Superseded

Technical Specification

Transport and Main Roads Specification MRTS91 Conduits and Pits

March 2025

Queensland Government

Superseded

Copyright

© The State of Queensland (Department of Transport and Main Roads) 2025.

Licence



This work is licensed by the State of Queensland (Department of Transport and Main Roads) under a Creative Commons Attribution (CC BY) 4.0 International licence.

CC BY licence summary statement

In essence, you are free to copy, communicate and adapt this work, as long as you attribute the work to the State of Queensland (Department of Transport and Main Roads). To view a copy of this licence, visit: https://creativecommons.org/licenses/by/4.0/

Translating and interpreting assistance



The Queensland Government is committed to providing accessible services to Queenslanders from all cultural and linguistic backgrounds. If you have difficulty understanding this publication and need a translator, please call the Translating and Interpreting Service (TIS National) on 13 14 50 and ask them to telephone the Queensland Department of Transport and Main Roads on 13 74 68.

Disclaimer

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained within. To the best of our knowledge, the content was correct at the time of publishing.

Feedback

Please send your feedback regarding this document to: tmr.techdocs@tmr.qld.gov.au

Contents

1 Introduction 1

2 Definition of terms 1

3 Referenced documents 2

4 Standard test methods 4

5 Quality system requirements 5

5.1 Hold Points, Witness Points and Milestones 5

5.2 Construction procedures 6

5.3 Batch approval for pit products 7

6 Requirements for the installation of cables, conduits and pits 7

6.1 Asbestos containing materials 7

6.1.1 Pit replacement scenarios in ACM-suspected installations 8

6.2 Requirements on Respirable Crystalised Silica 12

6.3 Electrical systems 12

6.4 Communications systems 12

7 Materials 12

7.1 General 12

7.2 Conduit for electrical cables 13

7.2.1 General 13
7.2.2 Non-metallic conduit 13
7.2.3 Metallic conduit 14
7.2.4 Flexible conduit 14
7.2.5 Heterogeneous conduit 14
7.2.6 Elbows and tees 14
7.2.7 Fixings 14
7.2.8 Limitations of location of types of conduits 14

7.3 Communications conduits 15

7.4 Conduit for boring / jacking 15

7.5 Marker tape 15

7.6 Draw rope 15

7.7 Pit Components 15

7.7.1 General arrangement 16
7.7.2 Material 16
7.7.3 Accessories 16
7.7.4 Mass 16
7.7.5 Mechanical strength of pits 17
7.7.6 Additional requirements for covers 17

7.8 High security pits and pit lids – locations 18

7.8.1 High security pit material and construction 19

7.9 Marker posts 19

7.10 Bedding material 19

7.11 Granular filter material 20

7.12 Lean mix concrete 20

7.13 Backfill 20

Superseded

8 Excavation for underground conduits and pits 20
8.1 General 20
8.2 Trench width 21
8.3 Trench walls 21
8.4 Bottom of trench 21
8.5 Timing of excavation 21
8.6 Existing pavement 21
8.7 Boring and/or jacking 21
8.8 Excavated material 22
8.9 Trench depth 22
8.10 Surplus excavated material 22
9 Installation of conduits 22
9.1 General 22
9.2 Location 24
9.3 Conduit bores 24
9.4 Road crossings 24
9.5 Conduits in barrier 24
9.6 Changes in levels or direction of conduit 25
9.7 Bends 25
9.7.1 Use of bends 25
9.7.2 Bends for road crossing conduits 25
9.7.3 Bends for backbone conduits 26
9.8 Bedding of conduit 26
9.9 Conduit at pits 26
9.10 Shared trenches and adjacent conduits 26
9.11 Marking tape 27
9.12 Jointing 27
9.12.1 General 27
9.12.2 Non-metallic conduit 27
9.12.3 Metallic conduit 27
9.12.4 Flexible conduit 27
9.13 Draw rope 27
9.14 Conduit plugs / bungs 28
9.15 Surface mounted conduits 28
9.16 Flexible conduit in concrete 28
10 Installation of pits 28
10.1 General 28
10.2 Placement of pits 28
10.3 Numbering of pits 29
10.4 Bedding of pit 29
10.5 Circular pit collars, risers and surrounds 29

Superseded

10.6 Split pit 30
10.7 Finished surface level 30
10.8 Entry of conduit 30
10.9 Vermin proofing of conduits 31
10.10 Installation of pit over existing conduit 31
10.11 Drainage 32
10.12 Pits installed on batter slopes 32
10.13 Installation of pits for busways 32
10.14 Maintenance marker posts 32
11 Conformance and As Constructed Survey 33
12 Existing Underground Asset 34
13 Backfilling 34
13.1 General 34
13.2 Conduits 34
13.3 Pits 35
13.4 Precautions against damage or movement 35
13.5 Roadways 35
13.6 Footways 35
14 Surface treatment 35
15 Unused conduits 35
16 Supplementary requirements 36
Appendix A: Conduits and pit layout 37

Superseded

1 Introduction

This Technical Specification applies to the supply, installation and testing of materials, pits, conduits and conduit fittings used to form a segregated wiring enclosure for the housing and protection of either electrical or communications cables.

In this version:

1. Renaming the title of Clause 6.1 to *Asbestos containing materials*.
2. Inclusion of the new WHSQ Requirements on Respirable Crystalised Silica (RCS) in the new Clause 6.2.

This Technical Specification covers the supply and installation of new materials. Refer to MRTS96 *Management and Removal of Asbestos* for existing transport infrastructure.

The wiring enclosure may be either:

- underground
- in a structure or barrier, or
- on a surface.

This Technical Specification shall be read in conjunction with MRS91 *Conduits and Pits*, MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements*, *Routine Maintenance Guidelines* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

Superseded

2 Definition of terms

The terms defined in MRTS01 *Introduction to Technical Specifications* apply to this Technical Specification. Additional terminology relevant to this Technical Specification is defined in Table 2 below.

Table 2 – Definition of terms

Term	Definition
Administrator	As defined in the Contract
ACM	Asbestos-Containing Material
Communications Supervisor	A Registered Cabling Provider or a Licensed Electrical Contractor under the direct supervision of a Registered Cabling Provider
Competent Person	As defined in *Work Health and Safety Regulation 2011* and as defined in MRTS96 *Management and Removal of Asbestos*
Conduit	Parts of a closed wiring system used to enclose cables in an electrical or communications installation, which allows the cables to be drawn in or replaced. Conduits shall have a circular cross-section. Conduits can include bends, elbows, junction boxes, tees and fixings
Conduit bends	Prefabricated curved lengths of conduit designed to join 2 conduits
Elbow	A conduit bend of shorter combination of length and angle than defined in Clause 9.7 of this Technical Specification

Term	Definition
Electricity entity	As defined in the *Electrical Safety Act* 2002 (Qld)
Electrical works	As defined in the *Electrical Safety Act 2002* (Qld)
Extra low voltage	Not exceeding 50 V AC, or 120 V, ripple free DC
FSL	Finished Surface Level
ITS	Intelligent Transport Systems
Licensed Electrical Contractor	Holder of an Electrical Contractor License under the *Electrical Safety Act 2002* (Qld)
Low voltage	Exceeding extra low voltage but not exceeding 1000 V AC or 1500 V DC
Pit	A wiring enclosure used to provide space for placing and joining cables, pulling cables, performing an operation on cables or for the inclusion of other equipment
RCS	Respirable Crystalised Silica
Registered Cabling Provider	A cabling provider registered in accordance with the *ACMA Telecommunications Cabling Provider Rules*
Department	Queensland Department of Transport and Main Roads
Unregistered Cabling Provider	A person who is not a Registered Cabling Provider, but who is directly supervised by a Registered Cabling Provider
WHSQ	Workplace Health and Safety Queensland
Wiring Rules	AS/NZS 3000 and/or AS/CA S009 as appropriate to the respective service

3 Referenced documents

The requirements of the reference documents listed in Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and the referenced documents, the requirements specified in this Technical Specification shall take precedence.

Table 3 – Referenced documents

Reference	Title
AS 1074	*Steel tubes and tubulars for ordinary service*
AS 3996	*Access covers and grates*
AS 4586	*Slip resistance classification of new pedestrian surface materials*
AS/CA S008	*Requirements for Customer Cabling Products*
AS/CA S009	*Installation Requirements for Customer Cabling (Wiring Rules)*
AS/NZS 1477	*PVC pipes and fittings for pressure applications*
AS/NZS 1580.408.5	*Paints and related materials – Methods of test – Adhesion – Pull-off test*
AS/NZS 2053, Part 1	*Conduits and fittings for electrical installations – General Requirements*
AS/NZS 2053, Part 2	*Conduits and fittings for electrical installations – Rigid plain conduits and fittings of insulating material*
AS/NZS 2053, Part 4	*Conduits and fittings for electrical installations – Flexible plain conduits and fittings of insulating material*
AS/NZS 2053, Part 7	*Conduits and fittings for electrical installations – Rigid metal conduits and fittings*

Superseded

Reference	Title
AS/NZS 2053, Part 8	*Conduits and fittings for electrical installations – Flexible conduits and fittings of metal or composite material*
AS/NZS 2648, Part 1	*Underground marking tape – Non-detectable tape*
AS/NZS 3000	*Electrical installations (known as the Australian / New Zealand Wiring Rules)*
AS/NZS 3879	*Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings*
AS/NZS 4130	*Polyethylene (PE) pipes for pressure applications*
AS/NZS 4680	*Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*
AS/NZS 61386, Part 1	*Conduit systems for cable management – General Requirements*
Energy Queensland Electricity Entity Requirements	*Electricity Entity Requirements – Working Near Overhead and Underground Electric Lines*
Electrical Safety Act	*Electrical Safety Act 2002* (Qld) *and associated Regulations and Codes of Practice*
HB 197	*Standards Australia Handbook: An introductory guide to the slip resistance of pedestrian surface materials*
MRS91	*Conduits and Pits*
MRTS01	*Introduction to Technical Specifications*
MRTS04	*General Earthworks*
MRTS14	*Road Furniture*
MRTS36	*Recycled Glass Aggregate*
MRTS50	*Specific Quality System Requirements*
MRTS56	*Construction Surveying*
MRTS70	*Concrete*
MRTS72	*Manufacture of Precast Concrete Elements*
MRTS78	*Fabrication of Structural Steelwork*
MRTS96	*Management and Removal of Asbestos*
MRTS140	*Horizontal Directional Drilling (HDD)*
MRTS200	*General Requirements for Intelligent Transport Systems Infrastructure*
MRTS256	*Power Cables*
RPDM	*Road Planning and Design Manual 2nd Edition*
SD1149	*Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*
SD1314	*Traffic Signals/Road Lighting – Cable Jointing Pit Drainage Details*
SD1395	*Road Lighting – Base Plate Mounted Pole within Concrete Barrier – Footing Details and Installation of Pole*
SD1415	*Traffic Signals/Road Lighting – Circular Cable Jointing Pit Types 60 and 100*
SD1416	*Traffic Signals/Road Lighting – Collar for Circular Cable Jointing Pit*

