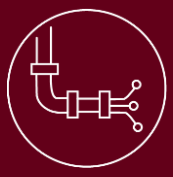
Cities and Active Transport



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Digital Infrastructure Requirements

Technical Guidance

This technical guide explains common terms, approaches and proposed treatments for embedding enabling digital infrastructure to support Smart Places design and the future needs of the place. It should be read in conjunction with the relevant standards and legislative requirements.

Digital infrastructure is fundamental to providing the capacity for flexible, future-focused digital connectivity to support smart, place-based solutions for the urban environment. It can be described as 'digital plumbing' because it is best planned for with other utilities, such as water and electricity, and deployed across cities and regions as part of construction wherever possible.

Digital plumbing includes the provision of high-capacity conduit and common access pits and may also include a network of multi-function poles (MFPs) and smart street furniture. It aims to provide a flexible, efficient, long-lasting and cost-effective digital connectivity environment to support Smart Places design (refer to Technical Guidance: Smart Places Design) and meet current and future communication and digital needs.

Changing connectivity requirements

The world we live in continues to change rapidly. As a result, our telecommunication environment is constantly expanding, and we need connectivity to more locations outside traditional telecommunication equipment sites, businesses and residential buildings.

The current approach to connecting sensors and devices involves a combination of direct **optical fibre** cable and wireless connections to neighbouring devices, creating a '**mesh**'. At a point in a mesh network, the concentrated services connect back to a wider network, either by fibre or cellular.

This technical guide recommends providing conduit from the network to all known street furniture and equipment locations (known as non-premise or facilities) that have a current or proposed power and/or telecommunication connection, such as:

- street and traffic lights
- environmental and city management sensors
- waste collection
- electricity control devices and smart meters
- water and sewerage equipment
- parking management solutions
- electric vehicle / device charging points
- wireless network access points

Optical fibre

Hair-like and transparent fibre that is used for the transmission of data signals over large distances with higher speed.

Internet of Things

A network of devices, such as air quality or bin sensors, and other technologies that connect and exchange data over the internet.

Mesh

A type of wireless network where each node (device) not only receives and transmits data, but also acts as a relay for other nodes. It allows for multiple paths for data to travel, making the network more resilient, and allowing for a larger number of devices to be connected to the network. Therefore, each device works together to distribute data throughout the network, rather than relying on a centralised router or access point.

- edge computing facilities
- traffic monitoring and communication.

The proposed treatments for enabling digital infrastructure outlined in this technical guidance should be treated separately in its ownership and operation and installed in addition to any 'fibre-ready' pit and conduit under the *Telecommunications Act 1997* by Statutory Infrastructure Providers.

'Fibre-ready' telecommunication infrastructure

The term 'fibre-ready' under the *Telecommunications Act 1997* refers to the provision of underground ducting or pit and conduit infrastructure, through which telecommunications lines can be fed to individual lots. This Act sets out the obligations on property developers to ensure developments have modern telecommunication infrastructure in place prior to selling or leasing a property.

The Communications Alliance guideline *G645:2017 Fibre-Ready Pit and Pipe Specification for Real Estate Development Projects* outlines the minimum requirements for a telecommunications pit and conduit installation within a real estate development project to be considered a fibre-ready facility.

Statutory Infrastructure Provider

The Statutory Infrastructure Provider (SIP) regime has been introduced so that all Australians can access modern broadband services. The SIP regime is set out under Part 19 of the *Telecommunications Act 1997* (Cth) and commenced on 1 July 2020.

SIPs are nominated carriers that must provide basic wholesale broadband services in specific service areas – only one for each service area. This includes voice services if operated as fixed-line or fixed-wireless networks.

NBN Co is the default SIP for most Australian premises. Other carriers can also be SIPs where they have installed telecommunication network infrastructure to connect premises such as in new real estate developments, shopping centres or apartments.

