



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Signalling)

Category: Standard

# Construction of Cable Route and Associated Civil Works

## SCP 21

### Applicability

New South Wales	✓	CRIA (NSW CRN)	✓
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### Primary Source

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1.3	24 June 2010	Various	Various sections transferred to ESC-11-01. Updated superseded terminology. Signalling forms removed and replaced with a link to the Engineering Extranet. Document transferred to new template and edited for grammar and style.

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## About This Standard

This document is one of a series of detailed standards which together set out the total requirements for signalling projects on the Australian Rail Track Corporation system.

This document details the requirements for the construction of buried cable route, cable route in steel troughing and cable route in concrete or HDPE or LLDPE ground level troughing. It also details the requirements for the construction of associated civil works such as location bases and foundations.

This document is to be read in association with the project specification and referenced documents.

## 1 General

### 1.1 Scope

Refer to Section 1.1 Scope in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### 1.2 Referenced Documents

Refer to Section 1.8 Referenced Documents in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### 1.3 Definitions

Refer to Section 1.5 Definitions in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### 1.4 Approvals and Inspections

Refer to Section 1.7 Submissions for Approval and Section 1.11 Submissions for Approval in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### 1.5 Environmental Considerations

Refer to Section 1.10 Environmental Considerations in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### 1.6 Responsibilities

Refer to Section 1.12 Responsibilities in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### 1.7 Site Surveys

Refer to Section 1.13 Site Surveys in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### 1.8 Location of Equipment

Refer to Section 1.14 Location of Equipment in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 1.9 Signal Location

Refer to Section 1.15 Signal Location in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 1.10 Installation Drawings

Refer to Section 1.16 Installation Drawings in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 1.11 Existing Equipment

Refer to Section 1.17 Existing Equipment in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 1.12 Temporary Level Crossings

Refer to Section 1.18 Temporary Level Crossings in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 1.13 Location of Services

Refer to Section 1.19 Location of Existing Services/Cabling in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 1.14 Alternative Materials, Products or Processes

Where this document proposes a particular material, product or process, or range of materials, products or processes, alternatives may be accepted for use where permitted by the project specification, provided they receive Type Approval and it can be demonstrated that the alternative:

- is fit for purpose
- is better rather than worse in optimally achieving the performance requirements
- improves rather than reduces system safety, security and availability
- is closer rather than further from best practice
- is equally or more suitable in form, fit and function, and equally or more compatible with its interfaces, operating environment and maintenance environment
- increases rather than decreases compliance with environmental and occupational health and safety requirements
- decreases rather than increases life cycle costs
- improves rather than reduces maintainability and supportability
- increases rather than decreases adaptability for foreseeable change
- provides a net benefit to ARTC.

## 2 Supply of Materials

Refer to Section 2 Supply of Materials in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 3 Excavation, Boring, Backfilling and Compaction

Refer to Section 3 Excavation, Boring, Backfilling and Compaction in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **4 Concrete and Stabilised Sand**

Refer to Section 4 Concrete and Stabilised Sand in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **5 Cable Route General Requirements**

Refer to Section 5 Cable Route General Requirements in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **6 Buried Cable Route (Cable Route Types 1, 2, 3 and 4)**

### **6.1 General**

Refer to Section 6.1 General in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **6.2 Depth of Cable Route**

Refer to Section 6.2 Depth of Cable Route in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **6.3 Shared Trenches**

Refer to Section 6.3 Shared Trenches in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **6.4 Protective Cover over Signalling and Communications Cables**

Refer to Section 6.4 Protective Cover over Signalling and Communications Cables in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **6.5 Earth Cables and Wires in Trenches**

Bare copper earth cables shall be installed in cable trenches in areas which are proposed for 25 kV AC electrification. Stainless steel earth wires shall be installed in cable trenches in all other areas. At a distance midway between location cases or buildings, a ten metre long gap shall be provided between the ends of the earth wires.

Earth wires in trenches shall not be located within 20 metres of any high voltage earth installation.

The project specification will indicate whether or not the area concerned is proposed for 25 kV AC electrification and the earthing arrangements shall be installed in accordance with the requirements of SCP 04 Lightning and Surge Protection Requirements.

### **6.6 PVC Cable Marker Tape in Trenches**

Refer to Section 6.5 PVC Cable Marker Tape in Trenches in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **6.7 Rock Areas**

Refer to Section 6.6 Rock Areas in ESC-11-01 Construction of Cable Route and Associated Civil Works.