Superseded

Reference	Title
SD1417	*Traffic Signals/Road Lighting – Cable Jointing Pit Circular Pit Cover (Drawing 1 of 2 to Drawing 2 of 2)*
SD1418	*Traffic Signals/Road Lighting – Junction Box Supporting Strap*
SD1440	*Traffic Signals/Road Lighting – Cable Jointing Pit Rectangular Concrete Surround*
SD1469	*Single Slope Concrete Barrier – Fabrication and Installation Details of Cover Plates at Road Lighting Poles in Concrete Barriers*
SD1627	*Road Lighting – Switchboard Top Mounted (Sheet 1 of 2 and Sheet 2 of 2)*
SD1630	*Traffic Signals/Road Lighting – Conduit Entry Details Into Circular Pits*
SD1631	*Traffic Signals/Road Lighting – Cable Jointing Pit Types 1(J), 3, 4, 7 and 8*
SD1632	*Traffic Signals/Road Lighting – Cable Jointing Pit Cover Type 1(J)*
SD1633	*Traffic Signals/Road Lighting – Cable Jointing Pit Cover Types 3 and 4*
SD1634	*Traffic Signals/Road Lighting – Cable Jointing Pit Cover Types 7 and 8*
SD1681	*Traffic Signals/Road Lighting – Riser for Circular Cable Jointing Pit*
SD1685	*Traffic Signals/Road Lighting/ITS – Precast Concrete Surround for Circular Pit*
SD1695	*Traffic Signals/Road Lighting/ITS – Circular Split Pit*
SD1707	*Road Lighting – Base Plate Mounted Pole Mounted on Bridges Wiring Details*
TN63	*Assessment of Electrical Pit Products to MRTS91 and MRTS78*
WHSQ Code of Practice 2022	*Managing respirable crystalline silica dust exposure in construction and manufacturing of construction elements*
-	*Australian Communications and Media Authority (ACMA) Telecommunications Cabling Provider Rules*

Superseded

4 Standard test methods

For conduits and pits forming an electrical wiring enclosure, the Administrator shall certify that the materials and installation complies with the Standard Drawings, the Technical Specifications, Australian Standards and Regulations.

For conduits and pits forming a communications wiring enclosure, the Administrator shall certify that the materials and installation complies with the Standard Drawings, the Technical Specifications, Australian Standards and Regulations.

Testing of compaction of backfilling shall be carried out in accordance with the requirements of MRTS04 *General Earthworks*.

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

Additional requirement regarding the release of Hold Points and Witness Points and Milestones.

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

For the release of the Hold Points, Witness Points and Milestones, even though it is stated that the Administrator / Principal releases the points, they must be approved by an Electrical Inspector or an Electrical Supervisor who must have formal electrical qualifications, if the Administrator / Principal does not have the qualifications.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.3	1. Construction Procedures		Evidence of contractor adequacy of special training and audit / inspection process. Provision of construction procedures for the installation of conduits and pits (14 days)
6.1	2. Asbestos presence assessment		
7.1	3. Material Compliance Certificate		
8.1	4. Excavation for underground conduits and pits		Set out of underground conduits and pits (at least 48 hours)
8.4		1. Bottom of trench	
8.7	5. Boring and/or jacking of conduits		
8.9		2. Trench Depth	
9.1	6. Installation of conduits	3. Conduits within structure or barrier	Installation of conduits
9.13		4. Draw rope installation	
10.4		5. Bedding of pits	
10.9	7. Vermin proofing of conduits		
10.11		6. Pit drainage	
13.1	8. Backfilling of trenches		

Superseded

5.2 Construction procedures

The electrical contractor is required to provide evidence of the adequacy of specific training in the construction procedure and audit / inspection process in the form of training manuals, training logs and audit / inspection logs.

A construction procedure for the installation of all conduits and pits shall be submitted to the Administrator at least 14 days prior to the commencement of installation. **Milestone**

This construction procedure shall include, but not be limited to, detailing the materials and methods to be used for:

a) pits
b) conduits
c) pits over existing conduits
d) sealing of conduits
e) vermin proofing of conduits
f) marker tape
g) draw rope
h) shared trenches
i) installation of fixing brackets and/or anchors to structures
j) storage of materials on site
k) disposal of excess materials
l) boring and/or jacking methods
m) product identification and traceability
n) inspection and test plans, and
o) identification and safe management of ACM.

Superseded

No excavation activity associated with the installation of conduits and pits shall commence until the expiration of the 14-day period. **Hold Point 1**

HOLD POINT 1	
Process Held:	Use of Construction Procedures
Submission details:	Evidence of contractor adequacy of special training and audit / inspection process. Construction procedure for the installation of all conduits and pits to be submitted 14 days prior to commencement of excavation.
Release of Hold Point:	The Administrator will consider the evidence and procedure submitted prior to approval.

5.3 Batch approval for pit products

All pit products, including pit, cover, collar and riser used in departmental projects shall be registered products assessed in accordance with TN63 *Assessment of Electrical Pit Products to MRTS91 and MRTS78*.

On delivery, all pit products must be accompanied by a Batch Certificate of Compliance issued by Statewide Network Operations branch, Department of Transport and Main Roads.

In addition to batch approval, one physical sample of the High Security Pit shall be provided to Transport and Main Roads for physical penetration testing in accordance with Clause 7.8.1.

6 Requirements for the installation of cables, conduits and pits

6.1 Asbestos containing materials

If asbestos is suspected or found in existing installation:

1. Any work at this site that may disturb the suspected or confirmed asbestos must be stopped immediately
2. The area at the site where the suspected or confirmed asbestos is located must be secured to prevent access, and
3. The finding must be reported to the Principal immediately for their decision and instruction on the work to be carried out at the site. Refer to MRTS96 *Management and Removal of Asbestos*. **Hold Point 2**

HOLD POINT 2	
Process Held:	Asbestos is suspected or found in existing installation.
Submission details:	The finding must be reported to the Principal immediately for their decision and instruction on the work to be carried out at the site.
Release of Hold Point:	The Principal will decide and give instruction on the work to be carried out at the site.

Superseded

The explicit activities listed below related to Asbestos Containing Materials (ACM) are mandatory or strictly prohibited:

1. The modification of any ACM pits and/or ducting, which will create more difficulties and hazards to field workers during subsequent activities that involve working with such assets, are strictly prohibited. Some examples of such prohibited practices of this category include, but are not limited to:
    a. The use of any sleeving of ACM ducting (that is, use of PVC ducting inserts), and
    b. The placement of pit risers above and/or into ACM pits.

2. Any works that result in ACM conduits no longer being utilised for cabling that is used for ITS, traffic signals or road lighting purposes shall be:

    a. **First preference** – removed from the site in accordance with MRTS96 *Management and Removal of Asbestos*, where reasonable site access opportunities permit (that is, where excavation works result in less than 300 mm of residual cover for ACM ducting sections), or

    b. **Last preference** – abandoned and left insitu. For this case:

        i. all ACM conduit ends shall be encapsulated with a sealant and capped, and

        ii. details of the conduits and their locations shall be marked up on the project plan for the preparation of the As Constructed drawing. The details shall also be forwarded to the Principal for the updating of the Transport and Main Roads asbestos registers.

3. The placement of pits into ACM ducting sections shall be in accordance with the relevant scenarios in Clause 6.1.1.

4. Any works that result in ACM pits no longer being utilised for cabling that is used for ITS, traffic signals or road lighting purposes shall also require the ACM pits to be removed from the site in accordance with MRTS96 *Management and Removal of Asbestos*.

5. New cabling shall not be installed into ACM pits and ducting of which are not completely physically intact, and free of visible damage.

Cables must be installed in wiring systems as per AS/NZS 3000 *Wiring Rules*. The wiring systems are required to provide mechanical protection to the cables to ensure a degree of safety and protection. Mechanical protection is provided by installing the cables in a wiring enclosure, formed by the use of conduits and pits.

Suitable cable rollers, guides, swivels and associated cable installation accessories shall be used to prevent damage to cables and conduits. Damage shall not be limited to friction and abrasive damage during installation of cable or drawing of ropes through any conduit, conduit fitting or pit.

Swivels shall be used to prevent the twisting of cable or cables whilst drawing through conduits.

If cables are damaged, they shall be replaced.

If cables are twisted during installation, they shall be removed and reinstalled.

All cables that are pulled out from ACM pits and/or conduits should be decontaminated in accordance with MRTS96 *Management and Removal of Asbestos* prior to being reinstalled or removed, and the asbestos pits and conduits should be labelled in accordance with MRTS96 *Management and Removal of Asbestos.*

All new installations shall segregate electrical cables from communications cables by way of separate wiring enclosures.

6.1.1 Pit replacement scenarios in ACM-suspected installations

The main scenarios for replacement or modification of existing pits located at ACM-suspected installations are as follows:

1. The pit is ACM free, but linking conduits contain ACM.

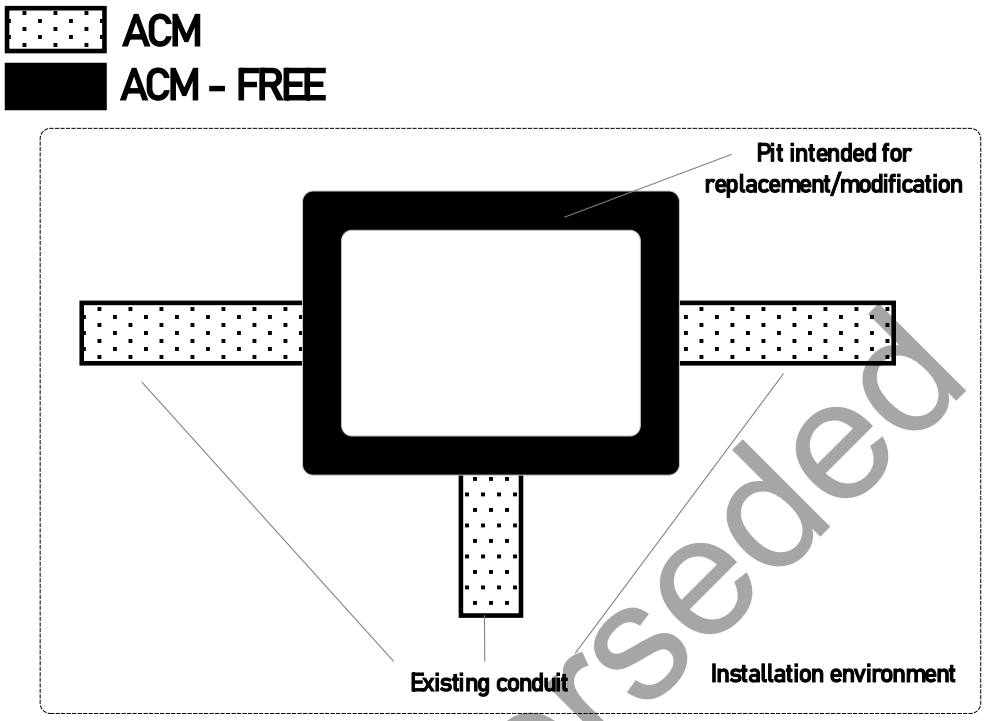
2. ACM pit in ACM-free linking conduits.

Superseded

3. Both pits and conduits contain ACM.
4. Both pit and conduits are ACM-free but immediate environment (soil, other adjacent installations) may contain ACM.

