Department of Transport and Main Roads

**Technical Note 159**

# Treatment of non-compliant Underground Wiring Systems (UWS) in Brownfield Installations

**July 2025**

Queensland Government

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## 1 Background

The Department of Transport and Main Roads standards specify compliance and minimum depth requirements for underground wiring systems (UWSs) to ensure durability in the installation environment or protection against inadvertent damage due to manual or mechanical excavation work. UWSs that does not meet the depth requirements are deemed 'under-depth'.

This document is intended for inspectors and project managers who have identified legacy or Brownfield installation sites that do not meet the minimum UWS requirements and may pose an electrical safety risk to any third parties who would undertake manual or mechanical excavation work in the vicinity of those sites. It is necessary to mitigate those risks by prescribing treatments which will render those sites compliant with the expressed intent of the department’s requirements and/or Part 1 of the AS/NZS 3000 Electrical installations (known as the Australian / New Zealand 'Wiring Rules').

Furthermore, this document addresses a secondary issue concerning the installation of new cables into non-compliant conduits. The challenge lies in ensuring that these installations, which are often crucial for departmental operations, adhere to the necessary safety standards without the need for complete site redevelopment. This involves conducting a thorough risk assessment and adhering to the guidelines specified in Clause 1.9.4 (referred to as Part 1) of AS/NZS 3000. By following these guidelines, new cable installations can be safely integrated, while addressing potential safety risks, operational efficiency, and cost-effectiveness.

Note: This document does not apply to the installation of new conduits.

Third parties who are unsure about the existence of an underground electrical cable should always seek advice by contacting the relevant Transport and Main Roads region for underground cable location information, before excavation. Obtaining accurate information about a work site significantly minimises the risks for injury, personal liability, and death.

This document is not an exhaustive list of all safety matters that need to be considered.

In many instances, it may be cost-prohibitive to replace the entire underground wiring system to ensure compliance. A suitable alternative approach would be to identify portions or segments within an installation likely to be subjected to manual or mechanical excavation work and then apply the relevant treatment to the identified segments such that the installation becomes compliant by specific design as outlined in Clause 1.9.4 of AS/NZS 3000.

## 2 Scope

This document applies to the treatment of under-depth or non-compliant UWSs in Brownfield sites for non-compliances associated with low voltage underground conductors. Such installations should comply with the department’s Standard Drawings 1149 and 1421 which are based on the Category A conduit type (a) (heavy duty conduit) wiring system as described in Part 2 of AS/NZS 3000. Brownfield installations with UWSs that, due to practical reasons, could not meet the department’s requirements, shall meet the requirements for compliance by specific design as outlined in Clause 1.9.4 of AS/NZS 3000.

Additionally, this document addresses the integration of new cables into existing non-compliant conduits at Brownfield sites. Recognising the importance of these installations for achieving departmental goals, this document provides a methodology for upgrading the sites safely and effectively. The process involves a detailed risk assessment and strict adherence to Part 1 of AS/NZS 3000, enabling the safe installation of new cables without the need for complete site redevelopment. This approach ensures that critical departmental operations continue uninterrupted, while maintaining high standards of safety and regulatory compliance.

Although this document provides some recommendations based on the Queensland *Electrical Safety Code of Practice*, it is the responsibility of the department's Principal Representative, in collaboration with inspectors and project managers, to ensure compliance with the department's requirements or Part 1 of AS/NZS 3000.

This document applies to UWSs installed in the department's road network but excludes UWSs installed within the confines of a building.

This document does not apply to UWSs for Greenfield sites, neither does it apply to UWS installed as part of a project and which are still under warranty. Such installations are not considered Brownfield sites. Any non-compliances in such installations shall be remedied to the department's standards as per the provisions of contract.

***Table 2.1 – Definition of terms***

| Term | Definition |
|---|---|
| COP | Code of Practice |
| Flexible conduits | As defined in AS 61386.1 and includes legacy AGI pipes, which are corrugated pipes of black colour commonly used in Transport and Main Roads sites for electrical cabling (see Appendix A following where it is defined as non-slotted flexible conduit). |
| Principal Representative | For the purpose of this document, the Principal Representative is anyone who is responsible for designing and/or rectifying the site. |
| RPEQ | Registered Professional Engineer of Queensland. |
| UWS | Underground Wiring System. |

## 3 Identifying sites for treatment

Any site with an under-depth electrical LV conduit poses a potential electrical safety risk to third parties who would undertake manual or mechanical excavation work at the site; however, the risk is different from site to site as it depends on the extent of under-depth, as well as the likelihood of excavation works being carried out at the site. Additionally, when considering installation of new cables onto existing non-compliant conduits, justification must be provided regarding the nature of the new installation and its alignment with departmental objectives. It is the responsibility of the department's Principal Representative to ensure proper risk assessment is undertaken for the site and the appropriate method of treatment is selected as prescribed in Section 4.

### *3.1 Selection of sites or portions to be treated*

Once the entire under depth conduits on the site have been identified, the extent of treatment, including possibility of new cable installations, should be determined. Main options include:

- treatment of entire under depth conduit installation

- treatment of a segment of the under depth conduit installation based on site risk analysis, or
- adding new cables onto existing non-compliant conduits in line with the risk analysis and adherence to Part 1 of AS/NZS 3000, especially for mission critical operations.

## *3.2 Risk analysis*

To determine the risk for each site, where treatment and/or new cable installations are being considered, the type of hazard, the likelihood of the hazardous event, and the consequence of the hazard must be carefully considered. These three items are discussed following.

### 3.2.1 Site hazard

The primary hazard associated with under depth electrical UWSs, is the potential for persons excavating at the site coming into contact with live electrical wires and receiving an electrical shock.

For new cable installations onto the existing UWS, potential hazards could include exacerbating the current installation's issues. These hazards and other identified on site, will determine the level of risk associated with the treatment of a site. The Principal Representative may outline additional hazards to be considered in the risk analysis.

**Important:** The identification of a non-compliant UWS should not warrant disconnection of the site as it may not be an immediate electrical safety risk. Refer to the risk categories and controls defined in TN166 *Applying Electrical Safety Legislation requirements to Road Operations' Field Installations* and consult with the department's Principal Representative regarding risk to traffic operations / public safety of disconnecting an installation.

### 3.2.2 Likelihood

The likelihood of a hazard, such as, an excavator or other equipment coming into contact with live wire at the site depends on:

- the UWS site location
- the UWS depth, and
- other features of the site to be determined by the department's Principal Representative.

