Technical Note - TN 056: 2015

Issued date: 03 September 2015
Effective date: 03 September 2015
Subject: Withdrawal of ESC 540 Service Installations within the Rail Corridor

This technical note is issued by the Asset Standards Authority as a notification to remove from use the RailCorp standard ESC 540 Service Installations within the Rail Corridor, Version 2.2.

ESC 540 is a legacy document and shall be used for reference purposes only. ASA standard THR CI 12190 ST Service Installations within the Rail Corridor, Version 1.0 supersedes this document.

Authorisation:

<table>
<thead>
<tr>
<th>Technical content prepared by</th>
<th>Checked and approved by</th>
<th>Interdisciplinary coordination checked by</th>
<th>Authorised for release</th>
</tr>
</thead>
<tbody>
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<td>Signature</td>
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<td></td>
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<td></td>
<td>Standards and Services</td>
</tr>
</tbody>
</table>

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www.asa.transport.nsw.gov.au
Technical Note - TN 033: 2015

Issued date: 11 June 2015
Effective date: 11 June 2015
Subject: Update to RailCorp engineering standards ESC 410, ESC 540 and TMC 411

This technical note supersedes TN 009: 2013 and is issued by the Asset Standards Authority as a temporary update to the standards listed in Table 1.

Table 1 – RailCorp engineering standards

<table>
<thead>
<tr>
<th>Reference No</th>
<th>Title</th>
<th>Version</th>
<th>Issue date</th>
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<tbody>
<tr>
<td>ESC 410</td>
<td>Earthworks and Formation</td>
<td>2.0</td>
<td>01/07/2010</td>
</tr>
<tr>
<td>ESC 540</td>
<td>Service Installations within the Rail Corridor</td>
<td>2.2</td>
<td>01/07/2010</td>
</tr>
<tr>
<td>TMC 411</td>
<td>Earthworks</td>
<td>2.0</td>
<td>01/07/2010</td>
</tr>
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</table>

The SMS document reference on CTN 13/04 has changed to SMS-06-GD-3066 Guide to managing construction hazards.

Documents listed in Table 1 are presented as legacy RailCorp documents and shall be read in conjunction with this technical note and interpreted according to the interpretation guides listed in Table 2.

Table 2 – Interpretation guides

<table>
<thead>
<tr>
<th>Reference no</th>
<th>Title</th>
<th>Version</th>
<th>Issue date</th>
</tr>
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<tbody>
<tr>
<td>TS 10762</td>
<td>Legacy RailCorp Standards Interpretation - Management Overview</td>
<td>1.0</td>
<td>28/06/2013</td>
</tr>
<tr>
<td>TS 10760</td>
<td>Guide to interpretation of organisational role and process references in RailCorp standards</td>
<td>1.0</td>
<td>17/06/2013</td>
</tr>
<tr>
<td>TS 10760 - SMS</td>
<td>Interpretation guide RailCorp SMS References within RailCorp engineering standards</td>
<td>1.0</td>
<td>17/06/2013</td>
</tr>
</tbody>
</table>
1. **Embankment/cut slope instability due to toe disturbances and trenching**

This instruction includes mandatory requirements.

There have been several embankment destabilisations reported as a result of excavations into the toe of embankments. As shown in the photographs (Figure 1 to Figure 5), it appears that the toe was cut to create access at the expense of embankment stability.

Removing the toe restraint, which is an integral part of the earth structure, leads to slip failure progressing towards the track. This is one of the worst forms of destabilisation for dynamic loading. It was noted that vertical cuts were left unsupported until track patrol discovered the slip failure.

Each incident led to emergency repairs being undertaken to reinstate the embankment with temporary speed restrictions to manage the risk until repairs had been completed.

Embankment toes and slopes shall not be disturbed by any means including cuts, cable and pipe trenches or otherwise as this directly affects the stability of the earth structure.

If excavation is unavoidable, advice shall be sought from the geotechnical engineer.

Any trenching at the toe of cuttings for cable routes, cess drainage and so on, shall not be carried out without a stability assessment or advice from the geotechnical engineer. Trenches especially at top of soil/soft rock cuttings and embankments shall not be left open overnight. Water ponding in trenches can result in slope failures (see Figure 4 and Figure 5). Excavation work shall not commence without a risk assessment and implementation of appropriate controls.

