

Superseded

Technical Specification

**Transport and Main Roads Specification
MRTS91 Conduits and Pits**

March 2021

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Superseded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. Reference to updated standard drawings to cover Type 100 Circular Pits in Table 3.1.
2. Additional requirements on plastic circular pit collars in Clause 10.5.
3. Changes in construction surveying requirements as requested by Hydraulics, Design & Spatial Branch, in Clause 11.

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.

2 Definition of terms

The terms used in this Technical Specification are as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Administrator	In the context of this Technical Specification, the Administrator (or representative) must have formal electrical qualifications
ACM	Asbestos-Containing Material
Communications Supervisor	A Registered Cabling Provider or a Licensed Electrical Contractor under the direct supervision of a Registered Cabling Provider
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 shall include bends, elbows, junction boxes, tees and fixings
Conduit bends	Prefabricated curved lengths of conduit designed to join two conduits
Elbow	A conduit bend of shorter combination of length and angle than defined in Clause 9.6 of this Technical Specification

Term	Definition
Electricity entity	As defined in the <i>Electrical Safety Act</i>
Electrical works	As defined in the <i>Electrical Safety Act</i>
Extra low voltage	Not exceeding 50 V a.c., or 120 V, ripple free d.c
FFL	Finished floor level
ITS	Intelligent Transport Systems
Licensed Electrical Contractor	Holder of an Electrical Contractor License under the <i>Electrical Safety Act</i>
Low voltage	Exceeding extra low voltage but not exceeding 1000 V a.c. or 1500 V d.c.
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
Registered Cabling Provider	A cabling provider registered in accordance with the <i>ACMA Telecommunications Cabling Provider Rules 2000</i>
Unregistered Cabling Provider	A person who is not a Registered Cabling Provider, but who is directly supervised by a Registered Cabling Provider
Wiring Rules	AS/NZS 3000 and / or AS/CA S009 as appropriate to the respective service

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AS 1074	<i>Steel tubes and tubulars for ordinary service</i>
AS 3996	<i>Access Covers and Grates</i>
AS 4586	<i>Slip resistance classification of new pedestrian surface materials</i>
AS/CA S008	<i>Requirements for Customer Cabling Products</i>
AS/CA S009	<i>Installation Requirements for Customer Cabling (Wiring Rules)</i>
AS/NZS 1477	<i>PVC pipes and fittings for pressure applications</i>
AS/NZS 1580.408.5	<i>Paints and related materials – Methods of test – Adhesion – Pull-off test</i>
AS/NZS 2053, Part 1	<i>Conduits and fittings for electrical installations – General Requirements</i>
AS/NZS 2053, Part 2	<i>Conduits and fittings for electrical installations – Rigid plain conduits and fittings of insulating material</i>
AS/NZS 2053, Part 4	<i>Conduits and fittings for electrical installations – Flexible plain conduits and fittings of insulating material</i>
AS/NZS 2053, Part 7	<i>Conduits and fittings for electrical installations – Rigid metal conduits and fittings</i>
AS/NZS 2053, Part 8	<i>Conduits and fittings for electrical installations – Flexible conduits and fittings of metal or composite material</i>
AS/NZS 2648, Part 1	<i>Underground marking tape – Non-detectable tape</i>
AS/NZS 3000	<i>Electrical installations (known as the Australian / New Zealand Wiring Rules)</i>