For new cable installations, factors like installation method, available conduit capacity, susceptibility of the conduit to damage, quality of the cables used and their alignment with the existing system, should also be considered. The UWS site location may be one that no development works are expected, or it may be a busy intersection or an area with development proposals which may mean that excavations for other services are likely.

The UWS depth may range from a few millimetres, meaning a higher likelihood of encountering a hazard, to half a metre where the risk is reduced. Both factors, location, and depth, must be included in determining the likelihood. The department's Principal Representative may consider that some Brownfield UWSs do not strictly comply with the department’s standards but still comply with the broader Australian Standard, which could be acceptable.

### 3.2.3 Consequence

An excavator or other equipment coming into contact with a live wire at the site, may result in injury, personal liability, or even death. Therefore, the consequence of such an event is always classified as severe.

For retrofit installations, an improperly installed cabling might compromise its functionality, potentially leading to mission-critical failures, or damaging the existing UWS, which also has undesirable consequences.

### 3.2.4 Risk characterisation

The allocation of likelihood, consequence and resulting risk shall be in accordance with the department's Risk Assessments and Ratings.

The aim should always be to introduce treatments or installations that result in reduced risk; that is, 'medium' or 'low' from an initial default of 'Extreme' or 'High'.

***Table3.2.4 – Transport and Main Roads Risk Assessment and Rating Matrix***

| **Transport and Main Roads Risk Assessment and Rating Matrix** | | **Rare** | **Unlikely** | **Possible** | **Likely** | **Almost Certain** |
|---|---|---|---|---|---|---|
| | | Exceptional circumstances - once in five to ten years. | Sometime - once in one to five years. | Probable - once a month to 12 months. | Highly probable - once a week to month. | Very highly probable - once a day to a week. |
| **Severe** | Fatality, or significant disabling injury / illness, to one or more persons. | **High (16)** | **High (17)** | **High (19)** | **Extreme (24)** | **Extreme (25)** |
| **Major** | Considerable irreversible injury / illness, serious reversible injury / illness, to one or more persons. | **Medium (8)** | **Medium (13)** | **High (21)** | **High (22)** | **Extreme (23)** |
| **Moderate** | Moderate irreversible or reversible injury / illness resulting in time lost and/or restricted duties, to one or more persons. | **Low (5)** | **Medium (11)** | **Medium (14)** | **High (20)** | **High (18)** |

| Transport and Main Roads Risk Assessment and Rating Matrix | | Rare | Unlikely | Possible | Likely | Almost Certain |
|---|---|---|---|---|---|---|
| | | Exceptional circumstances - once in five to ten years. | Sometime - once in one to five years. | Probable - once a month to 12 months. | Highly probable - once a week to month. | Very highly probable - once a day to a week. |
| **Minor** | Reversible injury / illness to one or more persons requiring medical treatment, not resulting in time lost or restricted duties. | **Low (4)** | **Low (6)** | **Medium (10)** | **Medium (12)** | **Medium (15)** |
| **Insignificant** | Injury / illness requiring first-aid treatment at most. | **Low (1)** | **Low (2)** | **Low (3)** | **Medium (7)** | **Medium (9)** |

### 3.2.5 Risk mitigation

To effectively manage risks, the risk mitigation measures must be documented in a detailed and clear manner. The following are recommended steps to ensure proper documentation:

- **Identify and document the risk**: Begin by identifying the specific risk you are addressing. Refer to Section 4 for guidelines on how to identify and document risks.
- **Propose treatment measures**: Clearly outline the proposed treatment for the identified risk. This includes specifying one or more actions to mitigate the risk.
- **Categorise the treatment**: The hierarchy of control measures outlined in the *Managing Electrical Risks in the Work-Place - Code of Practice (COP*) must be used to categorise the treatment method for each of the specified actions. The hierarchy includes:
  - Elimination
  - Substitution
  - Isolation
  - Engineering Controls
  - Administrative Controls
  - Personal Protective Equipment (PPE)
- **Assess and document revised residual risk**: After applying the control measures, evaluate the remaining risk (residual risk). Document how the risk level has been altered due to the implementation of control measures.

Appendix B provides an example of a risk analysis, illustrating risk identification and mitigation for a non-compliant UWS site for use as a guide.

# 4 Treatment process

## *4.1 Identifying the problem*

This is the first step in resolving the non-compliant UWS in a given site location. To comprehensively understand the situation and identify the most appropriate treatment solution, detailed information about the existing installation must be gathered. Typical items to consider include:

- conduit type (for example, Heavy Duty (HD), Medium Duty (MD), Flexible, AGI pipe, and so on)
- date of installation
- inner / outer diameter of conduit (in mm)
- conduit thickness (mm)
- the depth (mm) of the conduit at the site in question
- present cabling details (cross-sectional area, type, cores)
- extent of non-compliance in meters (for non-slotted flexible conduits, such as AGI pipes, this is the distance from pit-to-pole – refer to note following in Section 4.1.1)
- the thickness (mm) of concrete, if any, above the conduit
- photos illustrating the non-compliant conduit within the connecting pit(s)
- the likelihood of an excavation work being carried out at the site by other parties (see Section 3.2.2), and
- whether the UWS is under trafficable area or carriageway, or just pit-to-pole.

### 4.1.1 Flexible conduits

In this document specific reference is made to two types of flexible conduits:

- **Legacy non-slotted flexible conduits installed between pit and pole**: All flexible conduits, including non-slotted AGI conduits that were installed between poles and pits as per the department's Standard Drawing 1421 Revision C, are in this category. These conduits are deemed acceptable if they comply with the standards that were in effect at the time of their installation. For details of the department's Standard Drawings 1421 Revision C, refer to Appendix A of this document.
- **Other AGI conduits**: Other AGI conduits installed between pit and pole, that do not meet the criteria of legacy non-slotted flexible conduits as described above, must be addressed in accordance with the procedures outlined in Section 4.2 of this document.

Where the date of installation is not documented or known, the manufacture date printed on the cables or conduit may be used as the installation date.