Below are recommended approaches for the replacement of pits in each scenario.

Figure 6.1.1(a) – Scenario 1: ACM-free pits in contact with ACM conduits

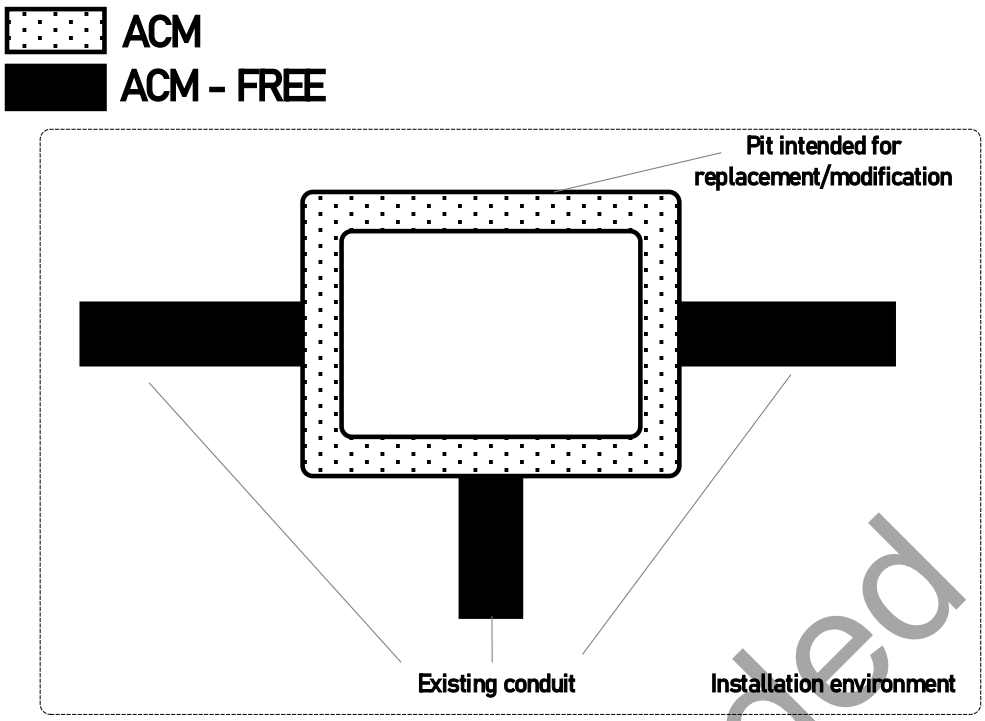


Superseded

Where a pit is ACM-free and the linked conduits contain ACM, the maintenance of the pit including replacement or modification can be performed as long as:

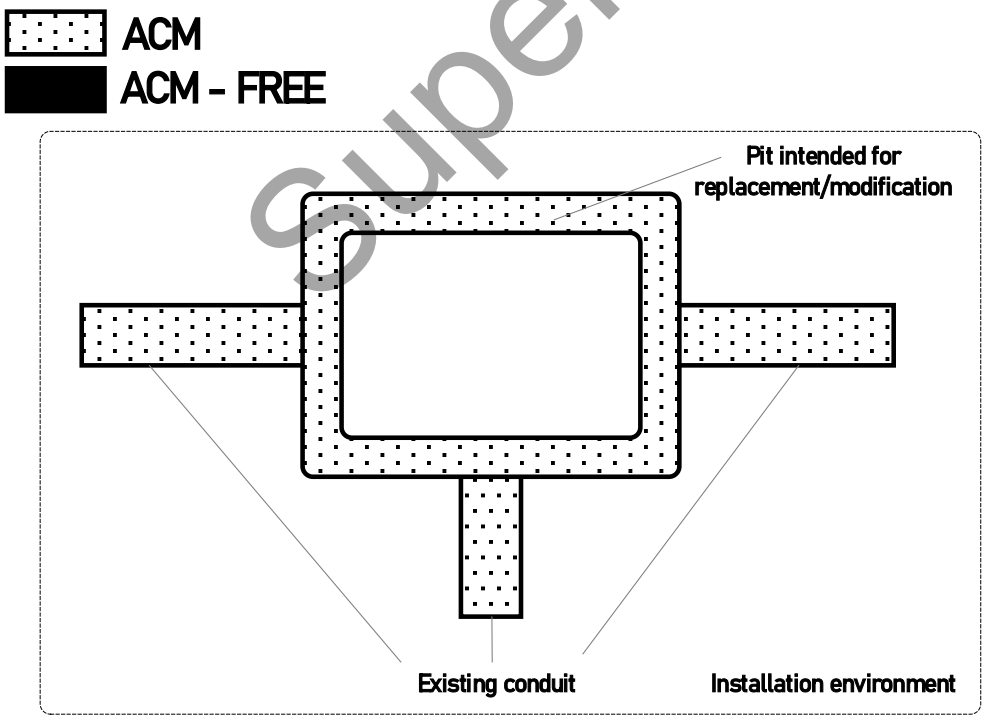
- all work is done in accordance with the guidelines in Clause 6.1 and MRTS96 *Management and Removal of Asbestos*
- existing ACM conduits are deemed to be non- friable as defined in MRTS96 *Management and Removal of Asbestos* and are in good condition by a Competent Person
- the work does not involve disturbance or removal of existing ACM, including the asbestos conduits, and
- the asbestos conduits are encapsulated and sealed prior to replacement of the pit.

Figure 6.1.1(b) – Scenario 2: ACM pits in contact with ACM-free conduits



Where the existing pit contains ACM and the linked conduits are ACM-free, the maintenance of the ACM pit shall be handled in accordance with Clause 6.1 and Asbestos management guidelines in MRTS96 *Management and Removal of Asbestos*.

Figure 6.1.1(c) – Scenario 3: ACM pits and conduits

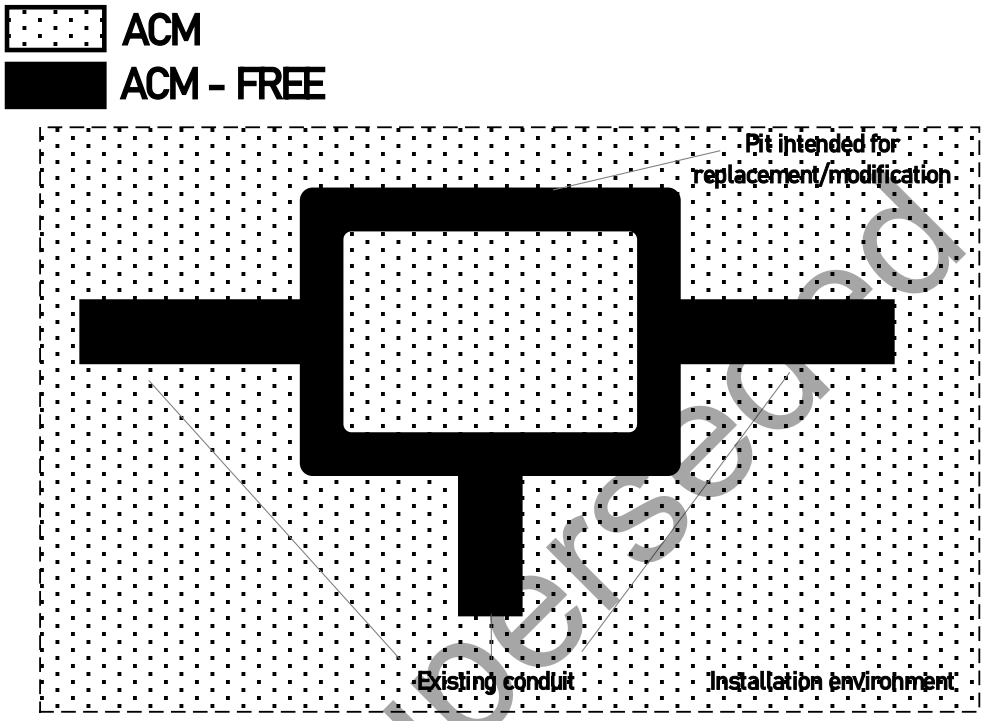


Superseded

Where the existing pit and conduits contain ACM, the maintenance of the pit including replacement or modification of the pit may be performed as long as:

- all work is done in accordance with the guidelines in Clause 6.1 and MRTS96 *Management and Removal of Asbestos*,
- existing ACM conduits are deemed to be non-friable as defined in MRTS96 *Management and Removal of Asbestos* and in good condition by a Competent Person, and
- the work does not involve disturbance or removal of existing ACM conduits.

Figure 6.1.1(d) – Scenario 4: Pits and conduits in ACM environment



Superseded

This scenario is mainly about pits and conduits in asbestos contaminated soil but could also include nearby installations suspected to contain asbestos.

This scenario is probably rare as Transport and Main Roads has removed a number of installations with asbestos contaminated soil, but some may remain, in which case they should be handled on a site-specific basis.

Where pits and conduits are in ACM environment, which include asbestos contaminated soil or nearby installations suspected to contain ACM, the Principal must be contacted prior to any maintenance of the ACM pit or conduits shall be handled in accordance with Clause 6.1 and Asbestos management guidelines in MRTS96 *Management and Removal of Asbestos*.

6.2 Requirements on Respirable Crystalised Silica

New WHSQ Requirements on Respirable Crystalised Silica (RCS).

All works are to conform to WHSQ Code of Practice 2022 on '*Managing respirable crystalline silica dust exposure in construction and manufacturing of construction elements*'.

6.3 Electrical systems

Electrical cables are installed to provide power circuits to equipment installed in the field, including traffic signals, road lighting and other Intelligent Transport Systems (ITS) equipment.

The Contractor must engage a Licensed Electrical Contractor to perform the duties and functions of Electrical Works.

Wiring enclosures forming part of an electrical wiring system shall be installed in accordance with the Wiring Rules and all works shall comply with the *Electrical Safety Act 2002* (Qld).

6.4 Communications systems

Communications cables are installed to transmit video, data and voice between ITS devices installed in the field and the Traffic Management Centres.

The Contractor must engage a Registered Cabling Provider to perform the communications cabling works.

Wiring enclosures forming part of a communications wiring system shall be installed in accordance with AS/CA S009 *Installation Requirements for Customer Cabling (Wiring Rules)*, and all works shall comply with the *Electrical Safety Act 2002* (Qld).

7 Materials

7.1 General

All materials must comply strictly with the requirements of this Technical Specification. For all materials, a certificate of such compliance shall be provided to the Administrator before the materials are incorporated into the works. **Hold Point 3**

HOLD POINT 3

Process Held:	Use of materials covered by the Material Compliance Certificates.
Submission Details:	Certificates of compliance for all materials which are incorporated into the works.
Release of Hold Point:	The Administrator will consider the Certificates submitted prior to approval.

Conduit and conduit fittings not protected against solar radiation shall be stored under cover to prevent damage by solar radiation.

Materials and equipment damaged prior to, and/or during installation must not be used.

Superseded

Conduit and conduit fittings with discolouration shall not be used.

Where so stated in Clause 1 of Annexure MRTS91.1, production samples of materials shall be provided to the Administrator. Production samples will be held throughout the period of the contract to provide a reference against which all subsequent items may be gauged for compliance with this Technical Specification.