Reference	Title
AS/NZS 3879	<i>Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings</i>
AS/NZS 4680	<i>Hot-dip galvanized (zinc) coatings on fabricated ferrous articles</i>
AS/NZS 61386, Part 1	<i>Conduit systems for cable management – General Requirements</i>
Electrical Safety Act	<i>Electrical Safety Act 2002 and associated Regulations and Codes of Practice</i>
HB 197	<i>Standards Australia Handbook: An introductory guide to the slip resistance of pedestrian surface materials</i>
MRS91	<i>Conduits and Pits</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS04	<i>General Earthworks</i>
MRTS14	<i>Road Furniture</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS56	<i>Construction Surveying</i>
MRTS70	<i>Concrete</i>
MRTS72	<i>Manufacture of Precast Concrete Elements</i>
MRTS78	<i>Fabrication of Structural Steelwork</i>
MRTS96	<i>Management and Removal of Asbestos</i>
MRTS140	<i>Horizontal Directional Drilling (HDD)</i>
MRTS200	<i>General Requirements for Intelligent Transport Systems Infrastructure</i>
RPDM	<i>Road Planning and Design Manual</i>
TN63	<i>Assessment of Electrical Pit Requirements to MRTS91 and MRTS78</i>

3.1 Standard Drawings

Table 3.1 lists the Transport and Main Roads Standard Drawings referenced in this document.

Table 3.1 – Referenced Standard Drawings

Standard Drawing number	Title
1149	<i>Traffic Signals/Road Lighting/ITS – Installation of Underground Electrical and Communications Conduit</i>
1314	<i>Traffic Signals/Road Lighting – Cable Jointing Pit – Drainage Details</i>
1395	<i>Road Lighting – Base Plate Mounted Pole and Footing in Concrete Median Barrier Installation Details</i>
1415	<i>Traffic Signals/Road Lighting – Circular Cable Jointing Pit Types 60 and 100</i>
1416	<i>Traffic Signals/Road Lighting – Collar for Circular Cable Jointing Pit</i>
1417	<i>Traffic Signals/Road Lighting – Cable Jointing Pit Circular Pit Cover, Drawing 1 of 2 and Drawing 2 of 2</i>
1418	<i>Traffic Signals/Road Lighting – Junction Box Supporting Strap</i>

Standard Drawing number	Title
1440	<i>Traffic Signals/Road Lighting – Cable Jointing Pit – Rectangular Concrete Surround</i>
1469	<i>Single Slope Concrete Barrier – Fabrication and Installation for Cover Plates at Road Lighting Poles in Concrete Barriers</i>
1627	<i>Road Lighting – Switchboard Top Mounted, Sheet 1 of 1 and Sheet 2 of 2</i>
1630	<i>Traffic Signals/Road Lighting - Conduit entry details into circular pits</i>
1631	<i>Traffic Signals/Road Lighting - Cable jointing pit Type 1 (J), 3, 4, 7 and 8</i>
1632	<i>Traffic Signals/Road Lighting - Cable jointing pit cover Type 1 (J)</i>
1633	<i>Traffic Signals/Road Lighting - Cable jointing pit cover Types 3 and 4</i>
1634	<i>Traffic Signals/Road Lighting - Cable jointing pit cover Types 7 and 8</i>
1681	<i>Traffic Signals/Road Lighting - Riser for Circular Cable Jointing Pit</i>
1685	<i>Traffic Signals/Road Lighting/ITS – Precast Concrete Surround for Circular Pit</i>
1707	<i>Road Lighting – Base Plate Mounted Pole Mounted on Bridges Wiring Details</i>

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

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

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 (48 hours)
8.4		1. Bottom of trench	
8.7	5. Boring and / or jacking of conduits		
9.1	6. Installation of conduits		Installation of conduits
9.13		2. Draw rope installation	
10.4		3. Bedding of pits	
10.8	7. Vermin proofing of conduits		
10.10		4. Pit drainage	
13.1	8. Backfilling of trenches		

5.2 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 Engineering and Technology branch, Department of Transport and Main Roads.

5.3 Construction procedures

The electrical contractor is required to provide evidence of the adequacy of specific training 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, and
- n) inspection and test plans.

No construction 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 construction.

Release of Hold Point: The Administrator will consider the evidence and procedure submitted prior to approval.

6 Requirements for the installation of cables, conduits and pits

6.1 General

If asbestos is suspected or found in existing installation, work at this site must be stopped immediately, and 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.