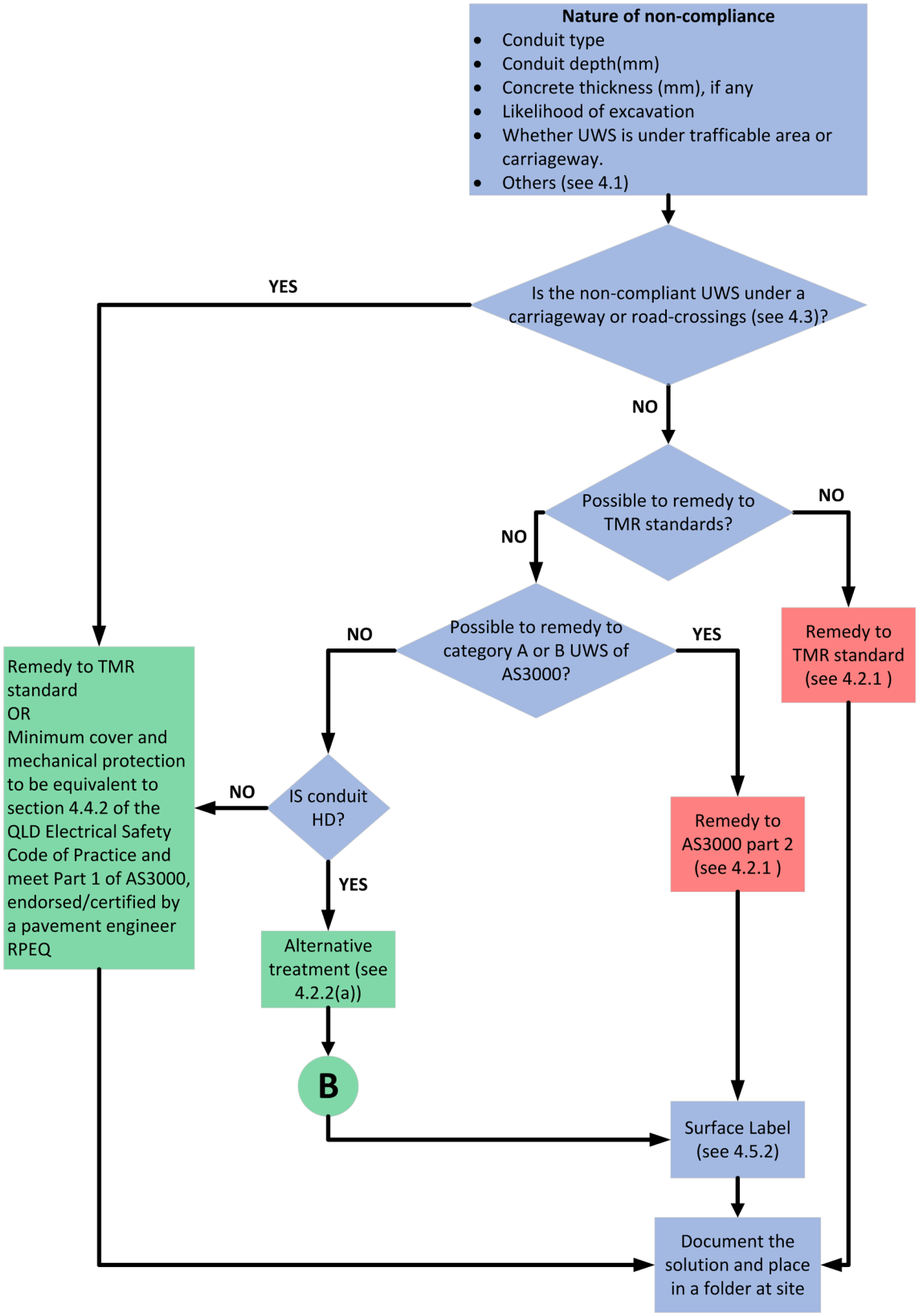
## *4.2 Treatment options for conduits under footways or islands*

Where possible, all non-compliant UWSs under footways or islands must be made compliant to the department's Standard Drawings 1149 and 1421.

While the main non-compliance addressed by this document is under-depth UWS, recognising the type of conduit in use is important as it affects depth specification and is also a determining factor in achieving compliance with the department's Standard Drawings 1149 and 1421 which strictly specify Category A UWS (or HD conduits).

Where it is not possible to achieve compliance with the department's Standard Drawings 1149 and 1421 or AS/NZS 3000 Part 2, other treatment options that would mitigate the electrical risk must be considered, such as compliance with AS/NZS 3000 Part 1. For Brownfield sites, remediation to UWS that meets Category A or B of AS/NZS 3000 should be considered as viable options. The treatment options are as shown in Figure 4.2.

***Figure 4.2 – Brownfield under-depth underground wiring systems treatment overall process***



### 4.2.1 Remediation of HD conduits to departmental Standard Drawings or AS/NZS 3000 Part 2

For a UWS to meet to the Department of Transport and Main Roads Standard Drawings listed in Section 5 (particularly SD1149 and SD1421), it must satisfy the following:

- the conduit must be heavy duty (HD), and
- the depth of the conduit must be as described in Table 4.2.1.

If the HD conduit depth does not meet the 600 mm requirement in Table 4.2.1, but exceeds a 500 mm depth, it is deemed to comply with AS/NZS 3000 Part 2, without surface covering. For HD conduit depth exceeding 500 mm for Brownfield installations, no remedial action is required.

Remediation to UWS that meet Category A or B of AS/NZS 3000 is acceptable for Brownfield sites.

The Contractor shall develop a process that will transition the non-compliant UWS to a remediated UWS compliant with the department's Standard Drawings.

The Principal Representative must ensure that the remediation process is followed by appropriate site labelling, where applicable, and also documentation of the adopted method.

The first two rows of Table 4.2.2(a) summarise the treatment of HD conduit to comply with Part 2 of AS/NZS 3000.

***Table 4.2.1 – Underground wiring system – minimum depth of cover for HD conduits***

| Covering on surface of ground above wiring system | Minimum depth of cover |
|---|---|
| Poured concrete of 75 mm minimum thickness. | 300 mm (AS/NZS 3000). |
| No surface covering or less than 75 mm thickness of concrete. | 600 mm (Transport and Main Roads) or 500 mm (AS/NZS 3000). |

### 4.2.2 Remediation of HD conduits and non-slotted flexible conduits to Part 1 of AS/NZS 3000

Recommended treatments for heavy duty and non-slotted flexible conduits between pits and poles are as shown in Table 4.2.2(a) and 4.2.2(b) respectively. The bottom two rows of Table 4.2.2(a) summarise the treatment of HD conduit to comply with Part 1 of AS/NZS 3000.