Refer to TMC 411 *Earthworks* and SMS-06-GD-3066 *Guide to managing construction hazards* for requirements for excavation work including planning of works, risk assessment, excavation work plans and excavation procedures. Also, refer to ESC 540 *Service Installations within the Rail Corridor* for detailed requirements for the location and installation of cables and pipes by trenching.
Figure 1 - Vertical toe cut leading to slip failure

Figure 2 - Vertical toe cut leading to slip failure

Figure 3 - Vertical toe cut with high risk for slip failure
Figure 4 - Cable trench left open at top of soil/soft rock cutting allowed ponding water to enter slope leading to failure (see Figure 5)

Figure 5 - Failure due to cable trench left open at top of soil/soft rock cutting

Authorisation:

<table>
<thead>
<tr>
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</tr>
<tr>
<td>Name</td>
<td>Sarath Fernando</td>
<td>Richard Hitch</td>
<td>John Paff</td>
</tr>
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</tr>
<tr>
<td></td>
<td>Geotech</td>
<td></td>
<td>Network Standards</td>
</tr>
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</table>
ESC 540

SERVICE INSTALLATIONS WITHIN THE RAIL CORRIDOR

Version 2.2

Issued July 2010
Document control

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date of Approval</th>
<th>Summary of change</th>
</tr>
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<tbody>
<tr>
<td>2.2</td>
<td></td>
<td>Changes detailed in Summary table below</td>
</tr>
<tr>
<td>2.1</td>
<td>November, 2009</td>
<td>Change of format throughout; minor editing; section 4.2: addition of reference to Signalling requirements document and new 4.2.2 Marking of services.</td>
</tr>
<tr>
<td>2.0</td>
<td>May, 2008</td>
<td>Retitled “Service Installations within the Rail Corridor” and expanded to include both RailCorp services and services owned by non-rail parties. Changes include: Location of existing services; Installation planning; Design requirements; Geotechnical assessment; Installation methods</td>
</tr>
<tr>
<td>1.1</td>
<td>October, 2007</td>
<td>Minor change to update reference in Section 7 to RailCorp Safety Management System.</td>
</tr>
<tr>
<td>1.0</td>
<td>September, 2006</td>
<td>First issue as a RailCorp document. Replaces G 5000, G 5001, G 5002, G 5003, G 5004, G 5005, G 5006, G 5007</td>
</tr>
</tbody>
</table>

Summary of changes from previous version

<table>
<thead>
<tr>
<th>Section</th>
<th>Summary of change</th>
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<tbody>
<tr>
<td>Document Control</td>
<td>Updated version details</td>
</tr>
<tr>
<td>All</td>
<td>Correction of internal section reference numbers</td>
</tr>
<tr>
<td>1</td>
<td>Clarification re requirements for track drainage</td>
</tr>
<tr>
<td>4.2.2</td>
<td>Change font colour</td>
</tr>
<tr>
<td>4.3</td>
<td>Added reference to RailCorp Environmental Management System</td>
</tr>
<tr>
<td>6.3.2</td>
<td>Add requirement re no underboring in vicinity of turnouts</td>
</tr>
<tr>
<td>6.3.6</td>
<td>Clarification re applicability to non-rail installations only</td>
</tr>
<tr>
<td>6.4.3</td>
<td>Additional requirements from ESC 420 for protection of rail infrastructure</td>
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</table>
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1 Purpose, Scope and Application
This Standard specifies the technical requirements for the design, installation and maintenance of electrical, signalling, communications and utility services, cables and pipelines on the rail corridor.

The requirements are applicable to both RailCorp services and services owned by non-rail parties.

The requirements are applicable to both above ground and below ground services.

Services covered in this document include:
- Electrical
- Signalling
- Telecommunications
- Water and sewerage
- Stormwater drainage
- Combustible liquids
- Flammable fluids.

The requirements for track drainage are specified in Engineering Standard ESC 420 - Track Drainage.

The document cross-references associated Standards published by the Electrical, Signals and Communications Engineering Groups. It also incorporates Occupational Health & Safety (OH&S) regulations associated with excavation and it places an emphasis on sound planning and protection of other existing RailCorp infrastructure.

The requirements apply to all RailCorp corridors and property.

2 References

2.1 Australian and International Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1289 - 2000</td>
<td>Methods of testing soils for engineering purposes</td>
</tr>
<tr>
<td>AS 3000: 2000</td>
<td>Electrical installations (known as the Australian / New Zealand Wiring Rules)</td>
</tr>
<tr>
<td>AS 4799 – 2000</td>
<td>Installation of underground utility services and pipelines within railway boundaries</td>
</tr>
<tr>
<td>AS 5100 - 2004</td>
<td>Bridge design</td>
</tr>
<tr>
<td>AS/ACIF S009: 2006</td>
<td>Installation requirements for customer cabling (Wiring Rules)</td>
</tr>
</tbody>
</table>