## 6.8 Cable and Pipe Plowing – Preparation of Route

Refer to Section 6.7 Cable and Pipe Ploughing – Preparation of Route in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.9 Cable Plowing – General

Refer to Section 6.8 Cable Ploughing – General in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.10 Cable Plowing – Demonstration

Refer to Section 6.9 Cable Ploughing – Demonstration in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.11 Cable Plowing – Restoration

Refer to Section 6.10 Cable Ploughing – Restoration in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.12 Buried Pipes

Refer to Section 6.11 Buried Pipes in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.13 Pipes in High Voltage Areas

Where communications cables are required to be run into high voltage earthed locations such as substations, power sectioning huts and transformer locations, these shall be looped into and out of the locations and be protected by pipes as shown on drawing number NS 3286.

An 'earth mat' is provided around high voltage locations as part of the earth protection arrangements for the high voltage installations. All cables (signalling and communications) to be installed within 20 metres of the earth mat shall be run in pipes. Details of the extent of the earthing arrangements around each high voltage installation will be provided by the IWMP representative.

Existing high voltage earthing arrangements shall not be disturbed under any circumstances.

## 6.14 Spare Buried Pipes

Refer to Section 6.12 Spare Buried Pipes in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.15 Pipes in Platforms and Other Paved Areas

Refer to Section 6.13 Pipes in Platforms and Other Paved Areas in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.16 Buried Cables Through Water Courses

Refer to Section 6.14 Buried Cables Through Water Courses in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 6.17 Cable Routes on Embankments

Refer to Section 6.15 Cable Routes on Embankments in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **6.18 Underground Services of Other Authorities**

Refer to Section 6.16 Underground Services of Other Authorities in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **6.19 Cable Route Markers**

Refer to Section 6.18 Cable Route Markers in ESC-11-01 Construction of Cable Route and Associated Civil Works.

# **7 Ground Level Troughing (GLT) Cable Route (Cable Route Type 5)**

Refer to Section 7 Ground Level Troughing (GLT) Cable Route in ESC-11-01 Construction of Cable Route and Associated Civil Works.

# **8 Galvanised Steel Troughing (GST) (General Route Type 6)**

## **8.1 General**

Refer to Section 8.1 General in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **8.2 Arrangements at or Near Overhead Wiring Structures**

Steel cable troughing or support brackets shall not be fixed to or installed within 75 mm of any part of any overhead wiring structure (OHWS) at any point in the cable route.

Where any metallic troughing or ladder passes within two metres of any OHWS, it shall be fitted with an insulated joint at least two metres distant from each side of the OHWS.

Steel troughing shall not be installed within 1500 mm of the overhead wiring.

## **8.3 Troughing Route Capacity**

Refer to Section 8.2 Troughing Route Capacity in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **8.4 Bends**

Refer to Section 8.3 Bends in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **8.5 Expansion Joints and Insulated Sections**

Refer to Section 8.4 Expansion Joints and Insulated Sections in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **8.6 Mounting Brackets and Fittings**

Refer to Section 8.5 Mounting Brackets and Fittings in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.7 Troughing on Posts

Refer to Section 8.6 Troughing on Posts in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.8 Troughing on Railway Bridges or Viaducts

Refer to Section 8.7 Troughing on Railway Bridges or Viaducts in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.9 Troughing on Rock Faces

Refer to Section 8.8 Troughing on Rock Faces in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.10 Troughing on Walls

Refer to Section 8.9 Troughing on Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.11 Troughing in Tunnels or Through Underbridges with Limited Clearances

Refer to Section 8.10 Troughing in Tunnels or Through Underbridges with Limited Clearances in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.12 Steel Troughing Across Culverts

Refer to Section 8.11 Troughing Across Culverts etc in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.13 Transition Between GST/GLT/Buried Cable Route

Refer to Section 8.12 Transition Between GST/GLT/Buried Cable Route in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.14 Steel Troughing Arrangements at Entries to Location Cases

Refer to Section 8.13 Troughing Arrangements at Entries to Location Cases in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 8.15 Fitting of Lids

Refer to Section 8.14 Fitting of Lids in ESC-11-01 Construction of Cable Route and Associated Civil Works.

# 9 Cable Ladder (Cable Route Types 7, 8 and 9)

Refer to Section 9 Cable Ladder Cable Route in ESC-11-01 Construction of Cable Route and Associated Civil Works.

# 10 Pipe Cable Route

Refer to Section 10 Pipe Cable Route in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 11 Underline and Under Road Crossings (ULX and URX)

Refer to Section 11 Underline and Under Road Crossings (ULX and URX) in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 12 Cable Pits, Cable Jointing Pits and Cable Turning Chamber

Refer to Section 12 Cable Pits, Cable Jointing Pits and Cable Turning Chambers in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 13 Signal and Gantry Foundations

### 13.1 Location of Signal and Gantry Foundations

The foundations for signals and signal gantries shall be installed at the position indicated on the corresponding Signal Sighting form.

Signal foundations shall be located at the distance from rail and the height above rail shown on the Signal Sighting form.