7.2 Conduit for electrical cables

7.2.1 General

Conduit and conduit bends forming part of a wiring enclosure for the installation of Low Voltage wiring systems shall be one of the types described in Clauses 7.2.2 to 7.2.4 inclusive.

Fittings and fixings shall comply with the requirements of Clauses 7.2.5 to 7.2.8 inclusive.

7.2.2 Non-metallic conduit

Non-metallic conduits and conduit bends shall be Heavy Duty (HD) Solid Plain Wall PVC complying with the requirements of AS/NZS 2053, *Part 2: Conduits and fittings for electrical installations – Rigid plain conduits and fittings of insulating material,* and AS/NZS 61386 *Part 1: Conduit systems for cable management – General Requirements*. Sandwich type of construction shall not be used.

For Solid Core Layer construction conduits, where more than one permanently fused solid layers are used, the conduit must be tested to Very Heavy Duty (VHD) for compression and impact resistance.

The conduit shall have a smooth inner bore and shall not have a corrugated outer surface.

For conduit product approval purposes, testing of non-metallic conduits shall be deemed to qualify 2 conduit sizes smaller than the conduit tested. Nominal conduit sizes as per AS/NZS 2053, Part 2 include: 16 mm, 20 mm, **25 mm**, 32 mm, 40 mm, **50 mm**, 63 / 65 mm, 80 mm, **100 mm**, 125 mm, 150 mm and **200 mm**.

For conduit sizes larger than what is specified in AS/NZS 2053, Part 2 (for example, exceeding 150 mm), the conduit shall conform to the requirements of Table 4.1, column PN 12 of AS/NZS 1477 *PVC pipes and fittings for pressure applications*.

For conduit product approval purposes only, with the compression test, the difference between the initial outside diameter and the diameter measured with the force applied shall not exceed 10%. Refer to Appendix A of AS/NZS 2053, *Part 1 Conduits and fittings for electrical installations – General Requirements*, and Clause 9.3 of AS/NZS 2053.2 for procedure.

For underground installations or where installed within a structure or barrier, the conduit shall be coloured appropriately for the service being supplied, that is, orange for power and white for communications.

For surface mounted installations, conduit shall be classified as having protection against solar radiation and marked with the letter ‘T’, indicating such protection.

Superseded

7.2.3 Metallic conduit

Metallic conduit and conduit bends shall be either:

a) a material classified as metal complying with the requirements of AS/NZS 2053, Part 7: *Conduits and fittings for electrical installations – Rigid metal conduits and fittings*, or

b) heavy duty galvanised steel tube complying with the requirements of AS 1074 *Steel tubes and tubulars for ordinary service*.

All metallic conduits shall be free of burrs that may damage cables or alternatively shall be installed with PVC sleeves to prevent damage to cables.

PVC adaptors shall be used where holes are drilled in metallic conduits.

Metallic conduits and bends must be earthed as necessary to comply with AS/NZS 3000.

7.2.4 Flexible conduit

Flexible conduit must comply with AS/NZS 2053, Part 4: *Conduits and fittings for electrical installations – Flexible plain conduits and fittings of insulating material* or AS/NZS 2053, Part 8: *Conduits and fittings for electrical installations – Flexible conduits and fittings of metal or composite material* and may only be used in specific situations as stated in this Technical Specification or in Clause 2 of Annexure MRTS91.1. Corrugated conduit shall not be used for trenched installations. Heavy duty corrugated or Core-flow™ conduit types are also excluded from trenched installations.

7.2.5 Heterogeneous conduit

Where 2 different types of conduits are joined, proprietary conduit mating joints (preferably threaded) or junction boxes shall be used.

7.2.6 Elbows and tees

Elbows and tees shall be of the same material and to the same standard as the adjacent conduit. Tees and elbows shall be provided with inspection plates.

Tees and elbows shall not be installed underground or within a structure or barriers.

7.2.7 Fixings

Fixing brackets and/or anchors for surface mounted conduit shall be either:

a) proprietary fixings deemed suitable by the manufacturer for the application, or

b) where so stated on the Standard Drawings or in Clause 3 of Annexure MRTS91.1, manufactured components complying with the stated requirements.

7.2.8 Limitations of location of types of conduits

Unless protected by a metal cover, only metallic conduits and fittings shall be used in sections of a surface mounted installation that are within 3 m of areas that may be accessed by the public.

Tees and elbows shall not be located within 3 m of areas that may be accessed by the public.

Superseded

7.3 Communications conduits

Communications conduits and conduit bends shall be Heavy Duty (HD) Solid Plain Wall PVC complying with the requirements of AS/NZS 2053, *Part 2: Conduits and fittings for electrical installations – Rigid plain conduits and fittings of insulating material*, and AS/NZS 61386, *Part 1: Conduit systems for cable management – General Requirements*. Sandwich type of construction shall not be used. Conduit and conduit bends forming part of a wiring enclosure for the installation of communications cables shall comply with the requirements of Clause 5.3 of AS/CA S008 *Requirements for Customer Cabling Products* except they shall be heavy duty. This applies to underground, surface mounted and within structure wiring enclosures. Communications conduits shall have a smooth inner bore and shall not have a ribbed outer surface.

7.4 Conduit for boring / jacking

Conduit used for boring / jacking shall be continuous and manufactured of Polyethylene (or equivalent), with a wall thickness as per AS/NZS 4130 *Polyethylene (PE) pipes for pressure applications* of Standard Dimension Ratio (SDR) of 13.6.

7.5 Marker tape

Marker tape shall comply with the requirements of AS/NZS 2648 Part 1: *Underground marking tape – Non-detectable tape*.

Orange marker tape shall be used to identify low voltage electrical wiring systems.

White marker tape shall be used to identify communications systems.

7.6 Draw rope

Draw rope shall be a general-purpose synthetic polypropylene filament rope of minimum diameter of 4 mm.

Draw ropes manufactured from other materials may be used where it can be demonstrated conclusively that draw rope will function to a standard equal to or better than that described above.

Metallic wire or cable shall not be used as draw rope.

Draw ropes shall be treated from being frayed.

7.7 Pit Components

All pit components, including pit, cover, collar and riser used in departmental projects shall be registered approved products assessed in accordance with TN63 *Assessment of Electrical Pit Products to MRTS91 and MRTS78*. On delivery, all pit products must be accompanied by a Batch Certificate of Compliance issued by Statewide Network Operations branch, Department of Transport and Main Roads.

The design life of all components shall be 20 years.

Electrical and communications pits shall be of the type specified by the Project Drawings. Where a type is not specified a circular pit shall be installed, except as follows:

a) Type 4, 7 or 8 pits may be used where physical constraints or service conflicts exist, and approval has been granted by the Administrator.

Superseded

b) Type 3 pits shall be used for termination of the vehicle detector loop feeder cable.

c) An additional Type 4 pit may be used for signal footing which is more than 3 metres away from a circular pit.

7.7.1 General arrangement

Pit components shall be manufactured to the dimensions and arrangement shown on the relevant Standard Drawings. The material shown on the Standard Drawings for pit covers is steel. However, this could be of any type of material to support loading and other requirements:

a) Circular pits – Standard Drawings 1415, 1416, 1417, 1681, and

b) Rectangular pits – Standard Drawings 1631, 1632, 1633, 1634.

Collars shall be designed to prevent misalignment of the cover to the pit, allow height adjustment of up to 50 mm and allow some vertical rotation to suit the cross-fall of the finished surface level. Collars shall be designed to facilitate a lockable cover but shall not impede cable installation.

7.7.2 Material

Pit components shall be manufactured of durable, abrasion-resistant materials and capable of being buried without any damaging effects or shall be treated for this purpose. Pits shall have smooth internal walls.

Plastic components shall incorporate protection against solar radiation as per AS 3996 *Access Covers and Grates*. Certification of material to be submitted for batch approval.

Steel components shall be hot dip galvanised in accordance with AS/NZS 4680 *Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*. Steel covers shall be manufactured in accordance with MRTS78 *Fabrication of Structural Steelwork*.

Concrete components shall be manufactured in accordance with MRTS72 *Manufacture of Precast Concrete Elements* from normal-class concrete complying with MRTS70 *Concrete*. Concrete pits shall not be used in any location nominated in Clause 4 of Annexure MRTS91.1

Pits shall be supplied as one complete unit with the base permanently attached. If the base is manufactured separately to the walls, it shall be attached using non-corrosive materials that do not protrude internally from the pit wall.

Superseded

7.7.3 Accessories

Pit components shall be provided with the following accessories:

a) with collars, an earthing screw, washer and nut and, where appropriate, shall be earthed by a non-ferrous earth wire in accordance with Standard Drawing 1416 *Traffic Signals/Road Lighting – Collar for Circular Cable Jointing Pit* and sized in accordance with AS/NZS 3000, and

b) removable cable supports with Type 7 and Type 8 rectangular pits.

7.7.4 Mass

Pits, risers and collars shall have a mass not greater than 40 kg.

Covers shall have a mass of between 10 and 25 kg

7.7.5 Mechanical strength of pits

Pit assemblies shall have sufficient strength in the vertical direction to resist a Class B serviceability design load when tested in accordance with AS 3996 and TN63 *Assessment of Electrical Pit Products to MRTS91 and MRTS78*. The resultant permanent vertical deformation of the pit assembly after the 5 loading cycles shall be no greater than 10 mm.

Removable cable supports for Type 7 and Type 8 rectangular pits must be removed during the load tests. Pits selected for testing shall be cored to simulate conduit connections with holes on each side and end as per Table 7.7.5. Holes shall be placed at least 30 mm from any corner or edge, and each other.

Table 7.7.5 – Hole requirements for pits

Pit type	# Holes	Hole diameter (mm)
1	1 per each side / and each end	50
3	2 per each side / and each end	65
4	2 per each side / and each end	85
7, 8	2 per each side / and each end	100
60, 100 (circular)	8 (evenly distributed around circumference)	100

The thickness of the walls and bottom of the pit shall exhibit a shearing or cutting characteristic such that the holes specified above can be cut with a normally available hole saw or press to within 30 mm of the corners and/or edges of the pit.

Covers shall be tested independently and conform to the requirements of AS 3996 using Class B design loads.

7.7.6 Additional requirements for covers

Covers shall comply with AS 3996.

Purpose-designed concrete infill covers shall be tapered to facilitate easy removal with a lifting device.

Twin covers shall be used for pit Types 7 and 8. In such a case, the 2 sections of cover shall be identical in dimension and form.

7.7.6.1 Locking and lifting

Option for lockable covers for both rectangular and circular pits.

Pit covers shall be designed and constructed such that members of the public cannot lift a pit cover using their hands, feet or any equipment that might normally be carried on their person.

Lifting holes shall be designed to prevent entry of foreign objects (for example, syringes) into the pit but allow soil to pass through so lifting is not impeded. Lifting holes shall be compatible with a standard lifting device.