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).
 - 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, where reasonable site access opportunities permit (that is, where construction 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 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 corporate asbestos register.
3. The placement of pits into ACM ducting sections is prohibited.
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 be removed from the site in accordance with MRTS96.
5. New cabling shall not be installed into ACM pits and ducting of which are not completely physically intact.

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

6.2 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*.

6.3 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*.

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.

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

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

For conduit sizes larger than what is specified in AS/NZS 2053, Part 2 (for example, exceeding 150mm), 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 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.

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 the 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™ conduits types are also excluded from trenched installations.

7.2.5 Heterogeneous conduit

Where two different types of conduit 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 shall not be installed underground or within a structure or barriers.

Elbows should 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 conduit

Unless protected by a metal cover, only metallic conduit 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.

7.3 Communications conduit

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 of at least 9 mm.

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 Engineering and Technology 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.
- 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 three 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.

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 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 five 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 side/end	50
3	2 per side/end	65
4	2 per side/end	85
7, 8	2 per side/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 two sections of cover shall be identical in dimension and form.

7.7.6.1 Locking and lifting

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 (e.g. 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.

Covers for circular pits shall 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 Drawing 1417.

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 1417 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 the 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 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.

7.9 Bedding sand

Bedding sand shall comply with the requirements of Clause 19.2.5 of MRTS04 *General Earthworks*.

7.10 Granular filter material

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

7.11 Lean mix concrete

Lean mix concrete for backfill shall comply with the requirements of Clause 19.2.11 of MRTS04 *General Earthworks*.

7.12 Backfill

Dry stabilised sand for backfill shall comply with the requirements of Clause 19.2.10 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.

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

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 Administrator at least 48 hours prior to the commencement of construction. **Milestone**

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

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 Administrator, at least 48 hours prior to the commencement of construction.
Release of Hold Point:	The Administrator may inspect the set out. Construction of pit and conduit installation shall not commence before the expiration of the period of notice, after the notice had been submitted.

8.2 Trench width

Trenches shall be excavated in accordance with the details shown on Standard Drawing 1149. 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 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 *Installation of Underground Electrical and Communications Conduit*.

Hold Point 5

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 <i>Horizontal Directional Drilling (HDD)</i> and Standard Drawing 1149 <i>Installation of Underground Electrical and Communications Conduit</i> .

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.

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

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. 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.

Conduits to be installed without dips/low points to ensure that drainage at pits operates as intended. The conduits are not to be lower than the pit it connects to unless approved by the Principal.

Road crossing installed by 'boring' conduit to be installed level to facilitate correct drainage of conduit.

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**

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 electrical conduit and one 100 mm communications conduit.

Conduits at barrier voids shall be minimum 10 mm above the FFL of the barrier void, and 100 mm above the finished level of the pavement as per Standard Drawing 1469, 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 FFL of the barrier void. Barrier voids shall be free draining to the carriageway.

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

For conduit installation in bridge barriers, refer Standard Drawing 1707.

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

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 two bends shall be installed in any four 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 bedded on bedding sand in accordance with the requirements of Clause 7.11 as shown on Standard Drawing 1149.

9.9 Conduit at pits

Conduit entering and exiting a pit shall conform to the locations and dimensions shown on Standard Drawings 1415 and 1630. 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, 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.

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 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 in accordance with Clause 7.5.

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 2**

9.14 Conduit plugs / bungs

PVC caps shall be installed as soon as practicable after installation, on all un-used 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 cap 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 strand 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 Drawings 1314, 1415 and 1630 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

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 be 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.

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*, Volume 3, Part 6, Clause 6.3.17) and deflection zone (refer *Road Planning and Design Manual*, 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 3**

Pits shall be bedded as per Standard Drawing 1314 and in accordance with the requirements of Clause 19.2.4 of MRTS04 *General Earthworks*.