Passive infrastructure overview

The **pits** and **conduits** of various sizes where optical fibre cables can be installed is called passive infrastructure. It is a key part of the digital connectivity environment, which is explained in greater detail in Technical Guidance: Smart Places Design. Conduit is described using a hierarchy of types ranging from lead-in and facility conduit to express conduit. A pit is a wiring enclosure that provides space for placing and joining cables, pulling cables, performing an operation on cables, or including other equipment. Figure 1 shows the different types of conduit connecting facilities and buildings and pits as a part of passive infrastructure.

Pit

A wiring enclosure forms part of passive infrastructure and varies in size. P5 and P8 refers to the standard pit size commonly used in industry. P5 is a smaller size generally 600 x 70 x 450mm and P8 is a large sized pit approximately 1355 x 545 x 895mm, with some variation.

Conduit

Parts of a closed wiring system enclosing cables within an electrical or telecommunications installation; it allows cables to be drawn in or replaced.

Facility

Any non-premise location, typically with a power supply or measurement device, where a telecommunication service may be required.

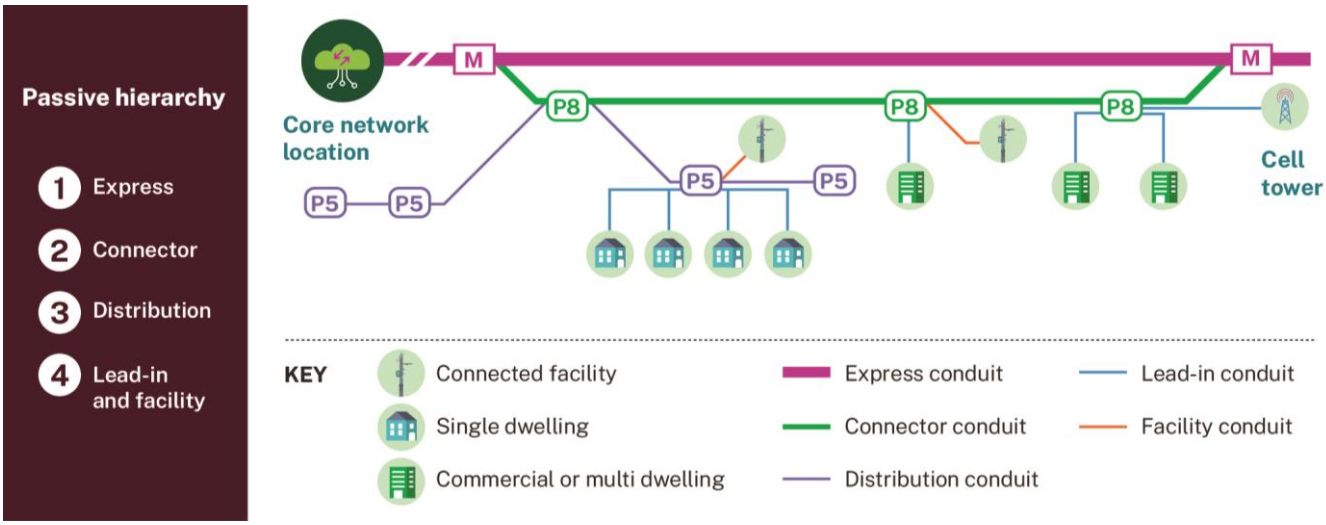


Figure 1 Passive infrastructure hierarchy example

Table 1 explains the different uses of conduit types. All conduits should be installed on the same alignment until a change is required to connect to a building or facility.

Table 1 Conduit types

Conduit type	Description
Express conduit	Provides the interconnection points to other network assets. This network can easily be expanded or interconnected without affecting the network's robustness.
Connector conduit	Higher capacity distribution network which provides distribution function within high density service locations and connects the express conduit to the distribution network.
Distribution conduit	The main conduit network that connects all locations and provides a continuous path from each service location to the boundary of each premise or non-premise.
Lead-in conduit	Connects the street network to each building. Extends from the nearest pit or manhole through to the network termination point within the building. For larger buildings, the network termination will be an equipment room.
Facility conduit	A term used in this document to identify conduit installed to provide connectivity to street furniture such as light poles, meters, electrical devices.

