel brackets required will be dependent on the Contractor’s design.

The rate covers all costs associated with the supply of galvanized steel bracket supports and their installation.

**R155P5.2 – Cable ladder**

The unit of measurement is the “lineal metre” of each cable ladder. The rate covers all costs associated with the supply and installation of the cable ladder.

Supply and installation of the conduits are paid separately under Pay Item R155P6.

**Pay Item R155P6 – Conduits**

**R155P6.1** 100 mm DN white rigid HD plastic communications conduit

**R155P6.2** 100 mm DN orange rigid HD plastic electrical conduit

**R155P6.3** 100 mm DN galvanized steel tube

The unit of measurement is the “lineal metre” of each conduit installed.

The rate includes:

- (a) supply, jointing and laying of conduit, including any associated materials, uncovering of and connecting on to existing conduits, and marking of the conduits where specified;
- (b) supply and installation of draw rope;

(c) testing of conduits in accordance with Clause 5.1.

**Pay Item R155P7 – Pits**

**R155P7.1** Communications pit, 900 mm x 900 mm

**R155P7.2** Electrical pit, 600 mm x 600 mm

**R155P7.3** Communication pit, 450 mm x 450 mm

**R155P7.4** Electrical pit, 450mm x 450mm

**R155P7.5** Electrical pit, 900 mm x 900 mm

The unit of measurement is “each” pit of each type. The dimensions stated are internal dimensions.

The rate covers all costs associated with the supply and installation of each pit type, including lids and connection of conduits.

The schedule quantity for Pay Item R155P7.5 is a Provisional Quantity.

**Pay Item R155P8 – Equipment Housing**

**R155P8.1** Equipment housing, 1300 mm x 600 mm x 400 mm,

The unit measurement is “each” equipment housing installed.

The rate covers all costs associated with the supply and installation of each equipment housing, including foundations and connection of conduits.

**Pay Item R155P9 – Brass Lid Labels**

The unit of measurement is “each” lid label installed.

The rate covers all costs associated with the supply and installation of each pit lid label.

## **ANNEXURE R155/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS**

Refer to Clause 1.2.3.

### **C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS**

<b>Clause</b>	<b>Type</b>	<b>Description</b>
2.7	Hold	Submission of detailed design drawings and design report
3.1.7	Hold	Submission of certificate of conformity prior to incorporation into the Works of any supplied conduits and associated items
4.4	Hold	Detailed set out of cableway route
4.5.4	Hold	Inadequate foundation material
4.6.2	Hold	Submission of Work Method Statement for trenchless techniques
4.7.4	Hold	Backfilling over conduits or marker tapes in trenches
4.8	Hold	Design and certification of steel conduit supports on concrete or rock faces
5.1	Witness	Testing of installed conduits

### **C2 SCHEDULE OF IDENTIFIED RECORDS**

The records listed below are Identified Records for the purposes of TfNSW Q Annexure Q/E.

<b>Clause</b>	<b>Description of Identified Record</b>
2.2	Detailed site survey
2.6.2	Detailed design drawings
2.7	Design report
3.1	Details of conduits, draw rope, marker tape, cable ladders, and steel brackets
3.1.7	Certificate of conformity, stating that the supplied conduits and associated items conform to the requirements of this Specification
3.2	Details of pits, including risers, lids, and rung ladders
3.3	Details of equipment housing
3.4	Details of bedding and other backfill material
4.8.1	Design and certification of steel support brackets for conduits on concrete or rock faces
4.8.2	Details of jointing to accommodate expansion/contraction for conduits in bridge crossings
5.1	Conduit test records
5.2	Completed final inspection acceptance checklist
5.3	Completion report

## **ANNEXURE R155/D – PLANNING DOCUMENTS**

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the Contract must be reviewed to determine additional documentation requirements.