Note that the required concrete thickness specified for non-slotted flexible conduits at a certain depth is the same as the concrete thickness required for HD conduits at a shallower depth.

In some installations, such as traffic signals, the area extending from a pit to a pole is typically covered with a layer of concrete. If this layer adheres to the recommended thickness outlined in Table 4.2.2(b), the flexible conduit or AGI pipe may be considered to comply with Part 1 relating to depth requirement.

***Table 4.2.2(a) – Treatment options for heavy duty electrical conduits under footways, roads, or islands for Brownfield sites***

| Non-compliant depth | Description of non-compliance | Recommended treatment |
|---|---|---|
| 500 mm < depth < 600 mm | Does not meet Transport and Main Roads standards but meets AS/NZS 3000. | Meets AS/NZS 3000 Part 2; no further action required. |
| 300 mm < depth < = 500 mm | Meets neither Transport and Main Roads standards nor AS/NZS 3000. | Overlay 75 mm concrete to meet AS\/NZS 3000 Part 2. |
| 200 mm < depth < = 300 mm | Meets neither Transport and Main Roads standards nor AS/NZS 3000. | If not possible to comply with Transport and Main Roads standards or AS/NZS 3000, apply alternative remedy; see Section 4.2.3. Design to be endorsed / certified by an Electrical and/or Structural RPEQ engineer(s) as appropriate. |
| depth < = 200 mm | Meets neither Transport and Main Roads standards nor AS/NZS 3000. | Unless the conduit is installed within the confines of a building as detailed in AS/NZS 3000 for category A UWS, retrench conduit and bring to compliance with departmental standards. |

***Table 4.2.2(b) – Treatment options for non-slotted flexible conduits installed between pit and pole (under footways, or islands) for Brownfield sites***

| Non-compliant depth | Description of non-compliance | Recommended treatment (requiring RPEQ-endorsement) |
|---|---|---|
| 600 mm < depth | Meets neither Transport and Main Roads standards nor AS/NZS 3000 Part 2. | Follow the mandatory procedures in Section 4.4 to determine if the conduit is in a usable condition.<br>If it is usable, installations must meet legacy specification (Appendix A) as a minimum.<br>If the conduit is usable but does not meet legacy specification, installations require the mandatory 75 mm concrete overlay and labelling as per Section **Error! Reference source not found.**. |
| 500 mm < depth < = 600 mm | Meets neither Transport and Main Roads standards nor AS/NZS 3000 Part 2. | Follow the mandatory procedures in Section 4.4 to determine if the conduit is in a usable condition.<br>If it is usable, installations must meet legacy specification (Appendix A) as a minimum.<br>If the conduit is usable but does not meet legacy specification, installations require the mandatory 75 mm – 100 mm concrete overlay and labelling as per Section 4.5. |
| 300 mm < depth < = 500 mm | Meets neither Transport and Main Roads standards nor AS/NZS 3000 Part 2. | Follow the mandatory procedures in Section 4.4 to determine if the conduit is in a usable condition.<br>If it is usable, installations must meet legacy specification (Appendix A) as a minimum.<br>If the conduit is usable but does not meet legacy specification, installations require the mandatory 100 mm concrete overlay and labelling as per Section 4.5. |
| depth < = 300 mm | Meets neither Transport and Main Roads standards nor AS/NZS 3000. | Retrench conduit and bring to compliance with departmental standards. |

### 4.2.3 Alternative treatment

Where it is impossible to remedy an under-depth conduit to comply with the department's Standard Drawings or the Queensland *Electrical Safety Code of Practice*, an alternative treatment must be implemented. Section 4.4.2 of the Queensland *Electrical Safety Code of Practice* states:

> *Where physical obstructions such as other services make it impossible to achieve these depths, additional mechanical protection should be provided by means of a minimum cover of 100 mm of 20 MPa concrete or equivalent. Any additional mechanical protection should be marked with the words electric cable or similar along its length.*

The alternative process and associated details are shown in Figure 4.4(a) and Figure 4.4(b).

The remediation process must include appropriate site labelling. Details of the treatment method must also be documented, and the documents kept at a suitable location on site, preferably in the electrical switchboard, traffic signal controller or Intelligent Transport System (ITS) cabinet as appropriate.

#### 4.2.4 Mechanical protection

##### 4.2.4.1 Reinforced concrete

The concrete cover for the alternative treatment shall be N25 / 20 and of minimum thickness 125 mm, reinforced by SL 81 steel mesh.

##### 4.2.4.2 Bedding sand and Type 2 filling

The bedding sand and Type 2 filling are as specified in Standard Drawing 1149.

#### 4.2.5 Equivalent mechanical protection

Where the HD conduit depth is below 200 mm, a mechanical protection equivalent to the intended practice in the Queensland *Electrical Safety Code of Practice* and compliant with Part 1 of AS/NZS 3000 shall be proposed and submitted to the Principal Representative for approval.

### *4.3 Treatment of underground wiring systems under carriageways or road-crossing*

Under-depth UWS beneath trafficable surfaces, carriageways or road crossings shall be remedied to comply with the department's Standard Drawing 1149. If compliance with the departmental standards is not possible, a minimum cover and mechanical protection equivalent to Section 4.4.2 of the Queensland *Electrical Safety Code of Practice* and meet Part 1 of AS/NZS 3000 shall be applied. Any applied treatment shall be endorsed / certified by a Pavement, Structural and/or Electrical RPEQ Engineer, as appropriate.

### *4.4 Installation of new cables onto non-compliant conduits*

The following are mandatory procedures when installing new cables into an existing shallow or non-compliant conduit, including non-slotted flexible conduits defined in Section 4.1.1:

- **Compliance with Part 1 (AS/NZS 3000)**: The party responsible for installation must adhere to the guidelines outlined in this document to ensure compliance with Part 1 of AS/NZS 3000.
- **Segregation of cabling**: Effective segregation from existing cabling may be required to facilitate cable hauling, or to separate cables operating on different voltage levels. This can be achieved through appropriate insultation, independent sheathing or by subducting with a conduit approved by the department.
- **Capacity check**: Prior to installation, the responsible party must verify that the conduit has adequate capacity. This involves assessing the space factor, which should not exceed 0.4, in accordance with the criteria set out in Appendix C of AS/NZS 3000. Refer to Appendix C.
- **Conduit condition assessment**: Using cameras, or other means, to determine the structural integrity of the conduit.
- **Labelling requirements**: In cases where the non-compliant conduit is not an HD conduit (for example, flexible or AGI conduit), a label must be affixed on the conduit in the pit, in accordance with the guidelines in Section 4.5. Where it is not possible to affix labels on the conduit, the labels may be affixed to the pit wall directly above the entry point of the conduit.