Gantry foundations shall be located at the location shown on the Signal Sighting form and at the distance from the nearest rail and at the height relative to rail level shown on the Engineering plans for the gantry.

### 13.2 Construction of Signal Foundations

The foundations for post mounted signals shall be of sufficient size, shape and depth in ground to support fully dressed signals in wind speeds to 160 km/h for areas south of a line through Taree and 180 km/h north of that line, without the need to rely on staying, bracing or the ladder for support. The foundation shall also be capable of supporting the signal plus two maintenance staff on the signal ladder or platforms in wind speeds to 80 km/h.

Ground mounted shunt signal foundations shall be of sufficient size, shape and depth in ground to support the signal and any route indicators attached thereto subject to the minimum depth in ground being 600 mm and the minimum cross section being 350 mm in diameter.

For sites such as on ash banks or on the top of retaining walls, the contractor shall supply engineer's drawings detailing the proposed signal foundation structures. Track retaining walls may be drilled or bored to anchor signal foundations but shall not be cut away or otherwise disturbed without written approval.

The foundations may be precast concrete or cast in situ. Bolts of the size specified in SCP 15 Installation of Trackside Equipment shall be cast into signal foundations to enable the signal posts or ground mounted signals to be bolted on and removed without disturbing the foundations.

The signal post holding down bolts shall be installed vertically in the foundation castings and the top surface of foundations shall be completely level.

Cable entry conduits of not less than 50 mm diameter shall be cast into signal foundations.

That portion of signal foundations visible above ground shall be neatly finished with smooth surfaces free of voids and shall have chamfered edges.

Square foundations shall be parallel to the track.

For signals in cuttings, the contractor shall, where necessary, cut back and shore the bank to provide space for the signal foundation. Concrete or brick retaining walls shall be built wherever there is a danger of erosion or subsidence of the bank or cutting due to the signal placement.

In areas of solid rock it is permissible for the signal post holding down bolts to be grouted into the rock. The rock shall be excavated to a depth of at least 200 mm and a concrete cap shall be keyed into this to form the signal foundation to the required height relative to rail level. Holding down bolts shall be keyed a further 300 mm into the rock.

### 13.3 Construction of Gantry Foundations

Gantry foundations shall be of such a size and depth to adequately support the gantry, signal cases, signals, walkway and handrail, incidental loadings from maintenance personnel, overhead wiring loads (where applicable) and resist wind loadings, in the terrain category applicable to the location, for wind velocities up to 160 km/h.

Unless otherwise specified in the project specification, the contractor shall supply engineer's drawings detailing the requirements for the construction of all gantry foundations. The provisions of those drawings shall be strictly adhered to in the construction of the foundations.

Retaining walls shall not be disturbed without written approval.

### 13.4 Backfilling and Levelling Site

When the signal and gantry foundations are installed and approved, the contractor shall backfill the foundations, level the site and remove any surplus spoil.

Telephones are installed at signals and signal gantries for driver use in case of emergency or during delays or interruptions to railway traffic. Safe and easy access shall be provided to all such telephones and, if necessary, a walkway from the track to the signal telephone shall be formed for driver access.

Handrails shall also be provided, where necessary, to protect train drivers from drains or embankments, etc.

Walkways (including handrails) from the track to signal telephones shall be provided where determined by the IWMP representative and shall be treated as a variation under the Contract except where these requirements have been shown in plans provided at the time of Tendering.

### 13.5 Foundations Affecting Track Drainage

If a signal or gantry foundation is to be located such that it would obstruct existing or proposed track drainage arrangements, the contractor shall provide alternative drainage arrangements. These could include drainage ducts through the foundations, or ducts or channels around the foundations.

### 13.6 Access to Signals and Gantries from Public Roads

Where railway lines run alongside public roads, access to signals and signal gantries from the public roads shall be provided. This shall include the provision of walkways/steps/handrails as necessary for safe and convenient access in addition to the provision of a lockable single width gate in the boundary fence in accordance with the requirements of Section 21 Construction of Railway Access Roads.

## 14 Location Case Foundations/Platforms

### 14.1 General

'Foundation' shall include both the concrete area under and the concrete surrounding the location case.

'Platform' shall include the metal platform, the associated supporting steelwork and handrails and ladders/steps, for locations on sloping sites or where the location case is to be elevated to avoid local flooding.

This section of the document sets out the basic requirements for foundations and associated concrete structures. Additional provisions may be necessary at difficult sites such as on high banks or in swampy areas. All location cases shall have secure foundations and safe and convenient access provided to the location case for maintenance and construction staff.

Concrete or brick retaining walls shall be provided where necessary to form a secure level area for location case foundations.