2.2 RailCorp Documents

<table>
<thead>
<tr>
<th>Document</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>EP 0491</td>
<td>Detailed Site Survey Accurate Field Drawing Procedure</td>
</tr>
<tr>
<td>EP 0492</td>
<td>Detailed Site Survey Data Capture Procedure</td>
</tr>
<tr>
<td>EP 0493</td>
<td>Detailed Site Survey Scope Procedure</td>
</tr>
<tr>
<td>EP 0494</td>
<td>Detailed Site Survey Work as Executed Procedure</td>
</tr>
<tr>
<td>EP 0495</td>
<td>Detailed Site Survey Services Infrastructure data Policy</td>
</tr>
<tr>
<td>EP 0496</td>
<td>Specification for Collection of Services Data</td>
</tr>
<tr>
<td>EP 0497</td>
<td>CAD Layer Standards</td>
</tr>
</tbody>
</table>
2.3 Other References

Cat. No. 312 WorkCover NSW “Code of Practice Excavation” (31 March 2000)

3 Definitions and Abbreviations

Terms used in this Standard are defined as follows:

Detailed Site Survey (DSS): Surveys for the acquisition of field data for the preparation of plans, cross sections and long sections of RailCorp and External Party underground and above ground services on the rail corridor

Non-Rail Party: Organisation external to RailCorp, e.g. Telstra, Optus, Local Government Authorities, electrical, water, sewerage and gas utilities

Applicant: Individual, company or organisation that wishes to install a service within the rail corridor

ULX: A service crossing beneath a rail line

URX: A service crossing beneath a roadway (e.g. access road)

Definitions of other standard terms used in this Standard are provided in AS 4799 “Installation of underground utility services and pipelines within railway boundaries”

4 General Requirements

4.1 Applications by Non-Rail Parties

Applications by non-rail parties for the installation of services on the rail corridor shall be made through RailCorp’s Rail Corridor Management Group (RCMG).
The RCMG will refer each application to the relevant local external works manager for review and assessment by RailCorp’s engineering group and the local configuration management board.

The RCMG will then advise the applicant whether approval is given or not to proceed with the installation of the service.

All service crossings installed by a non-rail party are to be covered by an appropriate agreement (Master Access Deed or Individual Access Deed).

4.2 Services Search

A Services Search shall be undertaken by the Applicant to identify any existing services that may be affected by the proposed new installation.

Service searches for non-rail (external) services are to be undertaken with the relevant authorities in accordance with industry-standard procedures including Dial-Before You-Dig. A services search is required where footings in the ground are proposed for service installations.

Service searches for RailCorp services are to be undertaken in accordance with Detailed Site Survey (DSS) Procedures EP 0491 to EP 0497. In areas not currently covered by DSS, service searches are to be undertaken in accordance with the requirements of the local asset management group.

4.2.1 Methods for locating existing services

There are various non-destructive methods available for validating the location of existing underground services on site. These include:

− Use of electronic cable locating equipment;
− Use of ground penetrating radar (GPR) equipment;
− Potholing by hand digging (refer to WorkCover NSW Guide “Work Near Underground Assets”);
− Potholing by vacuum excavation, using compressed air or water to break up the ground and vacuum to remove the loosened material.

Electronic cable locating equipment may interfere with the operation of the signalling system. The use of electronic cable locating equipment shall be in accordance with Signalling Engineering Manual TMG 1440 “Requirements for the Locating of Underground Services in the Rail Corridor”.

Potholing to expose a service provides a greater guarantee of the precise location of a service than the electronic or GPR methods.

4.2.2 Marking of services

Once identified, the ground marking of underground services shall be done using the following colour scheme:

<table>
<thead>
<tr>
<th>Type of Service</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signalling / Communication</td>
<td>Pink</td>
</tr>
<tr>
<td>LV &amp; HV Power Internal &amp; External</td>
<td>Orange</td>
</tr>
<tr>
<td>External Telecommunications</td>
<td>White</td>
</tr>
<tr>
<td>Gas</td>
<td>Yellow</td>
</tr>
<tr>
<td>Water / Sewerage / Drainage</td>
<td>Green</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Light Blue</td>
</tr>
</tbody>
</table>
4.3 Installation Planning

The installation of services within the rail corridor shall be thoroughly planned in order to ensure that people, the environment and property remain safe.

The planning process shall identify hazards associated with the proposed installation and shall develop work methods to mitigate the hazards.

The planning of excavation work shall incorporate the following processes:

- Preparation of Excavation Work Plan and Safe Work Methods Statements (SWMS). The SWMS shall address specific site factors for each proposal;
- Assessment of effect when installing undertrack crossings (ULX) on track settlement and the safe passage of trains, and determination of safe working methods (e.g. rail baulking if required and appropriate worksite protection);
- The need to monitor any movement of the track or other adjacent infrastructure by survey, during and after installation, and preparation of a track and structures monitoring plan;
- Obtaining of applicable permits and approvals from the relevant authorities.