10.5 Circular pit collars and surrounds

Additional requirements for circular pit collars.

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 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.

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.
- 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, or
5. in any areas subject to vehicular traffic, for example, grass slashers or tractors.

10.6 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.

10.7 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. 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 Drawings 1415 and 1630.

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 Drawings 1395 and 1469, shall be sealed such that ingress of sand and soil is prevented.

10.8 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 Ductplug Blank Plug or equivalent.
- Conduits containing cables shall be sealed with QuadPlex Ductplug or equivalent.

- Un-used 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 10.8.
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.

10.9 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.

10.10 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 down side 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.

Conduit systems and finished surface levels shall be installed to drain and direct water away from field equipment. Conduit systems 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 4**

10.11 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 (e.g. the roadway or shoulder) shall be treated in a manner sufficient to prevent any loose material interfering with the functioning of the pit.

10.12 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).

11 Conformance and As Constructed Survey

Changes in construction surveying requirements as requested by Hydraulics, Design & Spatial Branch.

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 three dimensional (3D) Geometric design.
- b) For conduits shown on Standard Drawings that use two 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)
 - iii. not clash with future construction of geometrically design assets such as gravity drainage, refer to 'Conformance' in Figure 11(c)

Figure 11(a)

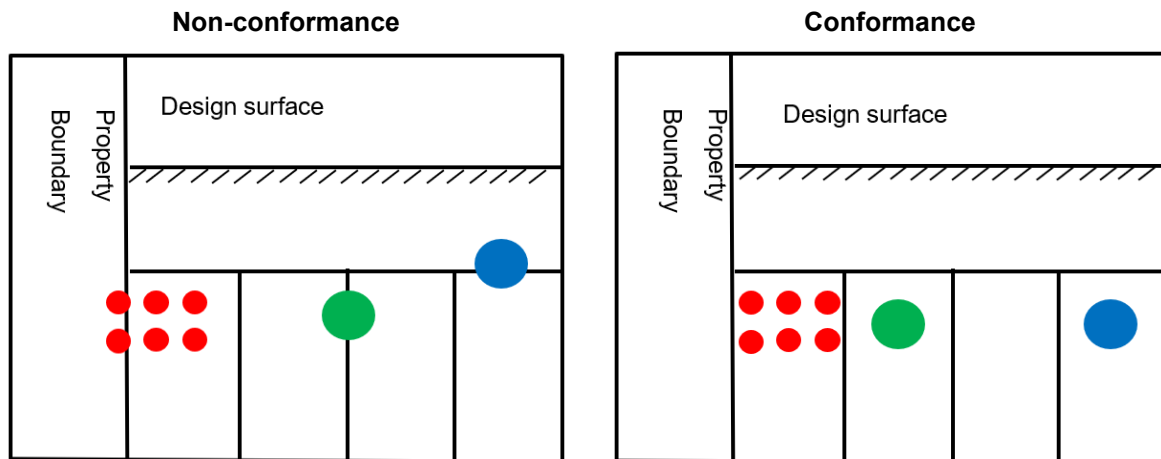


Figure 11(b)