In low lying areas, the local flood history shall be determined and the top of the location case base shall be at a height not lower than the recorded or projected 100 year flood level.

## 14.2 Construction of Location Case Foundations and Associated Work

Drawings SC 09 01/10, SC 09 01/11 and SC 09 01/12 in ESC-11-01 Construction of Cable Route and Associated Civil Works illustrate acceptable arrangements for the construction of a location case foundation on level, stable ground with the cable entries from a buried cable route, ground level troughing and steel troughing on posts respectively.

For sloping or unstable sites, the specific proposals shall be prepared for approval, but the layout and method of cable entry shall, as far as possible, be similar to those indicated on the drawings referred to above. In areas of sloping or unstable sites, retaining walls forming part of the location case foundations shall be provided as necessary.

Care shall be taken to ensure that location case foundations and location case platform foundations do not impede drainage and do not lead to scouring or erosion.

The base of location cases shall not be less than 300 mm above the concrete area surrounding the location cases.

## 14.3 Location Cases on Raised Metal Platforms

Where it is not practical to install concrete foundations for location cases such as on steeply sloping sites and over culverts, approved raised metal platforms shall be provided.

The platforms shall comply with the relevant parts of AS1657. In addition, each platform shall be capable of carrying a minimum of six persons in addition to the location case(s) and shall not bend, distort, sway or vibrate under this load and any combination of this load and wind loading (from passing trains).

Metal supporting posts shall be securely anchored in concrete foundations and where the ground is sandy or uncompacted, foundations shall be strip footings rather than individual footings under each post.

The area under the extended up to 1000 mm beyond the extremities of the raised platforms shall be covered with 50 mm of concrete. The area under the raised platform shall be enclosed to prevent the build-up of rubbish and the growth of grass or scrub underneath which could put location case contents and associated cables at risk in the event of fires, etc.

## 14.4 Steps, Ladders and Handrails

Where location cases are installed above ground level, fixed steps or ladders shall be provided where necessary to provide easy and safe access for maintenance and construction staff.

Handrails to AS1657 shall be provided on all steps and around the foundations of all location cases which are located on embankments etc, or where the safety of maintenance or construction staff could be at risk from accidentally stepping off an above ground structure.

Handrails shall also be required at ground level location cases where staff could step back into a track drain, culverts etc and on the track side of the location case where the location case is within 3600 mm of the nearest rail of any track.

Stairs and ladders to location cases shall comply with the requirements of AS1657 in respect to the selection of step type ladders or rung type ladders, stile, tread and rung sizes and the provision of safety cages and intermediate platforms.

Steps shall be not less than 600 mm wide and ladders shall be 450 mm wide.

## 14.5 Cable Entries to Location Cases

Cable entries to all concrete location case foundations shall comply with the requirements set out in Section 14.2 Construction of Location Case Foundations and Associated Work.

Cable entries to location cases on raised platforms shall be purpose designed to suit the particular location. The cables between ground level and the platform shall be encased in 100 mm diameter PVC or HDPE pipes, in steel troughing or in enclosed cable tray. Pipes, trough or tray shall be securely fixed at ground and platform level.

Cables in the vertical plane shall be secured at intervals of not greater than 600 mm to prevent the cables from sagging and causing undue pressure on cables at bends or on cable terminations in the location cases.

## 14.6 Access to Location Cases

Access shall be available to all location cases from the track in the immediate vicinity unless otherwise indicated in the project specification.

Where a public road runs alongside the railway line and location cases are positioned inside the boundary fences, personnel access shall be provided from the public road for maintenance and fault finding purposes. A personnel access gate in the boundary fence shall be provided in accordance with the requirements of Section 21 Construction of Railway Access Roads.

Paths and safety handrails shall, where necessary, be provided between the access gates and location cases.

Where pre-existing gates are to be used for access to the location cases, the paths, steps and handrails shall be upgraded to comply with this document and/or the relevant Australian Standards.

# 15 Communications Cable Termination Cabinet Foundations

## 15.1 General

Communications cable termination cabinets are generally Krone or Rittal type cabinets unless otherwise approved.

Communications cable termination cabinets shall be provided in the cable route at railway stations and other locations where stated in the project specification or indicated on communications cable route diagrams. Communication facilities for stations and other buildings will be fed from these cabinets.

## 15.2 Construction of Foundations for Cable Termination Cabinets

The cable termination cabinet foundation shall consist of a concrete slab 1800 mm x 1800 mm by 100 mm thick with 100 mm diameter pipes or a ground level trough (GLT) set into the concrete to provide access to the cables into the cabinet.

A raised concrete base or steel form 450 mm high shall be provided on the concrete slab to support the cable termination cabinet. The steel framed plinth shall be enclosed in steel sheeting of not less than 2 mm thick.