***Figure 4.4(a) – Alternative HD conduit treatment process (to be read in conjunction with Figure 4.2)***

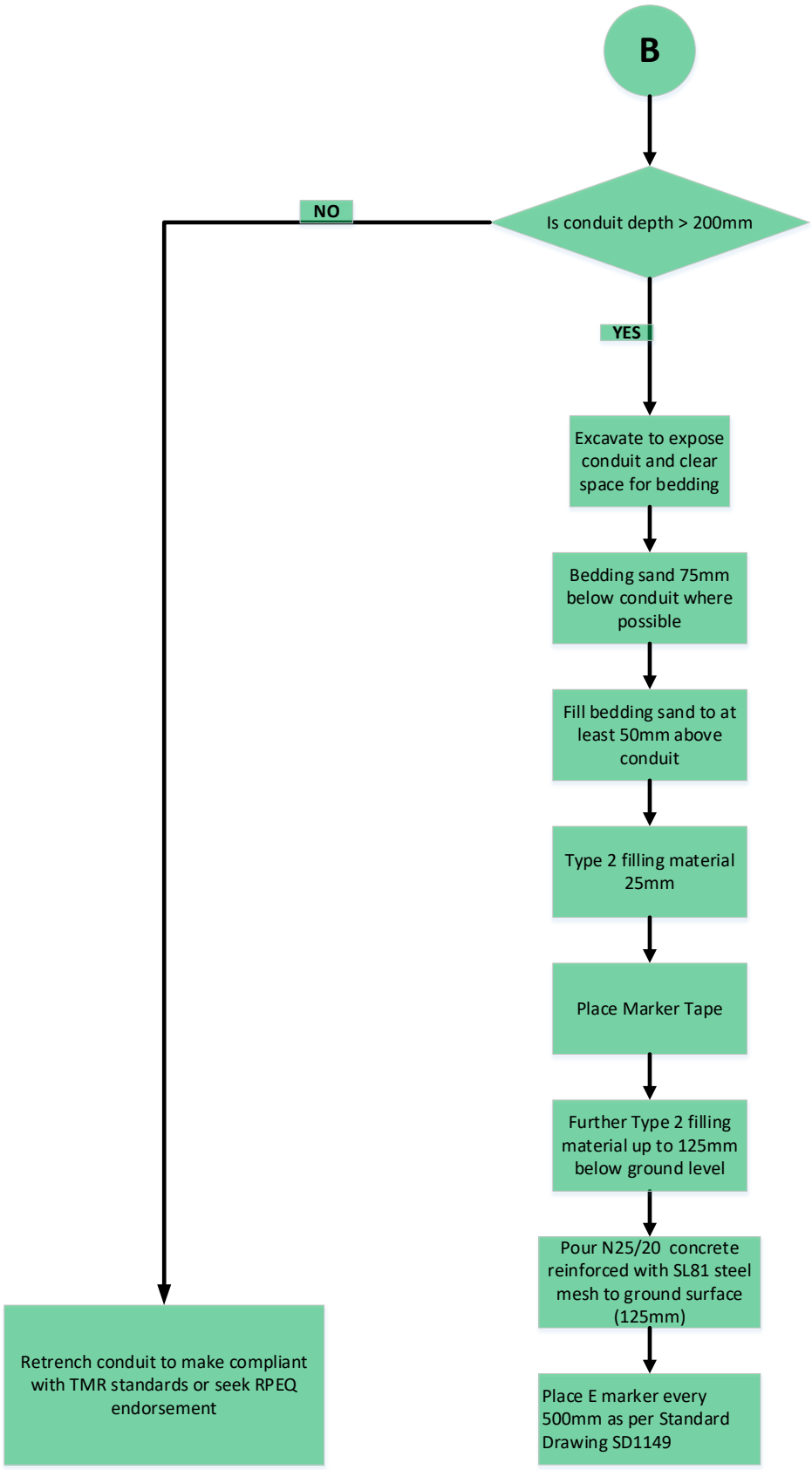
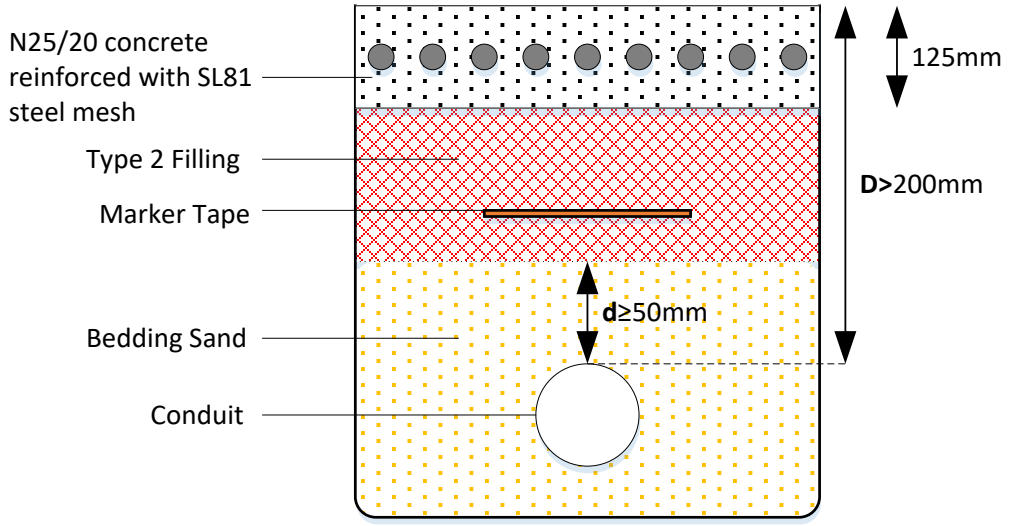


***Figure 4.4(b) – Alternative treatment detail (not to scale)***




## *4.5 Labelling*

Throughout the remediation process as shown in Figure 4.2 and Figure 4.4(a), labelling has been prescribed as an additional measure to alert other parties of the existence of an electrical service. The two types of labels are underground and above-ground labels / markers.