Options shall be available for pits to be lockable and be fitted with a tamper-proof mechanism, which can be locked and unlocked using a standard pit lifting device, as shown on Standard

Superseded

Drawing 1633 *Traffic Signals/Road Lighting – Cable Jointing Pit Cover Types 3 and 4* and Standard Drawing 1634 *Traffic Signals/Road Lighting – Cable Jointing Pit Cover Types 7 and 8* for rectangular pits and on Standard Drawing 1417 *Traffic Signals/Road Lighting – Cable Jointing Pit Circular Pit Cover (Drawing 1 of 2 to Drawing 2 of 2)* for circular pits.

7.7.6.2 Surface coating

Covers shall be manufactured from a non-conductive material or steel having a protective coating applied in accordance with Standard Drawing 1633 *Traffic Signals/Road Lighting – Cable Jointing Pit Cover Types 3 and 4* and Standard Drawing 1634 *Traffic Signals/Road Lighting – Cable Jointing Pit Cover Types 7 and 8* for rectangular pits and on Standard Drawing 1417 *Traffic Signals/Road Lighting – Cable Jointing Pit Circular Pit Cover (Drawing 1 of 2 to Drawing 2 of 2)* for circular pits to provide insulation against indirect contact with a live low voltage conductor. The insulation resistance through a pit cover shall be not less than 1 mega-ohm when tested in accordance with Clause 6.3.3.3 of AS/NZS 3000.

Coatings shall be tested for adhesion to the cover surface in accordance with AS/NZS 1580.408.5 *Paints and related materials – Methods of test – Adhesion – Pull-off test*. Adhesion tests shall be performed on the coating material by a suitably rated NATA laboratory and certification provided that the adhesion value is at least 1 MPa.

The top surface of pit covers shall conform to the requirements of AS 4586 *Slip resistance classification of new pedestrian surface materials* and Table 3 of Handbook HB 197 *An introductory guide to the slip resistance of pedestrian surface materials* where the classification is for ‘External colonnades, walkways and pedestrian crossings’.

The slip resistance shall be evaluated in accordance with AS 4586 and HB 197 where the nominated test method shall be either the ‘Wet Pendulum Test Method’ in accordance with Appendix A of AS 4586 or the ‘Oil – Wet Ramp Test Method’ in accordance with Appendix D of AS 4586.

7.7.6.3 Marking

Covers for pits forming a wiring enclosure for electrical cabling shall be marked with the word ‘ELECTRICAL’, with a minimum text height of 30 mm.

Pit covers for pits forming a wiring enclosure for communications cabling shall be marked with the word ‘COMMUNICATIONS’, with a minimum text height of 20 mm.

Lettering shall be in uppercase Arial font and shall be engraved, embossed, cast or otherwise made permanent and legible.

7.8 High security pits and pit lids – locations

High security pits and pit lids shall be installed for all lighting infrastructure within the following areas / corridors:

- Motorways / highways including on and off ramps
- Dedicated bikeways / pathways, and
- All Transport and Main Roads installations with a history of cable theft.

For all other non-lighting infrastructure with a history of theft, high security pits and pit lids shall be used.

Superseded

High security pits are defined as pits that can withstand multiple intrusion attempts from hand or powered tools for an extended period and has multiple secure locking mechanisms that withstand and deter unauthorised entry to the underground conduit and cabling network.

In situations where high security pits are not available in the required size, the next larger pit size can be used. For example, a P3 (earthling pit) may be substituted with a P4 lockable high security pit, subject to availability.

7.8.1 High security pit material and construction

High security pits shall be constructed of material with high mechanical strength that is capable of withstanding mechanical deflection impact, cutting or grinding by powered or hand tools from multiple attempts. The pit shall be free of material that contains asbestos, crystalline silica, or material that can generate hazardous particulates due to mechanical processes such as crushing, cutting, drilling, grinding or sawing.

Mechanical locking systems for high security pits and pit lids

High security pits and pit lids must use at least 2 different types of locking systems to deter theft. These systems may include:

- Security bolts and/or screws
- Cyberlock compatible marine grade stainless steel 316 padlocks (or equivalent), and
- Electronic locks.

Mechanical locking systems such as keys and security bolts shall be registered with the Principal and only supplied to persons undertaking maintenance or construction activities on Transport and Main Roads infrastructure.

Mechanical Restricted Key for Padlocks

During construction, lockable pits can be secured using the Contractor's own mechanical keying system. Upon handover / end of the defects liability period, Transport and Main Roads' Mechanical Restricted Key System – Registered key profile must be installed on all lockable pits. Restricted mechanical keys profiles are to be managed by the local Transport and Main Roads Principal.

Locking Security Bolts and Screws

Where security locking bolts or screws are used, it is the Contractor's responsibility to securely manage the keys and bolts. These locking keys must be returned to the Principal at the end of the defects liability period / handover.

7.9 Marker posts

Marker posts shall comply with the material requirements for Road Edge Guide Posts as set out in Clause 10 of MRTS14 *Road Furniture*. Marker posts shall protrude 1000 mm above ground level and be identified with durable retro-reflective black and yellow stripe material.

7.10 Bedding material

Bedding material may be sand compacted to a density index of not less than 60 or recycled crushed glass conforming to MRTS36 *Recycled Glass Aggregate*.

Superseded

7.11 Granular filter material

Granular filter material shall comply with the requirements of Clause 19.2.4 of MRTS04 *General Earthworks*.

7.12 Lean mix concrete

Lean mix concrete for backfill shall comply with the requirements of Clause 19.2.12 of MRTS04 *General Earthworks*.

7.13 Backfill

Dry stabilised sand for backfill shall comply with the requirements of Clause 19.2.11 of MRTS04 *General Earthworks*.

8 Excavation for underground conduits and pits

8.1 General

Excavation for conduits and pits shall be carried out in accordance with the requirements of MRTS04 *General Earthworks*.

Excavation for conduits and pits shall be classed as confined excavation as defined in MRTS04 *General Earthworks*. Care shall be taken to minimise disturbance to existing work consistent with complying with the minimum clearances stated in this Technical Specification.

Excavation works near overhead and underground electrical needs, including poles and stay wires, must meet Energy Queensland requirements as set out in the Electricity Entity Requirements – Working Near Overhead and Underground Electric Lines.

Existing underground services in the proposed excavation area shall be identified prior to commencement of excavation.

Excavation works shall not disturb ACM contaminated soils or asbestos containing pits and conduits. Refer to Clause 6.1 for note on asbestos.

Generally, the locations of conduits and pits shown on the Standard Drawings are indicative only and conduit runs shall set out so as to best suit the conditions on the site at the time of construction whilst maintaining the integrity and intent of the cabling design.

Conduit runs and pit locations shall be set out and notice of such set out shall be provided to the Principal at least 48 hours prior to the commencement of excavation. **Milestone**

Construction shall not commence before the expirations of the period of notice. **Hold Point 4**

Superseded

HOLD POINT 4	
Process Held:	Excavation for underground conduits and pits.
Submission Details:	Conduit runs and pit locations shall be set out and notice of such set out shall be provided to the Principal, at least 48 hours prior to the commencement of excavation.
Release of Hold Point:	The Representative of the Principal may inspect the set out. The installation of conduits and pits shall not commence until the set out of the same had been approved by the Principal.

8.2 Trench width

Trenches shall be excavated in accordance with the details shown on Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*. Trench widths less than those specified in that Standard Drawing may be used where it can be demonstrated that completed conduits and pits comply in all other respects with the requirements of this Technical Specification and that the performance of the conduit and/or pit will not be compromised.

8.3 Trench walls

Trench walls shall be cut vertical to within a tolerance of 1 horizontal in 10 vertical.

8.4 Bottom of trench

The bottom of the trench shall be compacted as per Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit* to form a firm uniform surface free from loose material. **Witness Point 1**

8.5 Timing of excavation

When excavating a trench in new roadwork, trenching operations shall be carried out after compaction of the earthworks and prior to the placement of any pavement material or surface finish.

8.6 Existing pavement

Where trenching is carried out across an existing paved surface, the surface shall be pre-cut in a straight line at both trench walls so as to minimise reinstatement work.

8.7 Boring and/or jacking

Boring and/or jacking of conduits shall be carried out by experienced operators using purpose made equipment which is capable of maintaining correct line and levels of completed conduits. Work shall not commence until it has been demonstrated to the Administrator that the proposed equipment can accurately install the conduit in accordance with MRTS140 *Horizontal Directional Drilling (HDD)* and Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*. **Hold Point 5**

Superseded

HOLD POINT 5	
Process Held:	Boring and/or jacking of conduits.
Submission Details:	Demonstrate evidence that boring and/or jacking of conduits shall be carried out by experienced operators, using purpose made equipment which is capable of maintaining correct line and levels of completed conduits.
Release of Hold Point:	It has been demonstrated to the Administrator that the proposed can accurately install the conduit in accordance with MRTS140 *Horizontal Directional Drilling (HDD)* and Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit.*

Excavation of working spaces to assist in boring and/or jacking operations shall be kept to a minimum and such working spaces shall be reinstated to as-found condition after completion of conduit installation.

8.8 Excavated material

The excavated material shall be placed well clear of the trench. If topsoil is required to be reused, it shall be kept separate from the remainder of the excavated material.

8.9 Trench depth

The minimum cover to conduits shall be as shown on Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*.

The maximum cover to conduits shall be such that the conduit depth shall not be greater than the depth of the appropriate pit entry.

Where trenching is required as part of staged works, the maximum cover to the conduits from the final surface level shall not exceed the requirements stated in Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*.

8.10 Surplus excavated material

Surplus excavated material shall be used or disposed of in accordance with the requirements of Clause 11 of MRTS04 *General Earthworks*.

9 Installation of conduits

9.1 General

The installation of conduits shall conform to the requirements of Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*. The installation of communications conduits shall also comply with the requirements of AS/CA S009.

Prior to installation, the Contractor shall inspect all conduit and conduit fittings to ensure that they are free of any defects that could damage the cables during installation.

The internal and external ends of the conduits to be de-burred and bevelled where the conduit enters pits or access points.

Superseded

There shall be no chips, cracks or rough edges and projections developed during conduit cutting.

A proprietary PVC priming fluid and solvent cement, manufactured to AS/NZS 3879: *Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings*, shall be used to join all PVC conduits and conduit fittings.

Ensure that all conduits are clean and free of debris.

All conduits and pits shall drain, with conduits installed without dips or low points to ensure that drainage at the pits operates as intended. Where this cannot be achieved and water remains in the pit and conduit system / section, the appropriate cable type must be used as per MRTS256 *Power Cables*. The conduits are not to be lower than the pit it connects to unless approved by the Principal.

Conduits installed by 'boring and/or jacking' conduit to be installed to facilitate correct drainage of conduit. Refer to MRTS140 *Horizontal Directional Drilling (HDD)* and Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit* for further details.

Before conduits are encased in concrete within a structure or barrier, they shall be thoroughly inspected to ensure compliance with the following requirements: **Witness Point 3**

Correct Alignment:

- Verify that the conduits are installed in the correct alignment as per the project design and specifications.

Adequate Clearances:

- Ensure there is sufficient clearance between conduits and reinforcement bars to allow for proper placement.

Proper Support and Protection:

- Confirm that the conduits are securely supported to prevent movement during the pouring and curing of concrete. Ensure adequate tie wire or cross bars are installed.
- Check that the conduits are properly protected from potential damage during construction, including from impact or exposure to harsh elements.