On sloping or uneven sites, retaining walls as necessary to support the foundations shall be provided. Safety rails shall also be provided where necessary to prevent staff from accidentally stepping off foundation platforms into drains or gullies or down embankments.

Where it is necessary to install communications cable termination cabinets on embankments or over culverts etc, the provisions in Section 13.3 Construction of Gantry Foundations and Section 13.4 Backfilling and Levelling Site shall apply.



Access shall be provided to all communications cable termination cabinets similar to the provided for location case as set out in Section 13.6 Access to Signals and Gantries from Public Roads.

## 16 Installation of Track Circuit Equipment

### 16.1 General

This section provides for the installation of track circuit equipment and cables in association with the construction of the cable route. Track circuit cables will generally be laid in with the main cable route for at least part of the way.

### 16.2 Bootleg Risers

For the purpose of this document, bootleg riser is defined as a small termination box mounted on a 50NB hollow steel post or pipe with a steel or concrete base. The incoming cable from relay room or location case to the bootleg riser shall pass through the base and inside the pipe into the termination box. Four RSA or similar terminals with links shall be provided within the box.

The bootleg riser is used as an interface between the surface mounted rail connecting cables and the track circuit cables running to the equipment location case or to the relay room as applicable, or between the surface mounted rail connecting cables and the bonding cables in the cable route.

Their most common application is AC and DC track circuits.

The bootleg riser is suitable for only for terminating cables of sizes up to 7/1.7 mm. For larger size bonding cables, specific proposals shall be submitted for approval.

Except where site conditions preclude, the bootleg risers shall be installed 2500 mm (minimum) from the nearest rail face and the top of the terminal box shall be 300–400 mm above ground level. Where track centres do not permit this position, the riser shall be placed centrally between the tracks and the top of the box shall be at least 50 mm below rail level.

### 16.3 High Voltage Impulse and Audio Frequency Track Circuits

Where the high voltage impulse and audio frequency track circuit trackside equipment can be installed within three metres of the rail, surface mounted track connecting cables may be run directly to the trackside equipment.

Posts used for mounting high, voltage impulse (Jeumont Schneider) and audio frequency track circuit (CSEE, ML and Westinghouse) trackside equipment and boxes shall be of sufficient cross section to support the box plus a load of 150 kg applied horizontally at the top of the post (nominally approximately one metre above ground level) with less than 20 mm deflection. In addition, the post shall have sufficient torsional rigidity to deflect less than 5° under a torque of 300 Nm applied at the top.

The posts shall be secured into the ground so that there will be no movement of the base of the post with a load of the box plus 150 kg applied vertically to the post plus the load of 150 kg applied horizontally at the top of the post or with these loads applied individually. The post shall also withstand a pullout load of at least 250 kg.

Incoming cable from the location case to the box shall be protected by either passing through the post or by a rigid conduit securely fixed to the post. Cables to the track shall be supported by clamping them to the post to minimise loading on the cable terminations.

Design life of the posts, the method of securing in ground, and conduits and cable supports shall be a minimum of 25 years.

Cable entries into tuning units shall be sealed to prevent entry of moisture.



## 17 Installation of Releasing Switches, Ground Frames and Associated Point Detectors

### 17.1 General

Releasing switch mounting posts and ground frame bases shall be installed in addition to construction of the cable route and installation of the cables to the releasing switches, ground frames and to the point detection boxes of ground frame operated points. Telephone cables to releasing switches shall be included.

### 17.2 Releasing Switches

The releasing switch and associated telephone shall be mounted on a suitable post, equivalent to a 100 NB pipe, bolted to a concrete foundation similar to that used for a dwarf signal. The telephone shall normally be mounted behind the releasing switch at approximately 1250–1400 mm above ground level. The releasing switch (that part which contains the handle and push button) should be 1400–1500 mm above ground level. Provision of a junction box at the base of the post is optional.

### 17.3 Ground Frame Bases

Ground frame bases shall consist of a concrete slab not less than 150 mm thick with suitable bolts cast into the slab for securing the ground frame in position.

The bolts shall be of sufficient length to permit 25 mm of timber packing between the ground frame and the concrete.

The operating platform for the ground frame shall consist of either a precast concrete channel section or a steel fabrication with Gridmesh or similar decking. The minimum width of the platform shall be 600 mm or the width of the ground frame plus 200 mm, whichever is greater. The minimum length of the platform shall be 1200 mm. A step at the end or one side of the platform shall be provided.

### 17.4 Cabling Arrangements to Ground Frame Operated Point Detectors

Cable arrangements to point detectors of ground frame operated points shall be similar to that required for electric switch machines.

## 18 Installation of Miscellaneous Trackside Equipment

### 18.1 Points Equipment

The cable route and cabling to the points to provide for point controls and detection circuits shall be provided in addition to cabling to a telephone post in the vicinity of the points (where applicable).