Where applicable, all occupational safety signs and labels shall be in accordance with AS 1319.

### 4.5.1 Underground markers

Underground labels shall be in the form of marker tapes compliant with AS/NZS 2648.1. The marker tape shall be placed within the Type 2 filling substrate, preferably midway between the top of the conduit and the ground surface.

### 4.5.2 Ground surface labels

E-marker (Figure 4.5.2(a)) labels shall be used to alert other parties of the existence of underground electrical conduits. These labels shall be placed in accordance with SD1149. Where new concrete is applied, additional marking with the words electric cable or similar may be stamped along the length of the concrete. Refer to Figure 4.5.2(b).

Below are general characteristics of the proposed above-ground label.

- **Material**: Metallic material not susceptible to rust, suitable for damp or wet environments.
- **Adhesive**: No adhesive; instead, use rivets or screws for permanent fixing to ensure it remains in place despite water or mud, ensuring it does not pose a trip hazard.
- **Size**: Large enough to be easily readable.
- **Print**: Laser-etched or engraved to prevent fading over time.
- **Text**: Clear and legible font detailing the necessary information or warning.
- **Finish**: Non-reflective finish to avoid glare and ensure readability.

***Figure 4.5.2(a) – Brass E-markers***


***Figure 4.5.2(b) – Above ground marker with wording***


### 4.5.3 In-pit label

Below are general characteristics of the proposed labelling in the pit, for the purpose of alerting presence of electrical cables in a non-HD conduit. An example is shown in Figure 4.5.3 following.

- **Material**: Heavy-duty hard plastic suitable for damp or wet environments.
- **Fixings**: Non-metallic fixtures must be used, such as zip ties for permanent fixing to ensure it remains in place despite water or mud.
- **Size**: Large enough to be easily readable, yet appropriate for the size of the pit.
- **Colour**: High contrast for visibility in low-light conditions common in pits.
- **Print**: Waterproof and fade-resistant ink to prevent fading over time.
- **Text**: Clear and legible font detailing the necessary information or warning.

***Figure 4.5.3 – In-pit label***

#### 4.5.4 Part 1 designation labels

Part 1 designation labels (Figure 4.5.4) shall be affixed to the electrical switchboard, traffic signal controller or Intelligent Transport System (ITS) cabinet as appropriate. Following are general characteristics.

- **Material**: UV-resistant laminated polyester or equivalent, ensuring longevity in various indoor conditions.
- **Adhesive**: Permanent, pressure-sensitive adhesive, or screws, to ensure the label remains affixed for an extended period.
- **Size**: Appropriate to the switchboard or Traffic Signal Controller's size, ensuring visibility and readability.
- **Colour**: Contrasting, typically using a combination of bright and dark colours (for example, dark text on yellow background, or white text on a red background) for high visibility.
- **Print**: Waterproof and fade-resistant ink.
- **Text**: Clear and legible font detailing the specific information or warning.
- **Finish**: Gloss or matte lamination for added protection against abrasions.

***Figure 4.5.4 – Part 1 designation label***


### *4.6 Documentation*

Once the treatment process is completed, the Contractor shall provide detailed documentation of the solution certifying compliance with the applicable standards and guidelines. Such documentation shall be retained by the Designer and also onsite at the electrical installation by the person with overall responsibility for the installation.

#### 4.6.1 Compliance with the department’s standard

Where remedy to the department’s standards is adopted, the following shall be provided:

- the original non-compliance, and
- a report detailing how compliance with the department’s standards and this document have been achieved.

### 4.6.2 Compliance with Part 1 of AS/NZS 3000

Where a treatment alternative to the department's standard was adopted, a report shall be provided with the following details as a minimum:

- a detailed description of the non-compliance in question
- the Contractor's acknowledgment as to any departure from the department's standards or Part 2 of AS/NZS 3000
- how compliance with Part 1 of AS/NZS 3000 and Section 4.4.2 of the Queensland *Electrical Safety Code of Practice* or equivalent is being achieved
- any requirements where the design requires specific installation use by the owner or operator of the electrical installation and a copy of these requirements for the owner or operator
- the verification undertaken to ensure full compliance with Part 1 of AS/NZS 3000 and the Queensland *Electrical Safety Code of Practice*, and the results of this verification, and
- certification of the design by a competent person. Clause 1.4.30 of AS/NZS 3000 defines a competent person.

Labelling as described in Section 4.5.