Dimensioning

Dimensioning is a term used to describe the size of the conduit, which houses the **optical fibre** or other utilities. The dimensions of conduit within a street network or a building's telecommunication infrastructure should be determined by the number of **premises**. This metric can usually be found in planning documentation and is the best indicator of overall telecommunication requirements.

With modern networks based on **fibre optic cable**, there is no longer a need to differentiate between business and residential premises, as a pair of fibres can service any required bandwidth. Business and residential networks now use the same optical fibre infrastructure and can receive different services.

The number of premises should include current and future requirements for the defined area and allowance made within the dimensioning rules for facilities (that is, non-premises) connections, such as Multi-function Poles (MFP) and connected street furniture.

Fibre optic cable

Also known as optical fibre, refers to a network cable which contains strands of glass fibres inside an insulated casing. It is designed for long-distance, high-performance data networking, and telecommunications.

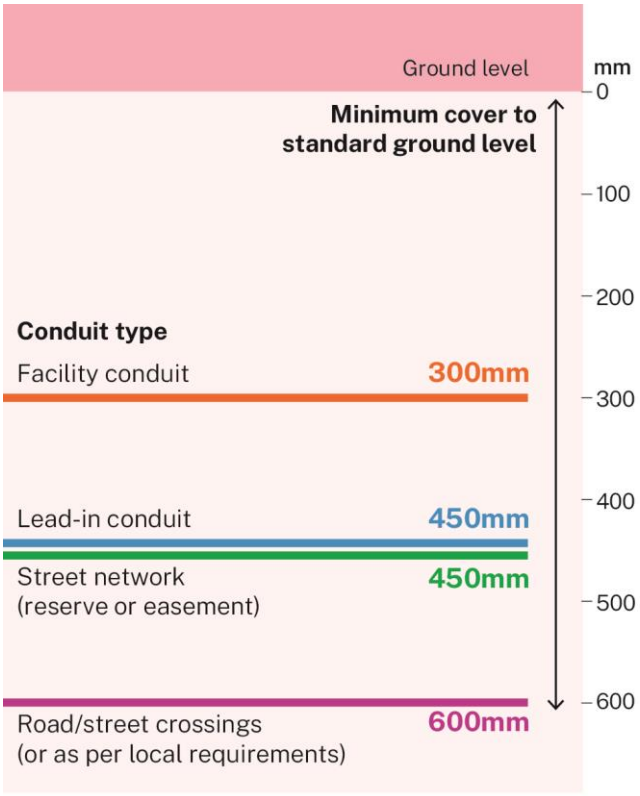
Premise

Any residential, business/office, or commercial/industrial unit.

The quantity for dimensioning of elements is the sum of all premises that will exist beyond a certain point, such as a building, a pit, or a floor in the building. Examples include the number of premises:

- within a building for dimensioning the equipment room
- to be connected beyond a nominated point in the network (such as a pit or conduit section)
- within a building to define the size of the lead-in conduit.

In Figure 2 below, the left-hand side shows the proposed minimum coverage from ground level for conduit installations. The street network may consist of express, connector and distribution conduits. The right-hand side shows the proposed minimum amount of separation that is be maintained from other services. This technical guidance should be read in conjunction with relevant standards and legislative requirements.



Service item	Requirement	Minimum radial clearances
Gas pipe	Over 110 mm	300 mm
	110 mm or less	100 mm
Power	High voltage	300 mm
	Low voltage	100 mm (where LV cable not in pipe)
Water mains	High pressure/ capacity	300 mm
	Local reticulation	150 mm
Sewer	Main	300 mm
	Connection pipe	150 mm
Hazardous services*	n/a	100 mm

Figure 2 Minimum coverage from ground level (left) Minimum separation amount (right)

Conduit and pit requirements

Conduit overview

Based on telecommunications standard requirements, this technical guidance proposes that installing conduit meet the following requirements:

- wholly white
- smooth internally with no burs
- finishing flush with the wall of pits
- made from PVC
- be standard industry sizes
- conduit is labelled according to the diameter of the pipe:
  - P20 has a diameter of 20 mm
  - P50 has a diameter of 50 mm
  - P100 has a diameter of 100 mm.