Excavation work shall comply with the requirements of RailCorp’s System Guide for Excavation and Earthworks (SMS-06-GD-0378), WorkCover NSW’s Code of Practice Excavation (Cat. No. 312) and WorkCover NSW’s Guide “Work Near Underground Assets” (2007).

Environmental protection of the site shall be in accordance with the RailCorp Environmental Management System.

Track monitoring shall comply with the requirements of RailCorp Engineering Specification SPC 207 “Track Monitoring Requirements for Undertrack Excavation”.

5 Above Ground (Aerial) Services

5.1 Types of Services

Above ground services include aerial lines such as electrical and communication services, free-standing structures carrying pipelines and services attached to bridges.

The services may run along or across the rail corridor.

5.2 Permitted Installations – Non-Rail Parties

Permitted installations of above ground services by non-rail parties include high and low voltage power, telecommunications, water, sewerage and gas.

5.3 Design Requirements

5.3.1 General

Electrical aerial crossings shall be designed and installed in accordance with RailCorp Electrical Standard EP 10 01 00 05 SP “Requirements for Electric Aerials Crossing RIC Infrastructure”.

Electrical requirements for cable crossings suspended from bridges or similar structures are contained in RailCorp Electrical Standard EP 08 00 00 14 SP “Services Erected Above Overhead Wiring”.

Aerial crossings for telecommunications and other utilities shall be designed and installed in accordance with relevant industry and Australian Standards.

Free-standing structures carrying pipelines shall be designed in accordance with RailCorp Standard ESC 360 “Miscellaneous Structures”.

5.3.2 Services attached to Bridges

Design loadings for services attached to bridges shall be in accordance with relevant Australian Standards. The bridge shall be assessed for the structural capacity to withstand the service pipeline design loadings.

Fixing details shall be in accordance with design codes and practices. They shall not impact on the structural integrity of the bridge. They shall not create an obstruction that causes water to pond or debris to accumulate on the bridge structure. They shall only be made into existing structural members with the approval of the Chief Engineer Civil.

The service and fixings shall not impinge on the clear walking space of walkways and the clear space of refuges.

Services and fixings shall not prevent access for inspection and maintenance of the bridge, including the structure immediately behind the service.

5.3.3 Location

Designs are to comply with the minimum clearances specified in RailCorp Engineering Standard ESC 215 “Transit Space”.

Other criteria for locating above ground services are to be applied as follows:
- access to RailCorp’s infrastructure shall be maintained as specified for the particular site;
- provision shall be made for any future railway track advised by RailCorp;
- design of any structure supporting an aerial service is to be such that the number of elements that are likely to be struck by a derailed train is minimised. Any columns at track level supporting the structure are to comply with the standards for pier and column protection (refer to Section 6.4 “Collision Protection” below).

No services are to be attached to bridges and structures without the approval of the Chief Engineer Civil and the regional Configuration Control Board. Proposals are to ensure that there is no adverse impact on the structure (e.g. walking areas for railway employees and access for inspection and maintenance of the structure).

5.4 Collision Protection

5.4.1 General

The design of piers or columns supporting service structures within the rail corridor is to comply with the provisions of collision protection and loading in AS 5100 “Bridge Design”.

The prime requirement is to protect the piers and columns against damage from a derailed train, which in turn could result in collapse of the structure onto the train.

5.4.2 Location of Piers and Columns

The minimum clearance to track centre line from any pier or column shall be as specified in ESC 215.

A pier or column shall not be located between tracks. Variation to this may only be approved by the Chief Engineer Civil.

5.4.3 Design Loading

All piers or columns supporting a new overhead service structure within the rail corridor shall be designed in accordance with the provisions of AS 5100.

A risk assessment should be undertaken to determine whether any relaxation to the load requirements of AS 5100 can be made. The risk assessment is to be performed in accordance with RailCorp’s Safety Management System. The analysis should consider the following criteria:
- Site condition, cutting, embankment etc.
2.2 UNCONTROLLED WHEN PRINTED

Derailment history
- Type of structure, i.e. potential for collapse damage to trains
- Track geometry
- Track speed
- Type of rolling stock
- Future usage and growth in patronage

The results of the risk analysis will determine the category of collision loading in AS 5100 that is to be applied to a support. The risk ranking determined from the risk analysis shall be equated to a loading requirement from AS 5100 in accordance with Table 1 below:

<table>
<thead>
<tr>
<th>RailCorp Level 2 Safety Risk Matrix Ranking</th>
<th>AS 5100 Collision Loading Requirements</th>
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<tbody>
<tr>
<td>A</td>
<td>All requirements of AS 5100.2 clause 10.4.3, clause 10.4.4, clause 10.4.5 and clause 10.4.6.</td>
</tr>
<tr>
<td>B</td>
<td>AS 5100.2 clause 10.4.3 (using loading for between 10m and 20m from centre line of track), clause 10.4.4, clause 10.4.5 and clause 10.4.6.</td>
</tr>
<tr>
<td>C</td>
<td>AS 5100.2 clause 10.4.4, clause 10.4.5 and clause 10.4.6.</td>
</tr>
<tr>
<td>D</td>
<td>AS 5100.2 clause 10.4.4 and clause 10.4.6.</td>
</tr>
<tr>
<td>E</td>
<td>No Loading Required</td>
</tr>
</tbody>
</table>

Table 1

The use of lower order protection devices such as earth mounds, gabions or guard rails etc. may be used in the risk analysis to reduce the risk ranking if approval is obtained from the Chief Engineer Civil.

5.5 Installation

Installation by non-rail parties shall be undertaken in accordance with the approval granted by RailCorp and as advised by the Rail Corridor Management Group. Installation shall be carried out in accordance with OH&S legislation and relevant WorkCover regulations.

Installation by in-house parties shall be undertaken in accordance with the approval granted by the Regional Configuration Control Board and RailCorp’s Safety Management System.

6 Below Ground (Underground) Services

6.1 Types of Services

Below ground (underground) services may include low or high voltage electrical, signalling and telecommunication cables and pipelines conveying, water, sewerage, combustible liquids (e.g. petroleum) and flammable fluids (e.g. gas).

The services may run along or across the rail corridor and pass beneath a rail line (ULX) or roadway (URX).

6.2 Permitted Installations – Non-Rail Parties

Installation of new service crossings directly across the rail corridor will be considered and may be approved by RailCorp, subject to all engineering requirements being met and a satisfactory agreement being reached between RailCorp and the Applicant.

Although there are many existing non-rail services that have been installed longitudinally along the rail corridor, further installations shall not be permitted unless approved by the Regional Manager.
Valves, compressor stations and flare points for combustible liquids or flammable fluids are not permitted on the rail corridor.

6.3 Design Requirements

6.3.1 General

Underground cables and pipelines shall be designed and installed in accordance with Australian Standard AS 4799 and the requirements of this Standard.

Power cable installations shall comply with RailCorp Electrical Standards including:
- EP 20 00 04 02 SP “Underground Installation Configurations for High Voltage and 1500Vdc Cables”;
- EP 20 00 04 05 SP “Cable Pits”;
- EP 20 00 04 06 SP “Underground Cable – Location recording”;
- Standard Drawing No. EL 0024639B “Underground Cables Undertrack Crossing”.

Signalling and communication service installations shall comply with RailCorp Specification SPG 0705 “Construction of Cable Route and Associated Civil Works”.

6.3.2 Location

For non-rail party installations, underground services shall be located in natural ground.

For internal services, they shall generally be located in natural ground but in restricted locations they may be located in the formation, including the shoulder areas.

Where the installation method includes excavation of the capping and formation, restoration of the formation and capping shall be carried out on completion of the cable laying works as specified in SPG 0705.

Minimum clearances to adjacent structures and vulnerable areas such as drains, toes of embankments, shoulders of embankments and tops of cuttings shall be in accordance with AS 4799 Section 3.

No services are to be attached to bridges and structures without the approval of the Chief Engineer Civil and the Regional Configuration Control Board. Proposals are to ensure that there is no adverse impact on the structure (e.g. walking areas for railway employees and access for inspection and maintenance of the structure).

When approval is given to place a pipe under a bridge, the trench shall be excavated no closer than 3 metres to the footings of any abutment or pier. The excavation shall not undermine the bridge footing or lead to instability or sliding of the abutment or pier. The stability of the abutment or pier shall be checked for the temporary open trench condition and it shall be demonstrated that the requirements of AS 5100 have been met.

When approval is given to install a pipe through a concrete culvert, the pipe shall be located close to the culvert wall and as close to the soffit as possible. The pipe is to be located by grouting under and over the pipe to present a smooth surface to the water passing through the culvert. The pipe is to return underground at each end of the culvert as quickly as practical.

No services are to be installed in an open channel drainage system.

No underboring can be carried out at any location under, or within 10 metres of turnouts or special trackwork (catch points, expansion switches, diamonds, slips etc.).

Guidelines for selecting cable routes for high voltage electrical services, to minimise the risk of damage to the cables or the potential to create a hazardous situation are detailed in RailCorp Electrical Standard EP 20 00 04 01 SP “Cable Route Selection Guide”.

Superseded by T HR CI 12190 ST
6.3.3 Geotechnical assessment

For proposed undertrack crossings, an assessment shall be made of the geotechnical conditions and the material through which the service is to be installed.