## 5 Referenced documents

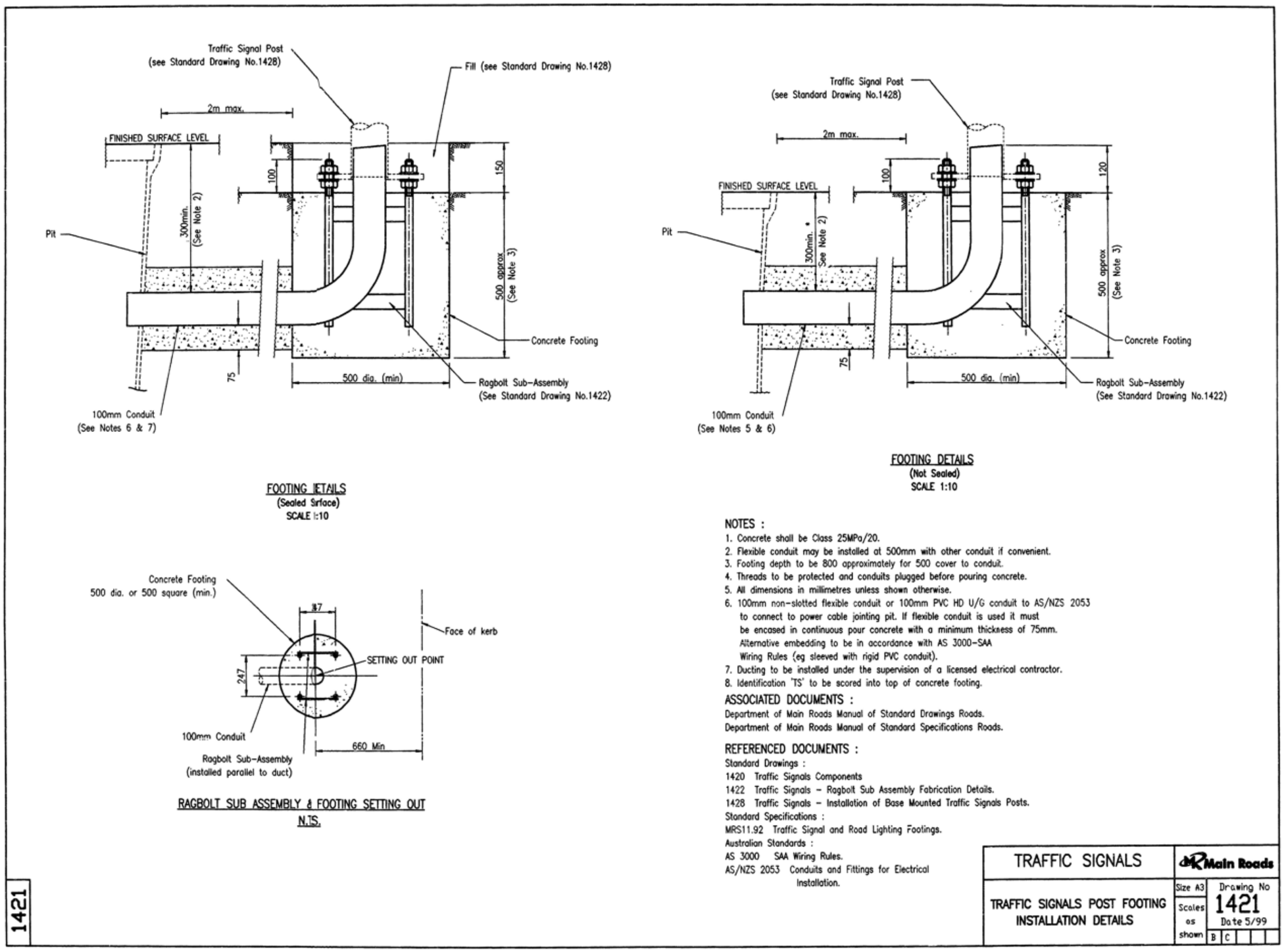
The Department of Transport and Main Roads Standard Drawings applicable to conduit installation:

- SD1149 – *Traffic signals / Road lighting / ITS – Installation of underground electrical and communications conduit*
- SD1380 – *Road lighting – Slip base pole and footing installation details for no crossfall*
- SD1381 – *Road lighting – Slip base pole and footing installation details for crossfalls up to and including 1:6*
- SD1382 – *Road lighting pole – Slip base pole and footing installation details for crossfalls greater than 1:6 up to and including 1:3*
- SD1392 – *Road lighting – Base plate mounted pole and footing installation details for crossfalls up to and including 1:2*
- SD1393 – *Road lighting – Base plate mounted pole and footing installation details for crossfalls greater than 1:2*
- SD1396 – *Traffic signals / Road lighting – Joint use traffic signal and road lighting pole and footing installation details*
- SD1403 – *Traffic signals – Mast arm footing installation details*
- SD1421 – *Traffic Signals – Traffic signals post and footing installation details*, and
- SD1429 – *Road lighting – Slip base pole and footing installation details for crossfalls greater than 1:6 up to and including 1:3 using concrete step tread.*

Legislation, standards and specifications:

- AS 1319 – *Safety signs for the occupational environment*
- AS/NZS 3000 *Electrical installations* (known as the *Australian / New Zealand Wiring Rules)*
- AS/NZS 2648.1 *Underground marking tape – Non-detectable tape*
- Queensland *Electrical Safety Code of Practice 2020 – Works – (Electrical Safety Office)*
- *Electrical Safety Act* 2002 (Qld*) – (Electrical Safety Office)*
- *Managing Electrical Risks in the Workplace – Code of Practice (Electrical Safety Office – 2021)*
- Electrical Safety Regulation 2013 – *(Electrical Safety Office)*
- MRTS91 – *Conduits and Pits,* and
- TN166 – *Applying Electrical Safety Legislation Requirements to Road Operations' Field Installations.*

## Appendix A – Legacy SD1421-SD1999 (Superseded in 2006)



## Appendix B – Risk analysis example

| Non-Compliance ID | Non-Compliance | Risk | Likelihood | Consequence | Risk category L:1-6 M:7-15 H:16-226 E:23-25 | Control Strategy | Tick | Description | Revised likelihood | Revised consequence | Revised risk category L:1-6 M:7-15 H:16-226 E:23-25 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **NC01** | Non-slotted flexible conduit not in accordance with TMR legacy specification. | Violates electrical codes, regulations, and standards, exposing individuals and organisations to legal and regulatory penalties. | **Almost Certain** | **Moderate** | **HIGH_18** | Elimination | | | **Unlikely** | **Minor** | **LOW_06** |
| | | | | | | Substitution | | | | | |
| | | | | | | Isolation | | | | | |
| | | | | | | Engineering Controls | X | Apply the treatments recommended in TN159 *Treatment of Under-depth Underground Wiring Systems (UWS) in Brownfield Installations* Table 4.2.2(b) – overlay 100 mm concrete and apply labelling. | | | |
| | | | | | | Administrative Controls | | | | | |
| | | | | | | PPE | | | | | |
| **NC02** | Non-slotted flexible conduit not in accordance with TMR legacy specification; new cabling may damage conduit. | Conduit may be unsuitable for cable pulling due to bending radius or deformation; risks conduit damage. | **Almost Certain** | **Moderate** | **HIGH_18** | Elimination | | | **Possible** | **Minor** | **MEDIUM_10** |
| | | | | | | Substitution | | | | | |
| | | | | | | Isolation | | | | | |
| | | | | | | Engineering Controls | X | Apply appropriate cable hauling tool (e.g. cable snake) that minimises damage. | | | |
| | | | | | | Administrative Controls | X | Electrical verification, including Insulation resistance measurements upon completion to assess condition.<br>Identify potential conduit deformations by 10% (e.g. using cameras)<br>If HDPE cables are used, confirm the bending radius of the HDPE cable does not damage the conduit walls. | | | |
| | | | | | | PPE | | | | | |
| **NC03** | Non-slotted flexible conduit not in accordance with TMR legacy specification; insufficient space for additional cables. | Capacity may be inadequate and may cause overheating of cables as they are bundled closely together. | **Likely** | **Major** | **HIGH_22** | Elimination | | | **Unlikely** | **Minor** | **LOW_06** |
| | | | | | | Substitution | | | | | |
| | | | | | | Isolation | | | | | |
| | | | | | | Engineering Controls | X | Confirm the combined new wiring and existing meet the spacing requirements for HD in appendix C10 of AS/NZS 3000.<br>Check conduit using visual means such as cameras to evaluate condition prior to installation. Use approved cable hauling methods that minimise risk of conduit damage. | | | |
| | | | | | | Administrative Controls | | | | | |
| | | | | | | PPE | | | | | |