Post mounted telephones at points shall be installed in accordance with the provisions of Section 18.12 General Purpose Cases Including Emergency Switch Machine Lock/Emergency Operation Lock Boxes.

From buried cable routes, the cables to the points equipment shall remain buried then be brought up to the ground surface in 100 mm diameter pipe positioned 2500 mm from the rail face, adjacent to the points machine cable entry end. The cables shall then be run in flexible heavy duty orange PVC conduit to the points machine.

From ground level troughing (GLT) which is within the track formation, the cable from the GLT to the points machine shall be run in surface mounted flexible, heavy duty, orange PVC conduits.

Where the GLT is not in the track formation or is on the other side of an access road to the points machine, the cables shall be buried 800 mm deep between the GLT and 2500 mm from the rail face and treated as for buried cable. 100 mm pipe shall also be provided where the cable descends from the GLT into the ground.

Similar requirements shall apply to steel troughing routes.

## 18.2 General Purpose Cases Including Emergency Switch Machine Lock/Emergency Operation Lock Boxes

An Emergency Switch Machine Lock (ESML) or Emergency Operation Lock (EOL) box is normally provided near points to house the points crank handle or EOL key and other equipment for use in an emergency. Points control circuitry is wired to a contact in the box such that when the crank handle or key is removed from its enclosure, a contact is activated causing the power to be disconnected from the points motors.

The ESML/EOL boxes and mounting posts complete with cable entries for the ESML/EOL shall be provided together with the cable route and cabling from the location case or relay room as applicable.

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*Note: At some sites the ESML/EOL boxes may be installed on the relay room wall and in such cases the installation of ESML/EOL boxes and cabling will not form part of the work covered by this document.*

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## 18.3 Electro-Pneumatic Points Control Valves

Boxes housing the control valves for electro-pneumatic points are placed as close as possible to the end of points which they control. For single ended points, this box will also contain the emergency operation push buttons. For multiple ended points, one box only will contain the emergency operation push buttons, the others containing only control valves.

Mounting stands or posts, suitable for the type of control valve to be used, shall be installed. The stands or posts shall provide for the hose from the air main, the hoses to the points air motor and plunger lock air motor (where applicable) and for the control valve (and emergency push button) cables to be run to the valve boxes.

Generally the methods of running cable from the cable route to the control valve shall be as for electric point machines. Connection to the air main shall be as required by SCP 19 Air Reticulation Systems.

## 18.4 Buffer Stop Lights

Cables to buffer stop light posts shall be buried in all cases unless otherwise approved.

Buffer stop lights are normally mounted immediately behind the buffer stop in the centre of the 'four foot' or immediately to the left of, and in line with, the face of the buffer stop.

The buffer stop light mounting post shall be capable of supporting a 150 kg horizontal load applied at 1.5 metres above ground level with deflection of less than 10 mm.

The post shall be secured, into the ground or otherwise, so that it is capable of resisting a pull out force of 250 kg plus the above specified horizontal loading without movement.

The cables to the buffer stop lights shall be run in heavy duty rigid pipes, or within the post, from the ground to the lampcase position(s).

## 18.5 Maintenance Release Switch

Maintenance release switches and associated cabling shall be installed where shown on the signalling plans or as detailed in the project specification. Cabling arrangements shall be as for releasing switches.

## 18.6 Guards Indicators

Guards indicators are required where shown on the signalling plans and/or detailed site survey plans. They may be installed on station structures or on separate posts on the platform depending on site conditions.

Guards indicator mounting posts may be steel pipe (minimum 75 NB) with capped top or RHS (minimum 75 x 75 x 3.2) whichever best matches the particular station architecture.

Note: On some stations that are heritage listed, posts which more closely match the period architecture of the station may be required. The necessity for this is to be determined in consultation with the IWMP representative.

The post may be bolted to a concrete foundation or cast into a concrete foundation. The size of the foundation shall be such that it can withstand a person swinging on the post without moving the foundation in the platform.

The guards indicator lampcase shall be mounted between 2200 mm and 2400 mm above platform level unless otherwise directed.

The post shall be painted the same colour as the station lighting posts.

Cabling to guards indicators shall be run in pipes buried in the platforms or in conduits or cable ducts in or on station buildings or other structures subject to specific approval. Exposed conduits or cable ducts shall be made as unobtrusive as possible and painted to blend with the supporting structure.

## 18.7 Cabling to Platform and Concourse Indicators

Cabling to platform and concourse indicators shall be provided where shown on the signalling plans and/or detailed site survey plans.

Cabling to platform and concourse indicators shall be run in the manner specified for guards indicators.