If existing information is unavailable or is not to the satisfaction of RailCorp’s Principal Geotechnical Engineer, it may be necessary to undertake testing on site by means of minor excavation or borehole. The geotechnical conditions may dictate the most suitable installation method.

The geotechnical assessment shall consider the effect of the proposed installation on the track, overhead wiring structures and other infrastructure, including any effects from changes in the water table.

Any application by a non-rail party to install an undertrack crossing shall be accompanied by a geotechnical investigation/report prepared by a qualified geotechnical engineer.

The geotechnical investigation for the proposed undertrack crossing shall include (but not be restricted to) the following:

- Boreholes or test pits at entry and exit points to a minimum depth of 1000mm below the base of the proposed excavation entry/exit points;
- Boreholes or test pits at the toe of the ballast on either side of the line to a minimum depth of 1000mm below the base of the proposed ULX invert. For double track lines, an additional borehole or test pit shall be carried out in the six foot if feasible. For multiple track lines, additional boreholes or test pits shall be carried out as required by RailCorp.

The geotechnical report for the proposed undertrack crossing shall include (but not be restricted to) the following:

- Site description and results of investigation;
- An accurately surveyed cross section along the ULX alignment showing current ground surface, rail levels/positions, position of proposed ULX, existing underground services, borehole or test pit information and correlation lines of subsurface layers between boreholes or test pits, and any other relevant information;
- Prediction of possible ground subsidence during the ULX installation, especially if non-cohesive soils are present;
- Recommendation for the most suitable installation method;
- An assessment as to whether a geotechnical engineer should be in attendance during construction to monitor any suspect ground conditions and ground movement.

6.3.4 Design traffic load

Pipelines carrying underground services within the rail corridor shall be designed for R20 vehicle loading. Refer to Appendix 1 for details of the R loading configuration.

Pipelines carrying underground services crossing under the tracks shall be designed for train loads as specified in ESC 310 “Underbridges”. The dynamic load allowance (DLA) shall vary linearly from 1.5 at 0.3 m depth to 1.0 at 3.5 m depth or greater, where the depth is measured from the top of rail. This load shall be applied to the length of pipe as specified in AS 4799.

6.3.5 Depth of cover

The minimum cover to underground services shall be as prescribed in AS 4799, except for crossings under the track.

For undertrack crossings, the minimum depth below rail shall be the depth specified in AS 4799 or 1600mm, whichever is the greater.
Where practicable, new undertrack crossings shall be installed at greater than the minimum depths specified above. This ensures that the service is well clear of other existing services and future RailCorp maintenance activities. The depth of cover should be 4.0 metres below ground level.

6.3.6 Direction of services

For non-rail party installations, undertrack service crossings shall cross at 90 ±5° to the tracks. Where this is not achievable, the crossing shall be as close as possible to 90°. Service crossings shall not have bends within the rail corridor.

6.3.7 Carrier and encasing pipes

In general, the need for an encasing pipe for undertrack crossings is to be assessed on a case by case basis.

Encasing pipes shall be provided for all undertrack crossings conveying high voltage cables, pressure pipelines and pipelines carrying combustible liquids and flammable fluids.

Steel encasing pipes are not permitted in or within 1 km of electrified traction areas.

6.3.8 Separation of services

Trenches may be shared by high voltage cables, signalling and communications cables and other services.

Different services are to be separated as prescribed in Clause 3.2.6 of AS 4799, Clause 6 of RailCorp Electrical Standard EP 20 00 04 02 SP, AS/ACIF S009 “Installation requirements for customer cabling (Wiring Rules)” and AS 3000 “Electrical installations (known as the Australian / New Zealand Wiring Rules)”.

6.3.9 Service pits

The design of service pits for underground power cables is to comply with RailCorp Electrical Standard EP 20 00 04 05 SP.

The design of cable pits for RailCorp signalling and communication services is to comply with Specification SPG 075.

Pits and access chambers for non-rail services shall be located outside the rail corridor.

Pits within the rail corridor shall be located in accordance with the requirements of AS 4799.

Pits within the rail corridor shall be designed for road vehicle loads. The minimum load shall be the R20 vehicle loading. Refer to Appendix 1 for details of the R loading configuration.

6.3.10 Electrolysis

Electrolysis occurs in the electrified areas of RailCorp’s corridors. The issue of potential corrosion and protection of the service from electrolysis is to be addressed as prescribed in Clause 3.4 of AS 4799.