<b>Clause</b>	<b>Description</b>
4.6.2	Work Method Statement for trenchless techniques of road or waterway crossing
4.7.5	Work Method Statement for compacting first 150 mm of backfill over conduits
4.8.1	Method of fixing steel support brackets to concrete or rock faces

ANNEXURE R155/E – FINAL INSPECTION ACCEPTANCE CHECKLIST

Pit No	Chainage	GPS coordinates	Type (Comms or Elect)	Design pit size	Pit size correct?	Class D lid?	Pit lid frame cleaned?	Pit lid lifting holes cleaned?	Label on lid correct?	Label on lid installed correctly?	Lid sits evenly in pit frame?	Pit free of debris?	Pit dry with no ingress of water?	Design number of conduits	Correct number of conduits installed?	Draw rope in each conduit?	Conduits are continuous?	Conduit end fitted with bell mouth?	Comments	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		

Notes for completion of checklist:

Column 5: Insert pit size shown in detailed design A: 450×450, B: 600×600, C: 900×900

Column 15: Insert number of conduits shown in detailed design

Columns 6 to 14, 16 to 19: Insert either "Yes" or "No" (Y/N)

Name and Signature:

TfNSW ITS Projects Representative

TfNSW Project Manager

Contractor Representative

**ANNEXURES R155/F TO R155/K – (NOT USED)****ANNEXURE R155/L – MINIMUM FREQUENCY OF TESTING**

Refer to Clause 1.2.5.

<b>Clause</b>	<b>Characteristic Analysed</b>	<b>Test Method</b>	<b>Minimum Frequency of Testing</b>
3.4.1	Type BH Select Fill:		
	particle size distribution	TfNSW T201	- One per 50 m <sup>3</sup> or part thereof prior to placement
	plasticity	TfNSW T109	- One per 100 m <sup>3</sup> or part thereof prior to placement
3.4.2	Type SO Select Fill:		
	particle size distribution	TfNSW T201	- One per 100 m <sup>3</sup> or part thereof prior to placement
	plasticity	TfNSW T109	- One per 200 m <sup>3</sup> or part thereof prior to placement

**ANNEXURE R155/M – REFERENCED DOCUMENTS**

Refer to Clause 1.2.6.

**TfNSW Specifications**

TfNSW G2	General Requirements
TfNSW G10	Traffic Management
TfNSW G22	Work Health and Safety (Construction Work)
TfNSW G36	Environmental Protection
TfNSW G38	Soil and Water Management
TfNSW G73	Detail Survey
TfNSW Q	Quality Management System
TfNSW R11	Stormwater Drainage
TfNSW R44	Earthworks
TfNSW R132	Safety Barrier Systems
TfNSW 3368	Skid Resistant Friction Coating for Temporary Steel Road Plates
TfNSW TS101	Traffic Control Signals – New Installation and Reconstruction

**TfNSW Test Methods**

TfNSW T109	Plastic Limit and Plasticity Index of Road Construction Materials
TfNSW T201	Particle Distribution of Aggregates (by Washing)

**TfNSW Model Drawings**

DS2012/000830	ITS Cableway Layout at Traffic Signalled Intersections
DS2012/000831	ITS Cableway in Box Girder Bridges
DS2012/000832	ITS Cableway in Obstacle Field
DS2012/000833	ITS Cableway Along Rock Face
DS2012/000834	Cableway Configurations without Traffic Control Signal (TCS)
DS2012/000835	ITS Roadside Equipment Housing
DS2012/000836	Conduit Trenching
DS2012/000837	ITS Cableway Pit Lid Labels
DS2012/000838	General Arrangement of Communications and Electrical Pits for Offset Installations

Copies of the above drawings are available on the TfNSW Internet website <https://www.rms.nsw.gov.au/business-industry/partners-suppliers/document-types/standard-drawings/intelligent-transport-systems.html>

**Australian Standards**

AS 1074	Steel tubes and tubulars for ordinary service
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AS 1100.401	Technical drawing – Engineering survey and engineering survey design drawing
AS 1102	Graphical symbols for electrotechnical documentation
AS 1657	Fixed platforms, walkways, stairways and ladders – Design, construction and installation
AS/NZS 2053.2	Conduits and fittings for electrical installations – Rigid plain conduits and fittings of insulating material
AS/NZS 2648.1	Underground marking tape – Non-detectable tape
AS 3000	Electrical installations (known as the Australian/New Zealand wiring rules)
AS 3008	Electrical installations – Selection of cables
AS 3725	Design for installation of buried concrete pipes
AS 4792	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
AS 4383	Preparation of documents used in electrotechnology