## 18.8 Cables to Station Buildings

Cables to station buildings for local signalling control panels, telephones, etc shall be provided as indicated on signalling plans and/or detailed site survey plans.

Cabling to station buildings shall be run in the manner specified for guards indicators.

## 18.9 Traffic Huts

The foundations for and cabling arrangements to traffic huts shall be provided where shown on the signalling plans and/or on detailed site survey plans.

The foundations for traffic huts shall be constructed as detailed on the applicable drawings with cable entries built in to suit the cabling requirements and site conditions.

## 18.10 Impedance Bonds

Impedance bonds shall be mounted vertically on steel stands. Unless space restrictions preclude, the stand shall be designed and constructed such that no part of the impedance bond is closer than 800 mm to the ground and the stand shall be located so that no part of the impedance bond is closer than 2500 mm to the nearest rail face.

The stand shall be capable of carrying double the weight of the impedance bond(s) plus a load of 200 kg applied horizontally to the top of the stand at 90 degrees to the long axis without visible deflection.

Where physical structures such as bridges or tunnels prevent installation as nominated above, the height and position of the impedance bond may be altered with specific approval.

The stand posts shall be concreted into the ground sufficiently to support the specified loadings without movement of the foundation.

Notwithstanding the provisions of the above paragraphs, in areas of restricted clearance, the mounting of impedance bonds on walls or other structures may be authorised and in such cases the suitable mounting frames and/or support brackets shall be provided for attaching the impedance bonds to the structure in question.

### **18.11 Half Pilot Staffs**

Where mounted on separate posts, cabling arrangements to half pilot staffs shall be provided where shown on the signalling plan or detailed site survey plans. The half pilot staff box shall normally be mounted 1200–1400 mm above ground on a suitable metal post. The post shall support the loadings specified in Section 16.3 High Voltage Impulse and Audio Frequency Track Circuits.

### **18.12 Post Mounted Telephones**

Telephone mounting posts and associated cabling shall be provided where shown on the signalling plans or on detailed site survey plans.

The telephone shall be mounted 1250–1400 mm above ground level on a suitable metal post. The post shall support the loadings specified in Section 16.3 High Voltage Impulse and Audio Frequency Track Circuits.

## **19 Cable Installation**

Refer to Section 13 Cable Installation in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **20 Testing of Cables**

### **20.1 General**

Refer to Section 14.1 General in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **20.2 Cables with Copper Conductors**

Cables with copper conductors shall be continuity and insulation tested in accordance with the requirements of Standard Specification SC 00410000 SP.

### **20.3 Optical Fibre Cables**

Optical fibre cables shall be tested in accordance with Standard Specification 816F.

### **20.4 Test Records**

Refer to Section 14.2 Test Records in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **21 Construction of Railway Access Roads**

Refer to Section 15 Construction of Railway Access Road in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **22 Fencing, Gates and Retaining Walls**

### **22.1 General**

Refer to Section 16 Fencing, Gates and Retaining Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **22.2 Fencing**

Refer to Section 16 Fencing, Gates and Retaining Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **22.3 Gates**

Refer to Section 16 Fencing, Gates and Retaining Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **22.4 Modifications to Existing Fencing**

Refer to Section 16 Fencing, Gates and Retaining Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **22.5 Temporary Fences**

Refer to Section 16 Fencing, Gates and Retaining Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **22.6 Bollards**

Refer to Section 16 Fencing, Gates and Retaining Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

### **22.7 Retaining Walls**

Refer to Section 17 Retaining Walls in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## **23 Removal of Redundant Material, Equipment and Surplus Spoil**

Refer to Section 18 Removal of Redundant Material, Equipment and Surplus Spoil in ESC-11-01 Construction of Cable Route and Associated Civil Works.

## 24 Appendix A: Electrical Cable Search Procedure

### 24.1 Aim

- To ensure the correct procedures for identifying the location of ARTC high and low voltage cables have been carried out before commencing any excavation, boring or grading work.
- To avoid interference or contact with cables.

### 24.2 Users of Search Form

The ESC1101F-01 Cable Search form is to be submitted a minimum of three weeks prior to the planned date for any excavation, boring or grading works.

No excavation, boring or grading work shall commence until the contractor is advised the results of the search.

### 24.3 Search Procedures

The following definitions apply:

- The person requesting a cable search hereinafter is referred to as 'the enquirer'.
- Worksite hereinafter means the area, where excavation or boring or grading work is to take place.
- A request for the location of ARTC electrical cables shall be submitted in duplicate by the enquirer on the ESC1101F-01 Cable Search form together with a worksite plan detailing the area to be searched. The request shall be submitted to the IWMP representative who will forward it to the relevant Electrical Engineer.
- Upon receiving the request, the Electrical Engineer will give each search a unique number.
- The search form is divided into two parts; part one consists of enquiry details and part two is for including details of ARTC electrical cables in the work area. Part one of the search form shall be completed by the enquirer prior to submitting the form.
- If cables are not found in the vicinity of the proposed work following the search, the search form will be appropriately completed. The original is then processed into the database and filed, with the duplicate copy returned to the enquirer. This shall be valid for 60 days only.