Reference should also be made to RailCorp Electrical Standard EP 12 30 00 01 SP “Electrolysis from stray DC current” for further technical information and guidance. In particular, the following precautions shall be taken:

- Keep metallic services ‘away’ from the track so that there is less chance of ‘picking up’ appreciable dc leakage current;
- Water and gas pipes servicing buildings on the rail corridor and near 1500 V track to have an isolating joint installed at the railway boundary;
- Water and gas pipes crossing or laid along the rail corridor and near 1500 V track to be insulated from earth. This also applies to other services such as power or communication cables with metallic sheaths;
- Ensure that there are no long lengths of metallic water/ gas/ air pipes within the rail corridor.
6.4 Installation

6.4.1 General

Installation by non-rail parties is to be undertaken in accordance with the approval granted by RailCorp and as advised by the Rail Corridor Management Group. Construction is to be carried out in accordance with OH&S legislation and relevant WorkCover regulations.

Installation by in-house parties is to be undertaken in accordance with the approval granted by the regional Configuration Control Board and RailCorp’s Safety Management System.

For excavation work, the requirements of WorkCover NSW’s “Code of Practice Excavation” are to be observed in their entirety. This Code gives specific direction on legal requirements for shoring of excavations, periodic inspections, safety fencing, excavations adjacent to buildings and structures, flooding risks, stacking of materials, protection from falling objects, work adjacent to or under overhead power lines, manual handling, lighting, ladders and scaffolding, mechanised plant and heavy machinery, working in confined spaces, use of personal protective equipment and environmental protection.

6.4.2 Installation methods

Depending on the particular site conditions, alternative methods for installing underground services under tracks or access roads within the rail corridor include:

− Cased auger boring (refer to Clause 3.6 of AS 4799): this method is suitable where precise accuracy is not crucial;
− Laser-guided micro-tunnelling: this method uses a laser-guided vacuum borer head with articulated positive steering;
− Pipe jacking (refer to Clause 3.6 of AS 4799): pipe jacking methods are generally suitable for larger pipe diameters and can be employed up to a distance of 100 metres. Accuracy in alignment is achieved by using a laser beam. In addition to Clause 3.6.2.2 of AS 4799, for jacking through non-cohesive soil where the pipe can be advanced ahead of excavation, removal of soil in the pipe shall only proceed to within one pipe diameter behind the leading edge of the pipe. Generally, excavation shall proceed not more than 50mm ahead of the leading end of the pipe before the pipe is jacked forward;
− Directional drilling: this process is surfaced launched and can be tracked down to a depth of over 100 metres below the surface. Services can typically be laid up to a distance of 1000 metres in a single bore. Advantages include elimination of trenching and associated excavation and shoring costs, greater safety, no disruptions to rail traffic and less delays owing to unfavourable weather conditions.
− Tunnel boring: this method typically employs a steel cylinder equipped with a hydraulic excavator in the front. Extracted material is removed with an auger or conveyor and a liner plate is installed in the rear section as the borer progresses forward. Using this method, tunnels up to 2400mm in diameter can be installed in granular soil;
− Trenching: trenching with rail baulks or temporary tunnelling under tracks is permitted in exceptional circumstances only. This method may necessitate a complete closedown of the track. Technical aspects of trenching are addressed in Clause 3.7 of AS 4799 and Section 11.3 of SPG 0705.

Trenching is also permitted for services running along the rail corridor and not crossing under a track or access road, subject to the technical requirements and procedures being followed as laid down in RailCorp Engineering Specification SPG 0705.

6.4.3 Protection of rail infrastructure

Care shall be exercised when excavating within 5 metres of rail infrastructure as there is a risk that the rail infrastructure may be disturbed or damaged.

This could include for example:

− Track subsidence;
− Excavation at the base of railway embankments, that might lead to destabilisation and failure of the embankment;
− Excavation in the vicinity of overhead wiring structure footings;
− Disturbance to drainage systems over railway cuttings that might lead to failure of the cutting slopes or fouling of the tracks below;
− Undercutting of the base of railway cuttings;
− Damage to railway cess drains and disturbance to the flow of stormwater runoff;
− Damage to train examination or staff walkway areas;
− Excavation adjacent to building, bridges or other structures that might undermine or destabilise the foundations;
− Damage to above ground railway equipment, e.g. signalling infrastructure;
− Damage to other existing underground services.

When excavating adjacent to structures, there is a risk that the footings may be undermined or the structure destabilized, resulting in structural failure and potential collapse.

Excavations in the vicinity of structure footings are therefore not permitted unless documented engineering advice and approval are obtained.

No excavation should be made within this 5m distance without prior analysis of structure stability with respect to the effects of the excavation.

No excavation shall be made below the base of the footings of any structure (for example bridges, retaining walls and station platform walls) without prior analysis of structure stability with respect to the effects of the excavation.

The approval will be in the form of a certification by a competent geotechnical/structural engineer with relevant engineering authority, based on the results of an appropriate geotechnical and/or structural investigation.

6.4.4 Width of trenches

The width of trenches shall only be wide enough for installation and compaction. The minimum requirement is pipe diameter plus 150 mm minimum each side.