Expansion Joint Protection:

- Ensure expansion joint conduits are sealed to prevent concrete ingress.

Conduit Condition and Compliance:

- Inspect the conduits for correct size, type, colour, and spacing, ensuring they are free from damage or discolouration.
- Verify that PVC priming fluid and solvent cement are installed as per design requirements.
- Verify petroleum jelly is applied at expansion joints, as per design requirements.

After installation and backfilling, the conduit and conduit fittings shall be proved by drawing a mandrel having a diameter of at least 95% of the internal diameter of the conduit. The mandrel shall have a length sufficient to allow it to pass around any bends in the conduit, but not shorter than 95% of the diameter of the conduit being tested. **Hold Point 6**

Superseded

HOLD POINT 6	
Process Held:	Acceptance of the installed and tested conduits.
Submission Details:	Verification that the conduit is installed in a manner that it has no blockages, will drain and is not lower than the pits to which they are connected. Mandreling of conduit following backfill of trench to the full depth.
Release of Hold Point:	The Principal will carry out inspection and auditing of conduit installation and mandrel testing. The Contractor shall repair and re-test the conduit should the mandrel not pass unhindered through the conduit.

The Contractor shall repair and re-test the conduit should the mandrel not pass unhindered through the conduit. **Milestone**

9.2 Location

Conduits shall be installed in the locations shown on the Standard Drawings or described elsewhere in the Contract.

Generally, the locations of conduits shown on the Standard Drawings are indicative only and conduit runs shall be pegged out so as to best suit the conditions on the Site at the time of construction whilst maintaining the integrity and intent of the cabling design.

9.3 Conduit bores

After installation, all conduits shall be free from foreign matter and from rough edges and projections which could damage the cable during installation.

The diameter of the bore shall be unaltered at bends and fittings.

9.4 Road crossings

Unless stated elsewhere in the contract, road crossings shall consist of at least two 100 mm electrical conduits and two 100 mm communications conduits.

Horizontal drilling shall comply with MRTS140 *Horizontal Directional Drilling (HDD)*.

At intersections, the minimum road crossing shall be two 100 mm electrical conduits and one 100 mm communications conduit. However, if the intersection forms part of the backbone, the minimum shall be two 100 mm electrical conduits and two 100 mm communications conduits, and minimum one 100 mm electrical conduit and one 100 mm communications conduit to field equipment or as the Contract requires.

9.5 Conduits in barrier

Conduits in barrier shall be minimum one 100 mm (internal diameter) electrical conduit and one 100 mm (internal diameter) communications conduit.

Superseded

Conduits at barrier voids shall be minimum 10 mm above the FSL of the barrier void, and 100 mm above the finished level of the pavement as per Standard Drawing 1469 *Single Slope Concrete Barrier – Fabrication and Installation Details of Cover Plates at Road Lighting Poles in Concrete Barriers*, regardless of whether the barrier contains road lighting.

Road crossing conduits entering a barrier void may enter through the base of the barrier void. Barrier voids with road lighting poles shall take into account the space provisions for the road lighting footing and the conduits and size the width of the barrier void accordingly. Conduits entering the barrier void shall finish minimum 50 mm above the FSL of the barrier void. Barrier voids shall be free draining to the carriageway.

Road crossing conduits into barrier shall be minimum one 100 mm (internal diameter) electrical conduit and one 100 mm (internal diameter) communications conduit.

For conduit installation in bridge barriers, refer Standard Drawing 1707 *Road Lighting – Base Plate Mounted Pole Mounted on Bridges Wiring Details*.

Cover plates which are installed in a barrier shall be labelled, similar to an electrical pit cover, to prevent non-electrical personnel from unwittingly accessing an electrical enclosure without an appropriate process in place.

9.6 Changes in levels or direction of conduit

Where the level or direction of conduit conflicts with that of other facilities, the level or direction of the conduit may be locally altered, provided that the completed installation complies in all respects with the requirements of this Technical Specification and that the performance of the conduit will not be compromised. In all cases the stated minimum cover shall be maintained.

9.7 Bends

9.7.1 Use of bends

The use of bends shall be kept to an absolute minimum consistent with the details shown on the Standard Drawings.

Additionally, local changes in level or direction of conduits between pits to avoid conflicts with other features may be accomplished by the use of bends.

9.7.2 Bends for road crossing conduits

The general requirements for road crossing conduits are shown in Figure A of Appendix A to this Technical Specification.

Changes in level or direction for road crossing conduits may be accomplished by the use of standard preformed bends as shown in Table 9.7.2.

Table 9.7.2 – Radius of curvature and bend angles for road crossing conduits

Conduit diameter (mm)	Minimum radius of curvature (mm)	Maximum angle of bend (degrees)
100	600	90
80	600	90
50	300	90
20	150	90

Superseded

No more than 180 degrees of total change in direction shall be installed between pits or barrier voids / junction boxes.

Conduit bends for road crossings to be cast in structures or concrete barriers shall comply with Table 9.7.3.

9.7.3 Bends for backbone conduits

The general requirements for backbone conduits are shown in Figure A of Appendix A to this Technical Specification. Changes in level or direction for backbone conduits may be accomplished by the use of a standard preformed bend as shown in Table 9.7.3.

Table 9.7.3 – Radius of curvature and bend angles for backbone conduits

Conduit diameter (mm)	Minimum radius of curvature (mm)	Maximum angle of bend (degrees)
100	750	22.5
80	600	22.5
50	450	22.5

No more than 90 degrees of total change in direction shall be installed between pits or junction boxes. A maximum of 2 bends shall be installed in any 4 metres distance of conduit run.

Conduits may be cold bent to an offset of no more than 250 mm in any 4 m length. However, any cold bend shall have a radius no less than 10 m.

9.8 Bedding of conduit

Conduit shall be installed within bedding sand in accordance with the requirements of Clause 7.9 and as shown on Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*.

9.9 Conduit at pits

Conduit entering and exiting a pit shall conform to the locations and dimensions shown on Standard Drawing 1415 *Traffic Signals/Road Lighting – Circular Cable Jointing Pit Types 60 and 100* and Standard Drawing 1630 *Traffic Signals/Road Lighting – Conduit Entry Details into Circular Pits*. Conduits shall protrude into pits at least 50 mm ± 10 mm and not more than 100 mm ± 10 mm.

Where practicable, conduits shall enter and exit a pit at the same height and orientation.

Sealing around conduits where they enter the pit is to be undertaken on the inside and outside of the pit.

With the exception of road crossing conduits or as otherwise shown on the Standard Drawings, conduits shall not enter through the base of the pit.

9.10 Shared trenches and adjacent conduits

Adjacent sections of conduit may be placed in one trench provided that the minimum clearance between conduits, shown on Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*, is maintained.

Conduit for communications cabling and conduit for electrical cabling may be installed in the same trench, provided that the requirements of AS/CA S009 are satisfied.

Superseded

Where conduit for communications cabling and conduit for electrical cabling are installed in the same trench, one type of conduit shall be installed exclusively on one side of the trench and the remaining type of conduit shall be installed exclusively on the other side of the trench.

9.11 Marking tape

Marker tape shall be laid at approximately 50% of the depth of the conduit and conduit bends and above any mechanical protection provided.

Marker tapes shall be installed in accordance with Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit* and AS/CA S009 where applicable.

Marking tape is not required if conduit has been installed by boring and/or jacking.

9.12 Jointing

9.12.1 General

All joints between adjacent lengths of conduit and between conduit and conduit bends shall be made such that ingress of sand and soil is prevented.

Conduits manufactured from dissimilar materials shall be joined in accordance with Clause 7.2.5.

9.12.2 Non-metallic conduit

Non-metallic conduit and conduit bends shall be joined using PVC priming fluid and solvent cement. Refer to Clause 9.1.

9.12.3 Metallic conduit

Metallic conduit and conduit bends shall be joined using threaded couplings. The minimum length of thread on the end of a conduit or conduit bend shall be 25 mm.

9.12.4 Flexible conduit

Flexible conduit shall be joined using proprietary fittings.

9.13 Draw rope

A draw rope shall be installed in each conduit run and shall extend a minimum of 500 mm above the top of pit collar. Rope ends shall be firmly secured to prevent the ends being lost in a conduit. The length of the rope is taken after whatever treatment used to stop fraying.

Where a conduit does not terminate at a pit, the draw rope shall be tied to a timber (or other appropriate material) peg with approximate cross section 100 mm x 100 mm and not less than 400 mm long, driven firmly into the ground with the top 50 mm projecting above the finished surface. The top of the peg shall be painted yellow.

Any joints made in the draw rope shall be capable of resisting the same tensile load as the draw rope without such a joint. The joint shall not appreciably increase the diameter of the rope. **Witness Point 4**

Superseded

9.14 Conduit plugs / bungs

A blank plug or a duct plug approved by the Principal shall be installed as soon as practicable after installation and on all unused or partially used conduits to prevent extraneous material entering the conduit. Plugs and bungs shall be fixed with easily removed adhesive such as silicon beading to prevent inadvertent removal. A small hole can be drilled in the plug to pass the rope through prior to gluing it with the silicon beading.

9.15 Surface mounted conduits

Fixing brackets and/or anchors shall be installed as shown on the Standard Drawings, or as stated in Clause 3 of Annexure MRTS91.1, or where not so shown or stated, in accordance with the manufacturer's recommendations.

Prior to drilling into existing concrete structures, reinforcement and built-in items shall be located by suitable non-destructive means so that such items are not to be damaged during installation. Concrete members incorporating tensioned steel stand shall not be drilled.

Conduit shall be installed in straight lines, or to follow a kerb line on a curved structure, as shown on the Standard Drawings. Conduit and fixings shall be installed so as to avoid protruding objects which might damage clothing or a human body.

9.16 Flexible conduit in concrete

Flexible conduit shall not be used in poured concrete.

10 Installation of pits

10.1 General

The installation of pits shall conform to the requirements of Standard Drawing 1314 *Traffic Signals/Road Lighting – Cable Jointing Pit Drainage Details*, Standard Drawing 1415 *Traffic Signals/Road Lighting – Circular Cable Jointing Pit Types 60 and 100* and Standard Drawing 1630 *Traffic Signals/Road Lighting – Conduit Entry Details into Circular Pits* and Figure A of Appendix A of this Technical Specification.

Prior to the issue of Certificate of Practical Completion, all pits shall be cleared of debris to the satisfaction of the Administrator and pit lids fitted securely.

10.2 Placement of pits

Relaxing of restriction on installation of pits if local area being obstructed with other services.

Pits shall be installed in the locations shown on the Standard Drawings or described elsewhere in the Contract. As described in Clause 8.1, the locations of pits shown on the Standard Drawings are indicative only and pits shall set out so as to best suit the conditions on the site at the time of construction whilst maintaining the integrity and intent of the cabling design.

Additional pits shall be provided as necessary to limit the number of bends as stated in Clause 9.7 Wherever practical, pits shall be installed adjacent to field equipment and generally spaced no more than 120 m apart.

Superseded

If at all possible, pits shall not be installed in roadways, driveways, drain inverts, bikeways, ramps, pedestrian alignments, wheel-chair access pathways or ramps.