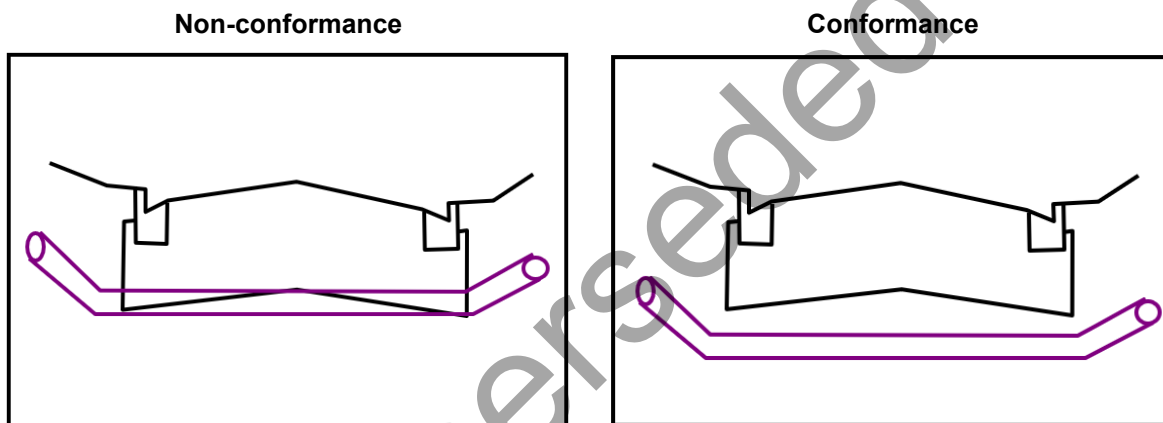
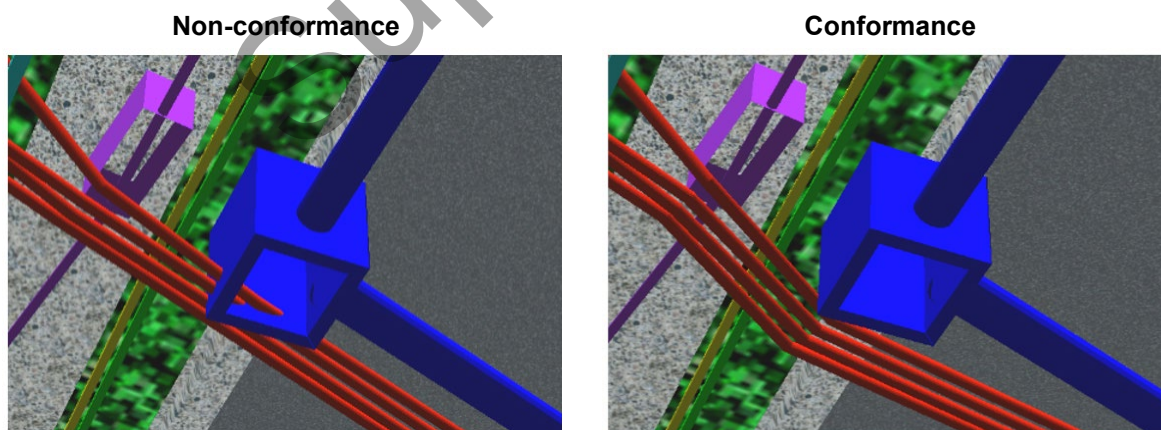


Figure 11(c)



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 *As Constructed Survey*, subclause 11.7 *Traffic Engineering Technology and Systems (TETS) – Conduits and Pits* in 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 *Existing Underground Assets Survey* in 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*.

Backfilling of trenches for conduits shall not commence until the conduit system 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 Clause 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 Clause 11 and 12, and notice of such works provided to the Administrator, before the hold point can be released.

Conduits shall be backfilled in accordance with the details shown on Standard Drawing 1149.

13.2 Pits

Rectangular pits shall be backfilled with stabilised sand in accordance with the requirements stated in Clause 7.14 and the details shown on Standard Drawing 1314.

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

13.3 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.

13.4 Roadways

Conduits in roadways shall be backfilled as detailed on Standard Drawing 1149.

13.5 Footways

Conduits in footpaths shall be backfilled as detailed on Standard Drawing 1149.

14 Surface treatment

All pits must have a concrete surround installed as per Standard Drawing 1440 or Standard Drawing 1685 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 in situ.

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 Un-used conduits

Un-used 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 un-used conduits shall be capped and glued (with easily removed adhesive) with a proprietary PVC conduit cap.