6.4.5 Backfilling and compaction

Backfilling and compaction of excavations under tracks shall be carried out in accordance with Clause 3.9 of AS 4799.

Other excavations more than 3 metres beyond the rails shall be backfilled with the same material unless otherwise approved and compacted to not less than 95% maximum dry density as determined by AS 1289 Test 5.1.1 and 5.3.1 (Standard Compaction).

The ground surface above and around backfilled excavations is to be graded so as not to restrict the flow of surface water and to prevent ponding.

6.4.6 Disposal of excavated materials

The provisions of Clause 3.8 of AS 4799 shall be applied to the disposal of excavated material.

6.4.7 Ponding of water in open trenches

At no time shall water be allowed to pond in open trenches. If rain is occurring or forecast, or if active seepage into the open trench is encountered, the trench shall be filled on the same day as the excavation.
6.5 Markers

Marker signs shall generally be installed in accordance with the technical requirements and procedures laid down in Clause 3.10 and Sections 4 to 6 of AS 4799.

In addition to above ground markers, plastic warning tape is to be laid in every trench 100 mm above telecommunications cables, to act as a warning during subsequent excavation, fire break grading or access road maintenance.

For high voltage and 1500 Vdc underground cables, the provisions of Clauses 4.1.2 and 7 of RailCorp Electrical Standard EP 20 00 04 02 SP shall apply.

For RailCorp signalling and communication cable routes, markers are to be installed in accordance with Clause 6.19 of RailCorp Signalling Specification SPG 0705.

7 Documentation

7.1 Design Stage

Documentation complying with AS 1100.401 “Technical drawing - Part 401: Engineering survey and engineering survey design drawing” and AS 4799 (underground services) is to be provided by the Applicant or in-house party as part of the planning and design process.

General requirements include a site survey and scaled plans and cross-sections detailing:

− Proposed location in plan view and rail kilometrage of the crossing, relative to the railway boundary, tracks and other adjacent railway infrastructure;
− Proposed reduced levels of the crossing, relative to the ground, track and other infrastructure;
− Angle of the crossing;
− Details of the proposed type and construction of the crossing;
− Location of proposed valves, pits, masts/poles and other fixtures and fittings;
− Details of markers or other protection devices to be installed;
− Details of other adjacent services as determined from the Services Search.

For underground services, the process for ensuring that the documentation complies with RailCorp’s standards and the scope of data required to be captured are outlined in DSS Procedures EP 0492 “Data Capture Procedure”, EP 0495 “Infrastructure Services Data Policy” and EP 0493 “Scope Procedure”.

7.2 Work-as-Executed Plans

Work-as-executed plans shall be prepared and submitted by the Applicant or in-house party on the completion of all new service installations and changes to existing services. Any variations to the approved plans must be clearly marked, particularly with respect to any change in location, changes in depth of services below ground or direction of services.

For underground services, the plans are to be formatted as specified in DSS Procedures EP 0491 “Accurate Field Drawing Procedure”, EP 0496 “Specification for Collection of Services Data” and EP 0497 “CAD Layer Standards”. Measurements are to be sufficient to enable the update or replacement of the registered DSS plans in the RailCorp Planroom, the associated CAD files and the information in the RailCorp corporate database.

All work-as-executed plans shall have an allocated Planroom “CV” number and be recorded and managed by the relevant Region’s configuration management procedures (refer to DSS Procedure EP 0494 “Work as Executed Procedure”).

Specific procedures apply to the recording of the location of high voltage underground cables. These procedures are detailed in RailCorp Electrical Standard “EP 20 00 04 06 SP.”
7.3 Record Keeping

The Rail Corridor Management Group shall maintain the master copies of each Individual or Master Access Deed.

Regional staff shall maintain records of the technical aspects of service crossings.

Information including technical aspects, agreements, maintenance responsibilities and contact details shall be readily accessible by relevant parties.

8 Maintenance Requirements

RailCorp maintenance staff must ensure that:

− Marker signs are not damaged, obscured or removed;
− Services are not damaged, particularly when undertaking earthworks such as clearing the right-of-way, cutting firebreaks or installing/maintaining drainage;
− Installations on bridges are examined as part of the cyclic bridge examination programme.

Non-rail party installations shall be maintained by the service owner.
Appendix 1  R Loading Configuration

The ‘R’ vehicle is a rigid truck with the same configuration as the prime mover portion (first 3 axles) of the ‘T’ vehicle and the numerical portion is the vehicle’s weight in tonnes.

<table>
<thead>
<tr>
<th>Axle Loads (Tonnes)</th>
<th>3700</th>
<th>1200</th>
<th>Variable 3000-8000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>To produce maximum loading effect</td>
</tr>
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</table>

Design Vehicle Configurations