To allow for the hauling of fibre optical cables and change of direction, it is recommended that conduits use pre-formed conduit bends. To prevent damage to cables, the minimum radius for bends is to be used, as shown in Figure 3.

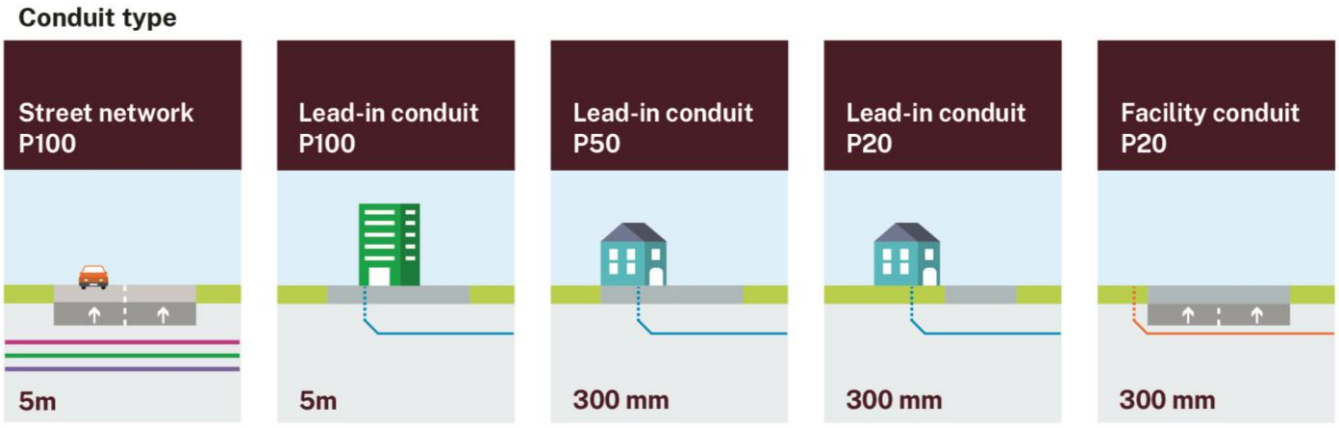


Figure 3 Minimum bend radius

Pit overview

The proposed treatment for pits is as follows:

- a minimum of 3 metres away from the corner of a property boundary on road or street intersections
- located such that drivers can park a vehicle on the same side of the road, 8 metres from a major pit
- on stable land not subject to any soil movement or expected erosion
- not located in an existing or proposed roadway, driveway or trafficable area
- not located on private property
- installed with the longest edge parallel to the property line.

In addition, telecommunication pit infrastructure should be:

- aligned within road reserves or existing easements
- designed so that all conduits and pipes enter pits or manholes from the short ends – side entry is not allowed.

The telecommunication passive network elements should be sized based on the number of premises that will be served beyond the current point in the network (see Dimensioning above). The Communications Alliance guideline *G645:2017 Fibre-Ready Pit and Pipe Specification for Real Estate Development Projects* provides more detail around pit sizes and the number of conduits that can service each pit.

To simplify network deployment, a limited number of standard conduit and pit sizes are proposed, as shown in Figure 4. The figure shows the typical elements of a street network and the reference point for measurement of premise number. It also illustrates where P100 street network conduits are required to service areas further along the route, with only one conduit connected through the minor pits.