Pits can be installed behind physical protection such as fences, guard rails, crash barriers. However, pits should be installed outside of the working width (refer to *Road Planning and Design Manual 2nd Edition,* Volume 3, Part 6, Clause 6.3.17) and deflection zone (refer *Road Planning and Design Manual 2nd Edition,* Volume 3, Part 6, Clause 6.3.15) behind the barrier.

10.3 Numbering of pits

Where so stated in Clause 5 of Annexure MRTS91.1, pits shall be numbered using the numbering system and the method of numbering described in that clause.

10.4 Bedding of pit

The bottom of an excavation for a pit shall be compacted to at least 95% relative compaction in accordance with the requirements of MRTS04 *General Earthworks*. **Witness Point 5**

Pits shall be bedded as per Standard Drawing 1314 *Traffic Signals/Road Lighting – Cable Jointing Pit – Drainage Details* and in accordance with the requirements of Clause 19.2.4 of MRTS04 *General Earthworks*.

10.5 Circular pit collars, risers and surrounds

The level of pit protection required is to be determined by the site conditions as shown in Table 10.5.

Table 10.5 – Site condition requirements for collar surround combinations

	Plastic Collar	**Cast Iron Collar**
No Surround	Not allowable	Not allowable
Precast Concrete Surround	Not allowable unless written approval is provided by the Principal	Only allowable where site conditions are good with high resistance to erosion and low exposure to maintenance vehicles.
Cast Insitu Concrete Surround	Not allowable unless written approval is provided by the Principal	Not allowable where site conditions are poor, with low resistance to erosion and/or high exposure to maintenance vehicles.
Pit Cast into Concrete Slab*	Not allowable unless written approval is provided by the Principal	Allowable in all site conditions

(*) The minimum requirements for concrete slabs for pits are as follows:

- Thickness (150 mm)
- Concrete grade (N25), and
- 300 mm minimum from edge of pit to slab edge.

The use of precast concrete surrounds as per Standard Drawing 1685 *Traffic Signals/Road Lighting/ITS – Precast Concrete Surround for Circular Pit* must be approved in writing by the Principal.

Pit collars shall be placed on circular pits prior to compaction of the backfill material to prevent deformation of the top of the pit.

Superseded

The use of circular pit collar is subject to the following conditions:

- Pit collars shall be placed on pits prior to compaction of the backfill material to prevent deformation of the top of the pit.
- The pit collar should not support the concrete surround. The pit backfill and surrounding earth should be compacted and also support the surround.
- All 12 bolts are installed as per Standard Drawing 1415 *Traffic Signals/Road Lighting – Circular Cable Jointing Pit Types 60 and 100*, and
- The top edge of the collar is flush with the top of a concrete surround or a concrete slab.

No plastic circular pit collar shall be installed on a pit:

1. in any sloping ground with a batter steeper than 1:20
2. in any grassed ground
3. in any ground subject to erosion
4. in association with a road lighting installation except as a collar for a circular pit in Standard Drawing 1627 *Road Lighting – Switchboard Top Mounted (Sheet 1 of 2 and Sheet 2 of 2)*, or
5. in any areas subject to vehicular traffic, for example, grass slashers or tractors.

The use of plastic pit risers to extend the pit must be approved in writing by the Principal.

10.6 Split pit

A split pit is a remediation pit for installing a new pit over existing services, refer to Standard Drawing 1695 *Traffic Signals/Road Lighting/ITS – Circular Split Pit.*

A split pit can be used for replacing an old or damaged pit. The pit is built around existing conduit so that cables are not required to be cut and connected back together saving time and cost of installation.

The sand band (or rubber band) is a rubber band that is used to hold the pit together, while the split pit is being assembled. The split pit has a thicker wall and has a plastic collar bolted on the base which gives the pit its strength.

10.7 Finished surface level

Pits shall be installed such that the top surface of the pit coincides with the plane of the finished surface level. Natural compaction of soil surrounding the pit shall be considered during installation in order to avoid pits sitting proud of the surface shortly after installation.

10.8 Entry of conduit

Conduits shall enter the pits no lower than 1200 mm depth, preferably at the minimum depth of cover as specified in the standard, except in the case of bored conduits for road crossings referring to MRTS140 *Horizontal Directional Drilling (HDD)* and Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit* for further details. Holes to allow conduit entry to the pit shall be made using a hole saw of the same diameter as the external diameter of the conduit. Conduit entries shall be in accordance with the requirements of the design drawings or Standard Drawing 1415 *Traffic Signals/Road Lighting – Circular Cable Jointing Pit Types 60 and 100* and Standard Drawing 1630 *Traffic Signals/Road Lighting – Conduit Entry Details into Circular Pits*.

Superseded

With the conduit in place, the joint between the conduit and the pit or other cavity, such as the concrete median barrier as shown on Standard Drawing 1395 *Road Lighting – Base Plate Mounted Pole within Concrete Barrier – Footing Details and Installation of Pole* and Standard Drawing 1469 *Single Slope Concrete Barrier – Fabrication and Installation Details of Cover Plates at Road Lighting Poles in Concrete Barriers*, shall be sealed such that ingress of sand and soil is prevented.

10.9 Vermin proofing of conduits

Vermin proofing of conduits shall be provided in the following locations:

- Conduits within barrier void
- Conduits between a pit and a barrier void (both ends)
- Conduits between a barrier void and an ITS Cabinet or Electrical Switchboard, and
- Conduits between a pit and an ITS Cabinet or Electrical Switchboard.

Where conduits enter an Electrical Switchboard, the conduit shall be sealed only in the pit. Vermin proofing at the switchboard shall be incorporated into the switchboard design. Where conduits require sealing:

- Conduits without installed cables shall be blanked with a blank plug approved by the Principal
- Conduits containing cables shall be sealed with a duct plug approved by the Principal, and
- Unused ports in the plug shall be blanked using the appropriate hole plug.

Any alternative proposed conduit sealing system shall be fit for purpose, and a proprietary system, and shall be submitted to the Administrator for consideration and approval prior to commencement of the installation of any cabling. **Hold Point 7**

HOLD POINT 7	
Process Held:	Vermin proofing of conduits with an unspecified sealing system.
Submission Details:	The alternative proposed vermin proofing system. Unless approved, vermin proofing of conduits shall be carried out as per Clause 10.9.
Release of Hold Point:	Any proposed alternative vermin proofing system shall be fit for purpose, and a proprietary system, and shall be submitted to the Administrator for consideration and approval prior to commencement of the installation of any cabling.

Vermin proofing of longitudinal underground conduits is not required unless otherwise specified.

10.10 Installation of pit over existing conduit

The installation of a pit over existing conduits is subject to special considerations and shall be carried out as described in the Construction Procedure provided in compliance with Clause 5.2.

Superseded

10.11 Drainage

All pits shall be provided with drainage holes in the bottom of the pit.

Where installed on a slope, the pit shall be installed such that the drain hole in the bottom of the pit is installed at the lowest point, on the downside of the slope.

The lowest pit in each conduit system shall be drained as shown on the Standard Drawings or, where not so shown, as Type A or Type B on Standard Drawing 1314 *Traffic Signals/Road Lighting – Cable Jointing Pit Drainage Details*.

All conduits and pits shall be drained with the lowest pit in each conduit system / section (determined by the lowest point with a given elevation) requiring drainage in accordance with Standard Drawings. Drainage shall typically follow Type A or Type B guidelines on Standard Drawing 1314 *Traffic Signals/Road Lighting – Cable Jointing Pit Drainage Details*, unless otherwise specified. If adequate drainage cannot be achieved, and water remains within the pit and conduit system, the appropriate cable type must be selected in accordance with MRTS256 *Power Cables*.

Conduit system / section and finished surface levels shall be installed to drain and direct water away from field equipment. Conduit system / section shall also be installed to drain from pits immediately linking to field equipment.

The lowest open end of conduits installed in poles and other field equipment enclosures shall be at least 50 mm higher than the surrounding finished surface level. **Witness Point 6**

10.12 Pits installed on batter slopes

Pits shall not be installed on slopes greater than 1 vertical to 3 horizontal except where specifically designed for the purposes as shown on the Standard Drawings.

Where pits are installed on batters with slopes greater than 1:3, the surface of the batter from the nearest access point (for example, the roadway or shoulder) shall be treated in a manner sufficient to prevent any loose material interfering with the functioning of the pit.

10.13 Installation of pits for busways

New pits installed for busways shall be circular (600, 1000). Any other type of pits shall be pre-approved by the Principal prior to installation.

10.14 Maintenance marker posts

Maintenance marker posts are required for pits installed in unsealed areas where mowing and slashing activities have the potential to damage transport infrastructure, except for pedestrian areas, and/or unless specified otherwise on the design drawings and/or in Clause 6 of Annexure MRTS91.1.

Maintenance marker post shall be installed as shown on the relevant Standard Drawings and as stated in Clause 6 of Annexure MRTS91.1. In accordance with Clause 7.10, maintenance marker posts shall be installed to assist in the locating of pits wherever they may be subject to heavy vehicles or machinery (that is, slashers).

The maintenance marker post shall be installed on the opposite side of the pit from a pole / post (if any).

Superseded

11 Conformance and As Constructed Survey

The conformance requirements associated with the installation of new or relocated conduits are to be carried out by a Surveyor to ensure the following:

a) Construction tolerances have been met for a 3 dimensional (3D) Geometric design.

b) For conduits shown on Standard Drawings that use 2 dimensional (2D) Schematic designs of abstract linework that are indicative only, they must:

i. be contained within the allocated corridor and constructed at the minimum depth below design surface height, refer to 'Conformance' in Figure 11(a)

ii. be constructed at minimum depth below design subgrade height, refer to 'Conformance' in Figure 11(b), and

iii. not clash with future construction of geometrically design assets such as gravity drainage, refer to 'Conformance' in Figure 11(c).