16 Supplementary requirements

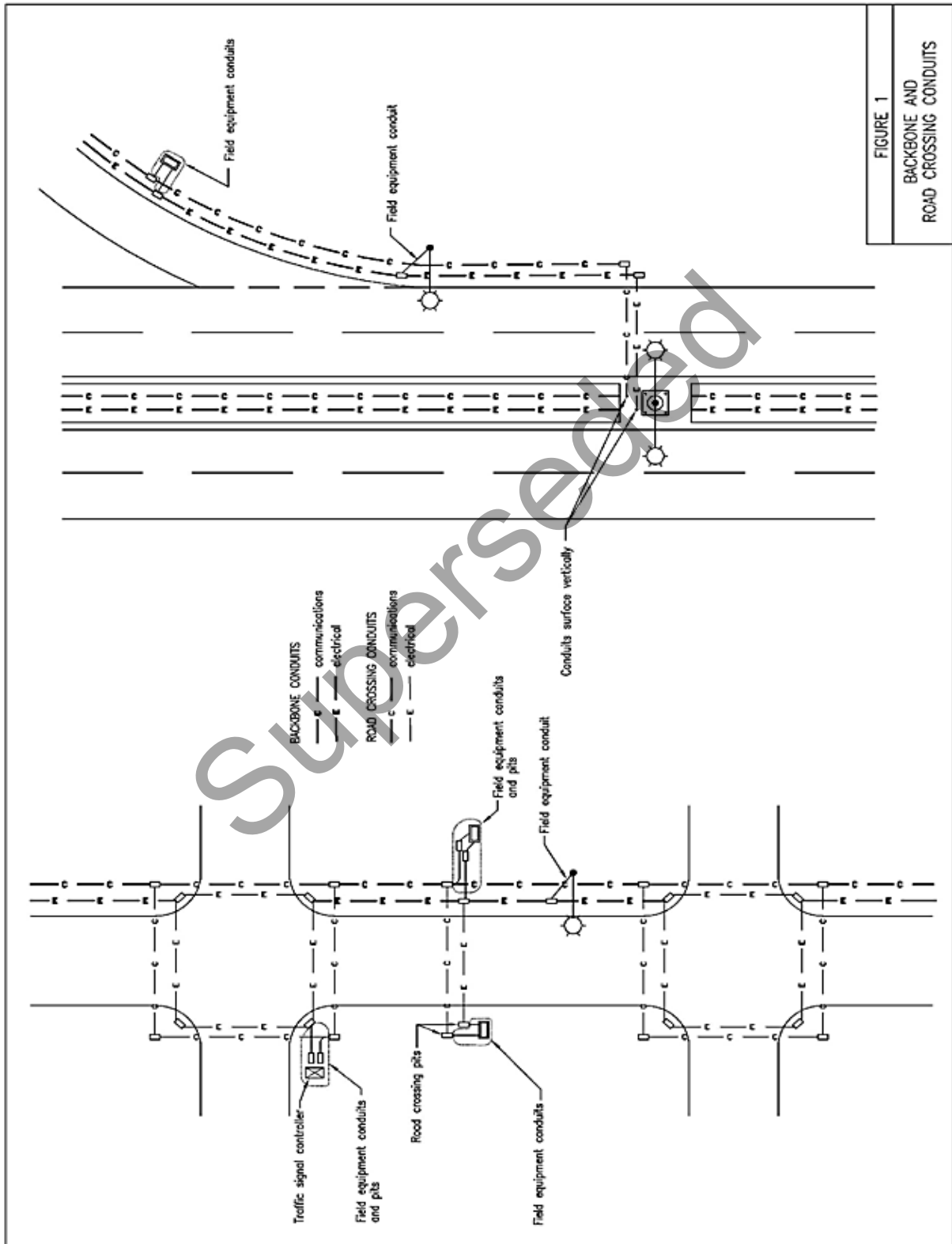
The requirements of MRTS91 *Conduits and Pits* are varied by the supplementary requirements given in Clause 7 of Annexure MRTS91.1.

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