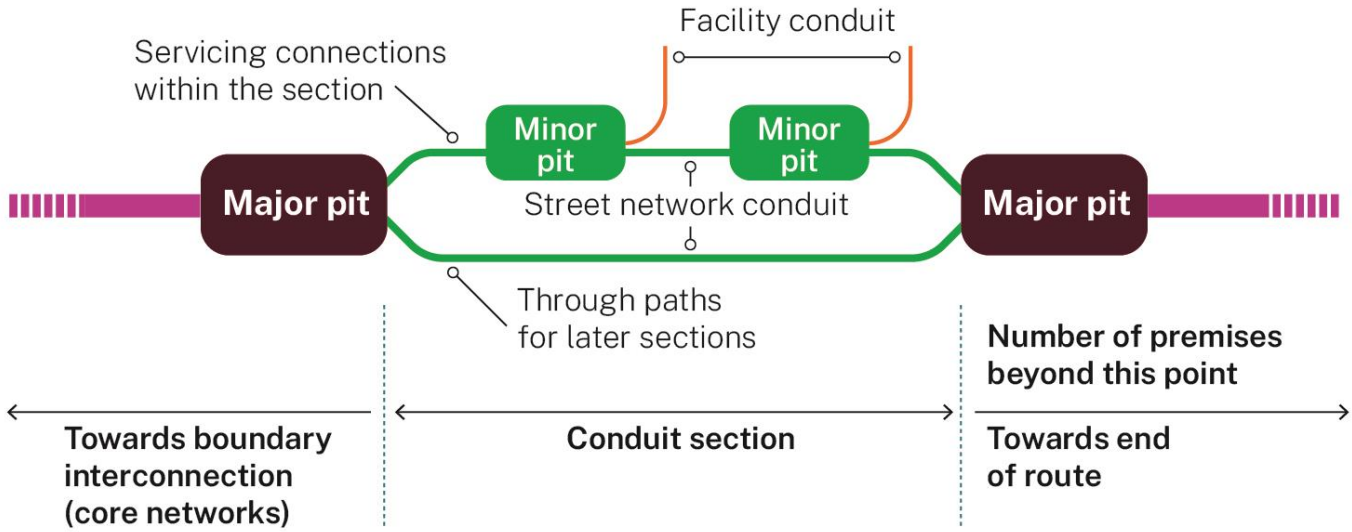


Figure 4 Pit overview example

Subduct

Subducting allows maximum protection for alternative carriers' cables during and after installation, and during recovery of cables. Therefore, each telecommunication carrier's cables should be housed in separate polyethylene (PE) subducts, except for building lead-in conduits.

The standard subduct is PE 32 (28 mm ID) to AS/NZS 4130:2009 'Polyethylene (PE) pipes for pressure applications'.

Number of subducts per conduit:

- P100 – 4
- P50 – 1
- P20 – nil.

Separation between carrier pits or manholes

There should be a minimum separation of 3 metres between each carrier's pits and manholes, as shown in Figure 5. Wherever possible, manholes and pits should be placed to allow multiple carriers to work in their respective underground plant at the same time. A minimum separation of 1 metre should be maintained between the adjacent walls of the manholes or pits.