Figure 11(a)

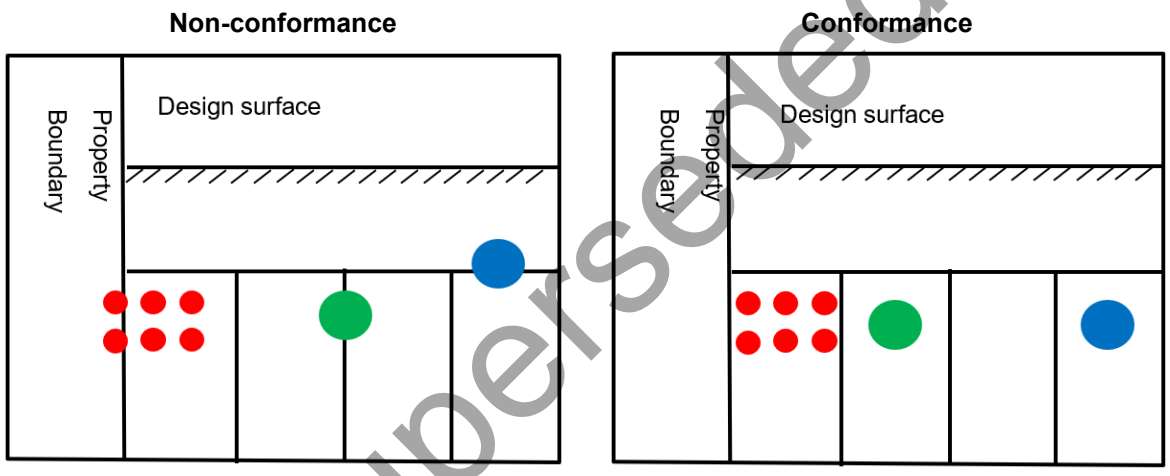
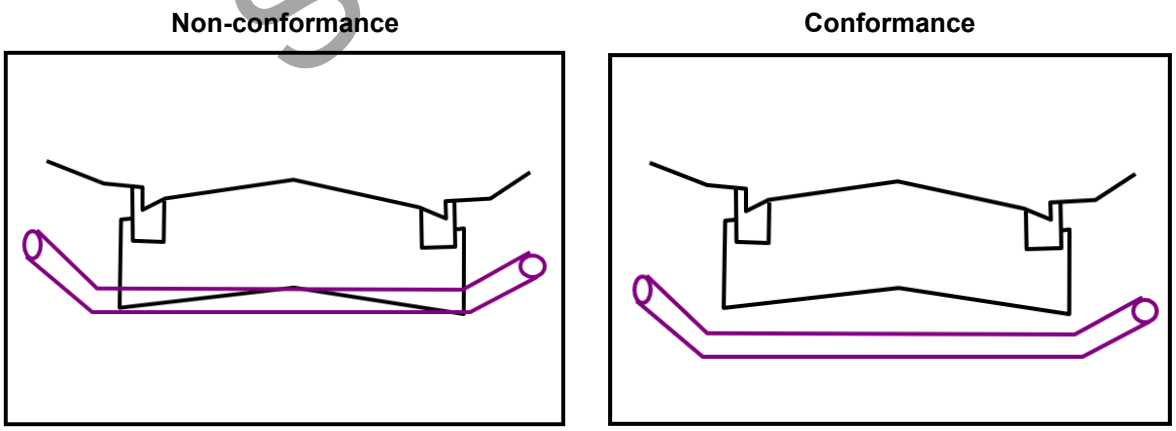


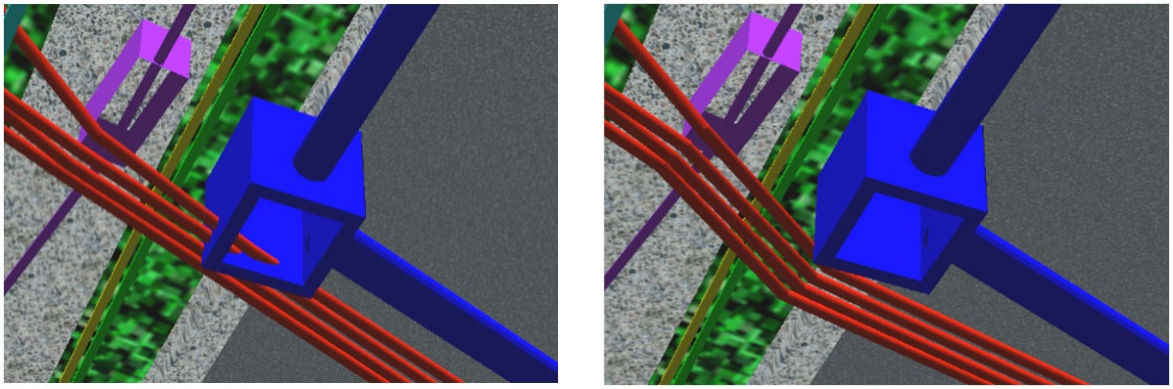
Figure 11(b)



Superseded

Figure 11(c)

Non-conformance **Conformance**



The As Constructed survey requirements associated with the installation of new or relocated conduits and pits are to be fulfilled as prescribed under Clause 11.7 of MRTS56 *Construction Surveying.*

12 Existing Underground Asset

In the event where any existing underground assets that may be fully or partly exposed during construction works for conduits and pits, additional surveying information is required to be undertaken as prescribed under Clause 13 of MRTS56 *Construction Surveying.*

13 Backfilling

13.1 General

Backfilling shall be carried out in accordance with the requirements of Clause 19 of MRTS04 *General Earthworks*.

13.2 Conduits

Backfilling of trenches for conduits shall not commence until the conduit system / section has been inspected by the Administrator.

Backfilling shall not commence until all the conformance and As Constructed survey requirements have been met as specified in Clauses 11 and 12 and notice of such works provided to the Administrator. **Hold Point 8**

HOLD POINT 8	
Process Held:	Backfilling of trenches.
Submission Details:	Notification that the conduits are ready for backfilling.
Release of Hold Point:	Backfilling of trenches for conduits had been inspected, and all the conformance and As Constructed survey requirements have been met as specified in Clauses 11 and 12, and notice of such works provided to the Administrator, before the hold point can be released.

Superseded

Conduits shall be backfilled in accordance with the details shown on Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*.

13.3 Pits

Rectangular pits shall be backfilled with stabilised sand in accordance with the requirements stated in Clause 7.13 and the details shown on Standard Drawing 1314 *Traffic Signals/Road Lighting – Cable Jointing Pit Drainage Details*.

Circular pits shall be backfilled in the same manner as the adjacent conduits.

13.4 Precautions against damage or movement

During backfilling operations all necessary precautions shall be taken to protect the conduit and pits from any damage or movement. The initial layer of backfill shall be rammed carefully around the conduit so as to cause no distortion to the cross section of the conduit.

13.5 Roadways

Conduits in roadways shall be backfilled as detailed on Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*.

13.6 Footways

Conduits in footpaths shall be backfilled as detailed on Standard Drawing 1149 *Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit*.

14 Surface treatment

All pits must have a concrete surround installed as per Standard Drawing 1440 *Traffic Signals/Road Lighting – Cable Jointing Pit Rectangular Concrete Surround* or Standard Drawing 1685 *Traffic Signals/Road Lighting/ITS – Precast Concrete Surround for Circular Pit* unless installed in a surface equivalent to concrete. If the pits are to be installed in a median too narrow for a precast surround, they are to have a surround installed insitu.

The minimum dimension for precast or poured insitu concrete surround shall be as shown on Standard Drawing 1440 *Traffic Signals/Road Lighting – Cable Jointing Pit Rectangular Concrete Surround* for rectangular pits and on Standard Drawing 1685 *Traffic Signals/Road Lighting/ITS – Precast Concrete Surround for Circular Pit* for circular pits.

Concrete shall be in accordance with MRTS70 *Concrete*. Precast surrounds shall be manufactured in accordance with MRTS72 *Manufacture of Precast Concrete Elements*.

Pits shall be provided with a surface treatment that blends with the surrounding surface.

In all cases, the surface treatment shall provide a smooth, free draining finish that will not present a trip hazard. Wherever possible, the surface treatment shall be sloped to direct water away from the pit.

15 Unused conduits

Unused conduits are defined as newly installed or existing conduits located during the construction of the works or shown on the Standard Drawings which are not yet used or no longer used.

All unused conduits shall be capped and glued (with easily removed adhesive) with a blank plug approved by the Principal.

Superseded

16 Supplementary requirements

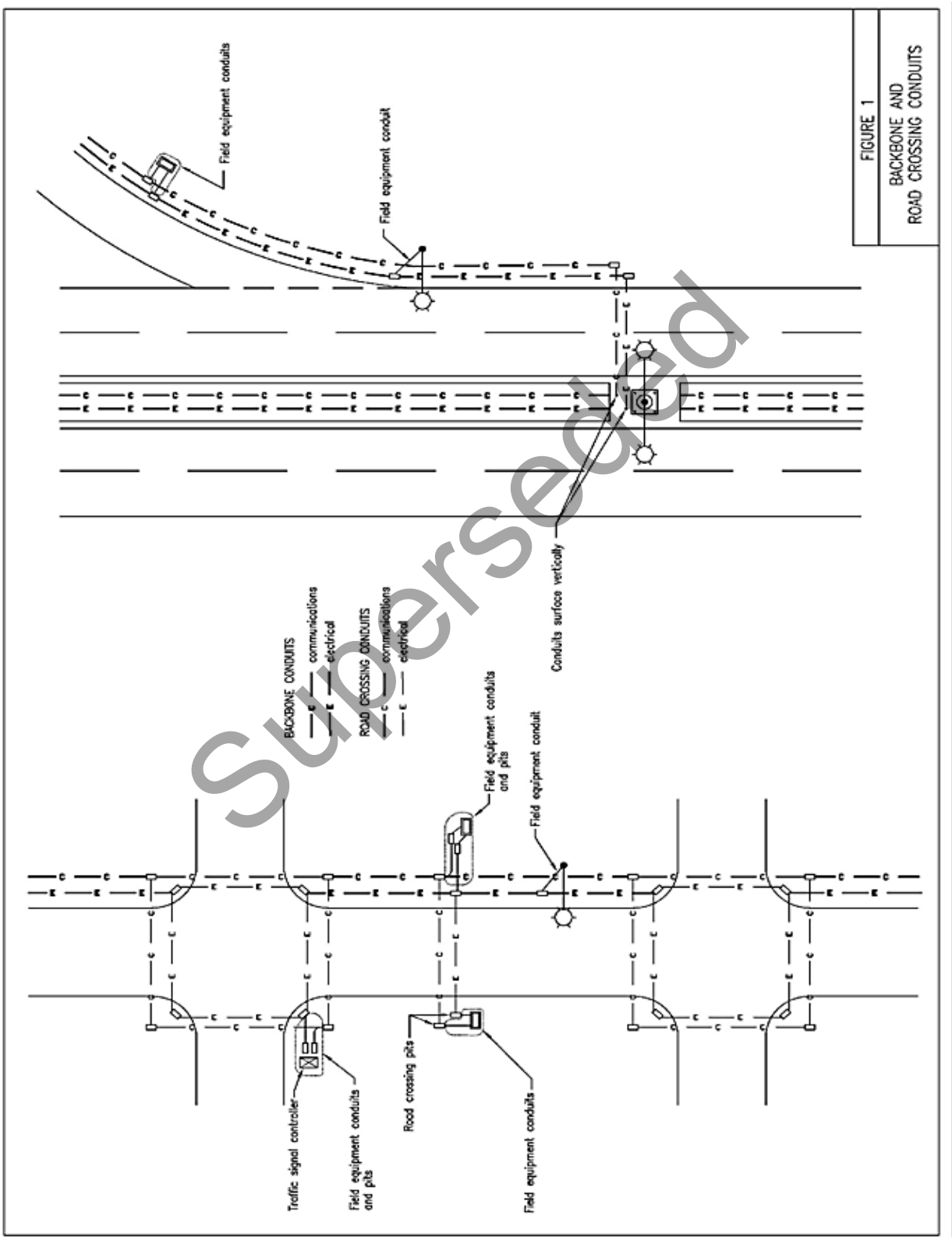
The requirements of this Technical Specification are varied by the supplementary requirements given in Clause 7 of Annexure MRTS91.1.

Superseded

Appendix A: Conduits and pit layout

For details of quantity of conduits in concrete barriers, refer to Part B of MRTS200 *General Requirements for Intelligent Transport Systems Infrastructure.*

Figure A – Backbone and road crossing conduits



Superseded

Superseded