| Non-Compliance ID | Non-Compliance | Risk | Likelihood | Consequence | Risk category L:1-6 M:7-15 H:16-226 E:23-25 | Control Strategy | Tick | Description | Revised likelihood | Revised consequence | Revised risk category L:1-6 M:7-15 H:16-226 E:23-25 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **NC04** | Conduit location susceptible to excavation by third parties. | Persons excavating at the site coming into contact with live electrical wires and receiving electrical shock. | **Likely** | **Major** | **HIGH_22** | Elimination | | | **Unlikely** | **Minor** | **LOW_06** |
| | | | | | | Substitution | | | | | |
| | | | | | | Isolation | | | | | |
| | | | | | | Engineering Controls | X | Affix above ground labels indicating electrical conduit underground - refer to preferred labelling in recommendation as per Section 4.5 (Figure 4.4.2(b)). | | | |
| | | | | | | Administrative Controls | | | | | |
| | | | | | | PPE | | | | | |
| **NC05** | Conduit type not HD for Low Voltage electrical wiring. | Conduit colour may lead third parties into thinking the installation is not low voltage electrical wiring, exposing them to electric shock. | **Almost Certain** | **Moderate** | **HIGH_18** | Elimination | | | **Unlikely** | **Minor** | **LOW_06** |
| | | | | | | Substitution | | | | | |
| | | | | | | Isolation | | | | | |
| | | | | | | Engineering Controls | X | Affix label in pit close to AGI conduit indicating "DANGER 230V" showing the installation is LV (Applicable to all Pits) as per Figure 4.4.3 (Section 4.5). | | | |
| | | | | | | Administrative Controls | | | | | |

## Appendix C – Conduit capacities for various cables specified in MRTS256 – *Power Cables*

| MRTS256 Cable Specification | | | | | Max. number of sheathed cables in each electrical conduit of diameters (mm) below | | | |
|---|---|---|---|---|---|---|---|---|
| **Configuration / Cores** | **Phases** | **Insulation type and minimum rating** | **Sheath** | **Typical application (Refer to MRTS256 *Power Cables*)** | **50** | **63** | **80** | **100** |
| 2 core x 2.5 mm² Flat | Single | PVC V-90 or 5V-75 | PVC 5V-90 or 5V-75 | Cable between pole switch-disconnector and luminaire. | 8 | 12 | 20 | 32 |
| 2 core x 4 mm² Flat | Single | PVC V-90 or 5V-75 | PVC 5V-90 or 5V-75 | General use cable between re-openable joint and pole switch-disconnector. | 6 | 10 | 16 | 26 |
| 2 core x 4 mm² | Single | XLPE or X-90 | GP-75-TPE | Minimum size cable for all applications. | 8 | 13 | 21 | 34 |
| 2 core x 16 mm² Flat / Round | Single | XLPE or X-90 | PVC 5V-90 or 5V-75 | General use cable, point of supply to switchboard, switchboard to pit, pit to pit. | 3 | 4 | 7 | 12 |
| 2 core x 16 mm² Flat / Round | Single | XLPE or X-90 | HDPE | Cable for continually wet and vermin-infested areas between re-openable joint and pole switch-disconnector. | 3 | 4 | 7 | 12 |
| 2 core x 25 mm² Flat / Round | Single | XLPE or X-90 | PVC 5V-90 or 5V-75 | Special cable for long runs, point of supply to switchboard, switchboard to pit, pit to pit. | 2 | 3 | 5 | 8 |
| 2 core x 25 mm² Flat / Round | Single | XLPE or X-90 | HDPE | Cable for continually wet and vermin-infested areas, point of supply to switchboard, switchboard to pit, pit to pit. | 2 | 3 | 5 | 8 |
| 4 core x 16 mm² | Three | XLPE or X-90 | PVC 5V-90 or 5V-75 | General use cable, point of supply to switchboard, switchboard to pit, pit to pit. | 2 | 3 | 5 | 9 |
| 4 core x 16 mm² | Three | XLPE or X-90 | HDPE | Special cable for long runs, for continually wet and vermin-infested areas, point of supply to switchboard, switchboard to pit, pit to pit. | 2 | 3 | 5 | 9 |
| 4 core x 25 mm² | Three | XLPE or X-90 | PVC 5V-90 or 5V-75 | Special cable for long runs, point of supply to switchboard, switchboard to pit, pit to pit. | 1 | 2 | 3 | 6 |
| 4 core x 25 mm² | Three | XLPE or X-90 | HDPE | Cable for continually wet and vermin-infested areas, point of supply to switchboard, switchboard to pit, pit to pit. | 1 | 2 | 3 | 6 |
| 6 Core | 4 x 1.5 mm² Active<br>1 x 1.5 mm² Earth<br>1 x 1.5 mm² Neutral | PVC | PVC | Pedestrian pushbuttons, wig-wags, etc. | 6 | 9 | 15 | 24 |

| MRTS256 Cable Specification | | | | | Max. number of sheathed cables in each electrical conduit of diameters (mm) below | | | |
|---|---|---|---|---|---|---|---|---|
| **Configuration / Cores** | **Phases** | **Insulation type and minimum rating** | **Sheath** | **Typical application (Refer to MRTS256 *Power Cables*)** | **50** | **63** | **80** | **100** |
| 19 Core | 16 x 1.5 mm² Active<br>1 x 2.5 mm² Earth<br>1 x 2.5 mm² Neutral<br>1 x 2.5 mm² ELV Return | PVC | PVC | End-of-run cable, mast arm/upper mounting assembly to final equipment. | 2 | 3 | 5 | 8 |
| 36 Core | 33 x 1.5 mm² Active<br>1 x 6 mm² Earth<br>1 x 4 mm² Neutral<br>1 x 2.5 mm² ELV Return | PVC | PVC | General use cable, controller to traffic signal pole, pole to pole. Preferred cable due to larger centre cores. | 1 | 1 | 3 | 4 |

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