If cables are found in the vicinity of the proposed work, the original form (including the relevant electrical plans) shall be forwarded to the Distribution Supervisor as soon as practicable after relevant items are entered into the database.

The copy of the form will be returned to the enquirer with the part stating that there are cables in the area filled in, but the plans shall not be marked showing the approximate position of the cables. It is not for the enquirer to determine if they are far enough away from a cable. The enquirer is then required to contact the person shown on the form for a site inspection and marking of cables.

- Upon being contacted by the enquirer, the Distribution Supervisor will arrange a mutually convenient time for a site inspection/marketing visit. All details of the site visit will be recorded on the ESC1101F-01 Cable Search form. This shall include cables marked and instructions given. A copy of this form will be provided to the enquirer, the original will be attached to the original search request and returned to the Distribution Engineer. All parties at the site visit shall sign the ESC1101F-01 Cable Search form.
- The Distribution Engineer will then update the cable search database and file the original of the search documents.
- Excavation shall not commence until the enquirer has possession of the completed search form and where applicable, the ESC1101F-01 Cable Search form. Any excavation, boring or grading work, after receipt of the completed form(s), shall comply with the instructions issued on the form(s).

- No excavation, boring or grading works shall be carried out within the following distances unless the electrical supply has been removed:
  - low voltage cables – 1.0 m measured horizontally<sup>1</sup>
  - high voltage cables – 2.0 m measured horizontally
- All works within these distances shall be hand excavation only. Work shall be carried out under the supervision of the Distribution Supervisor or their representative unless they approve otherwise, and shall continue until all underground ARTC electrical cables in the area are exposed and/or are relocated clear of the worksite.

The Distribution Supervisor or their representative shall determine at the site visit if an electrical isolation is required for the works. If an isolation is required, then it is the responsibility of the local rail staff to arrange the isolation. The enquirer shall note that it takes a minimum of fourteen days notice to arrange an isolation.

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**Note:** *HV cable relocation, either permanently or temporary, shall be carried out only by an authorised ARTC representative. The enquirer, or their representative, shall not carry out such work except under the supervision of the ARTC representative.*

*Exposed bare or damaged cables shall be rectified only by the ARTC representative and other persons shall not touch exposed bare cables. Work in the vicinity shall cease until repairs have been completed and approval to continue is given.*

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## 24.4 Updating of Cable Records

Where a site inspection indicates incorrect records, the Distribution Engineer will arrange for the records to be updated as follows:

- By the Electrical Engineer's office

Any minor amendment or alteration to the drawings should be carried out at the local maintenance office.

A duplicate copy of the plan and drawings should be forwarded to ARTC for records amendment.

- By an IWMP representative

Major alteration of the recording of cables such as major changes in route length and depth of underground cables should be arranged to be carried out by and IWMP representative.

It is the responsibility of the Distribution Engineer to ensure that the IWMP representative is advised of the changes and that new diagrams are issued.

## 24.5 Guidelines for Site Inspections

- Be familiar with the detection equipment.
- Ensure you have the search details and site plan.
- Be sure of whom you are meeting and where.
- Mark cable locations with spray paint.
- Enter the search reference number on the ESC1101F-01 Cable Search form.
- Ensure you have a list of attendees at the site visit.
- List cables marked and from where to where.
- Ensure all instructions given to the enquirer are written on the form.
- Use as many forms as necessary.
- The safe distances are:
  - 1.0 metres for LV cables measured horizontally.

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<sup>1</sup> For this appendix, low voltage and high voltage are as defined in AS3000.

- 2.0 metres for HV cables measured horizontally.
- If the enquirer wishes to work within these distances, the power must be turned off and excavations hand dug.
- Return the completed paperwork to the Distribution Engineer.
- If it is found that the location of a cable is significantly different from that shown on the search plan, the search plans are to be marked to show the correct location.
- If a cable cannot be located, it is to be brought to the attention of the Distribution Engineer as soon as possible. Approval to dig is not to be given to anybody without the approval of the Distribution Engineer.

The ESC1101F-01 Cable Search form is available on the ARTC Engineering Extranet.



## 25 Appendix B: ULX Inspection Report

The ESC1101F-02 ULX Inspection Report is available on the ARTC Engineering Extranet.

## 26 Drawings

Refer to Section 22 Appendix C: Drawings in ESC-11-01 Construction of Cable Route and Associated Civil Works.