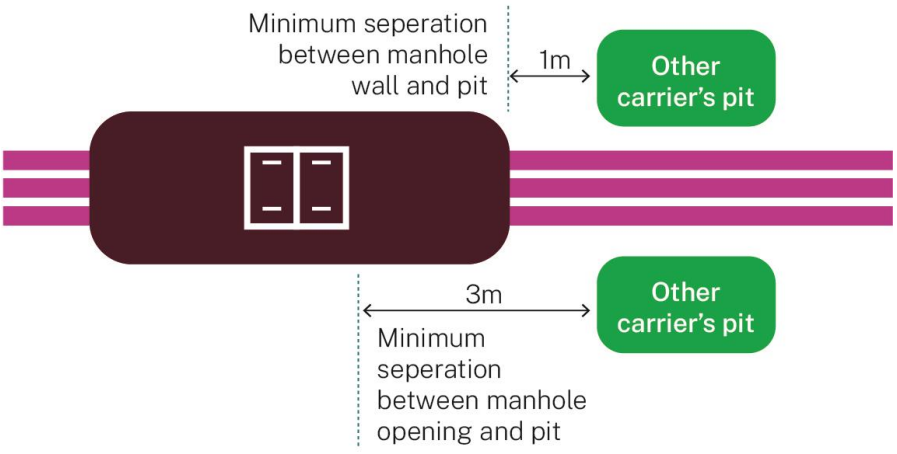


Figure 5 Example of pit separations

General proposed treatments

The general proposed treatments for the application of enabling digital infrastructure in greenfield and brownfield/infill developments are outlined below.

Greenfield

For areas where new roadways and service installations are still to be completed, the telecommunication conduit should be installed in a shared trench with the capacity defined in this technical guide.

Pits will typically be installed after the shared trench, but pit locations should be defined before work begins on the trench to ensure all current and future potential service locations can be connected.

Greenfield

An area with no existing infrastructure or buildings.

The following outlines the proposed treatments for telecommunication conduit in shared trench areas.

- **Express, connector and distribution conduit** wherever electrical distribution is being installed (the electrical design will define the routes). This includes where the route will be extending existing telecommunication infrastructure. These sections should allow for cables to be installed on alternate paths in the future as required.
- **Lead-in conduit** wherever electrical distribution is being provided to a building. If the site does not have a building, 'starter conduit' (conduit that leads out of the pit to the property boundary) approximately one metre in length should be installed and sealed.
- **Facility conduit** wherever electrical distribution is proposed to other locations such as street lights, traffic lights, water and sewerage, and transformers, a continuous conduit from the nearest pit to the new location should be installed.

Brownfield or infill

Telecommunication conduit in brownfield areas should comply with the general standards and capacity definitions, and is proposed to be installed as follows:

- **express and distribution conduit** when installed on the designated telecommunication infrastructure alignment
- **lead-in conduit:**
  - If the site does not have a building, starter conduit approximately one metre in length should be installed and sealed
  - If the site has a building, a lead-in conduit with bend that complies with general standards should be installed
- **facility conduit** should be installed as required by following the telecommunication infrastructure alignment until adjacent to street furniture and then using an appropriate bend to align with the base of the element.

Brownfield

An area with existing infrastructure and buildings.

Infill

Development of new dwellings on vacant or under-utilised land in existing built-up areas.

More technical guidance

Unlock the full potential of connected smart places with our SmartNSW Playbook and other Technical Guidance documents. Consult your organisation for the relevant industry standards that apply to your development.

Resources

- AS/CA S009 Installation requirements for customer cabling (Wiring Rules)
- AS/NZS IEC 60825.2 Safety of laser products - Safety of optical fibre communication systems (OFCS)
- AS/NZS IS0/IEC 14763.3 Telecommunications installations – Implementation and operation of customer premises cabling – Testing of optical fibre cabling
- AS/NZS 2053.1 Conduits and fittings for electrical installations – General requirements
- AS/NZS 24702 Telecommunications installations – Generic cabling – Industrial premises
- AS/NZS 3080 Information technology – Generic cabling for customer premises
- AS/NZS 3084 Telecommunications installations – Telecommunications pathways and spaces for commercial buildings
- AS/NZS 3085.1 Telecommunications installations – Administration of communications cabling systems – Basic requirements
- AS/NZS ISO/IEC 14763.2 Information Technology – Implementation and operation of customer premises cabling – Planning and installation
- SAA HB243 Communications cabling manual – Module 1: Australian regulatory arrangements
- SAA HB29 Communications cabling manual – Module 2: Communications cabling handbook
- TIA/EIA-568 Commercial Building Telecommunications Cabling Standard
- Deployment of nbn™ pit and conduit network guide
- Communications Alliance Industry Guideline G645:2017 Fibre-Ready Pit and Pipe Specification for Real Estate Development Projects Industry Guideline
- NBN Network Design Rules
- Interconnect Access to the Telstra Underground Network