Cities and Active Transport

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Deploying Multi-Function Poles

Technical Guidance

This technical guide outlines the proposed deployment of Multi-Function Poles (MFP) in public spaces to support place-based requirements and Smart Places design, while improving amenity and reducing street clutter. This technical guide should be read in conjunction with the relevant standards and legislative requirements.

Multi-Function Poles (MFPs), also known as 'smart poles', accommodate several functions and services on the same pole, which reduces the total number of poles needed on the street. As shown Figure 1, Multi-Function Poles can support services and devices including but not limited to lighting and 5G small cells, and have the ability to add other components, such as banners, CCTV, signs, planters, telecommunications equipment and a wide variety of smart city sensors in an integrated and often modular way. These services and devices may be owned, managed or used by multiple entities and may have more complex engineering requirements and other considerations than those needed for a traditional street pole.

Place owners are encouraged to seek advice from competent professionals for structural, electrical, telecommunications, lighting design and commercial agreements for commercial tenancy or maintenance before the MFPs are deployed.

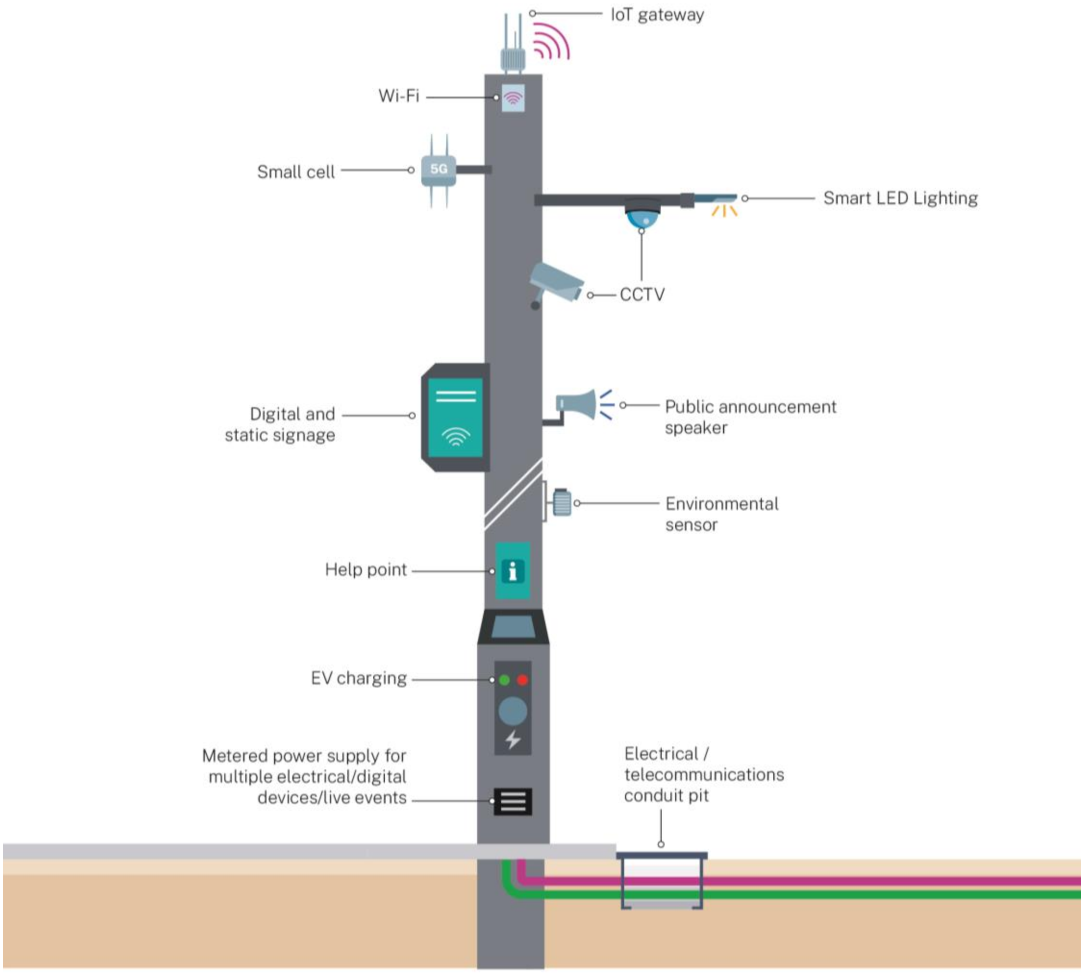

Figure 1 Multi-Function Pole example

NOT GOVERNMENT POLICY

General guidance for greenfield and brownfield/infill development

General guidance for deploying MFPs is to consider:

- deploying MFPs where street poles are required to reduce street clutter
- potential services to incorporate into the modular design of the MFP as part of the Smart Place design include:
  - street lighting
  - telecommunications (such as mobile cellular network providers)
  - local government's digital infrastructure requirements (such as CCTV, signage or lighting)
  - IoT sensors, devices and connectivity networks, with flexibility to enhance these in the future
  - digital wayfinding and signage.
- design treatments appropriate for the place including:
  - locating MFPs a minimum of 600mm from the face of kerb
  - avoiding impacts on existing and future mature street tree canopies
  - co-locating with other street furniture
  - provisioning pit and conduit to each pole to enable the future upgrading to smart lighting and the installation of smart meters to local government specification at each new lot
  - provisioning each MFP with two telecommunication conduits and two electrical conduits.

Facilitating the deployment of MFPs not only supports Smart Places objectives for a city or precinct development, but also supports the rollout of cellular networks such as 5G.

Greenfield

An area with no existing infrastructure and buildings.

Brownfield

An area with existing infrastructure and buildings.

Infill

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

Internet of Things (IoT)

A network of devices, such as a sensors, and other technologies that connect and exchange data over the internet.

Multi-function pole design and functionality

The primary function of a MFP is to integrate services into one location so that the street amenity is enhanced, providing more available space for pedestrian movement.

There are a range of sizes, types, and functionality of MFPs, from basic offerings (intervening poles) that may accommodate 3 to 4 external devices to full-capability MFPs that incorporate a full suite of smart city devices.

The design and functionality of the MFP for a precinct or development should be developed as a part of the place strategy, so that the deployment of MFPs meets the needs of the place.

Most commonly a combination of intervening poles and full-capability MFPs are used within a place or precinct. Full-capability MFP are modular in nature and able to accommodate the following device modules:

- 4G or 5G (**cellular**) **small cells**
- public **Wi-Fi access points**
- closed-circuit television (CCTV)
- electric vehicle charging
- speakers
- general power outlets (power points)
- USB outlets
- functional lighting
- decorative lighting
- traffic and pedestrian signals
- wayfinding and dynamic signage
- banner arms
- help buttons and microphones
- smart controls and sensors
- supporting infrastructure for autonomous vehicles.

Intervening poles should have design aesthetics that are complementary to the full-capability MFP in the network. Local government or place owners can decide what types of intervening poles are deployed. These could be either:

- standard poles meeting the local DNSP (Distributed Network Service Provider) specification
- narrower MFPs that are also modular and can accommodation up to four simple external devices from the list above.

Cellular

4G is the fourth generation of cellular network technology, technically referred to as Long-Term Evolution (LTE). It continues to provide increases in bandwidth. 5G is the fifth generation cellular network technology (technically known as 5G New Radio (5G NR)) and provides further increases in bandwidth.

Small cells

Radio transmitters for mobile phone services, installed by mobile network operators on structures such as MFPs, light poles, bus shelters or the sides of buildings.

Wi-Fi access points

Wireless access points (APs or WAPs) and networking devices that allow Wi-Fi devices to connect to a wired network; installed on fixed structures such as light poles, smart poles, bus shelters or the sides of buildings.

Considerations for multi-function poles

MFPs typically have larger dimensions and a larger footprint than traditional poles. The aesthetics of the MFP should be considered, and considerations may also be contingent on regional or local jurisdiction requirements. The MFP materials, fabrication, finishes and structural integrity should conform to all relevant Australian Standards (see Resources at the end of this guide).

Other considerations include adequate:

- dimensions to fit equipment and services within or on the MFP
- dimensions to access equipment and services within or on the MFP (for example, dual hatches for easy access)
- structural rigidity to support accessories (such as lighting fixtures) attached to the MFP
- structural rigidity to withstand wind loadings and vibrations
- resistant to extreme weather and disaster conditions (steady-state static analysis)
- an appropriate location for the MFP so that it can provide services to the surrounding area, such as lighting, CCTV, telecommunications, and public Wi-Fi
- allowance for extra capabilities to be incorporated in the future by catering for extra space in the MFP
- ability to use sustainable source of energy wherever possible
- ease of maintenance and ease to upgrade
- structural design should be animal resistant (ie snakes, mice) especially in rural or parkland environments.

Power supply ownership

When installing an MFP, consideration should be given to the location and asset ownership of the incoming underground low-voltage AC cabling. This can include reference to any easements required within public spaces, category of land requirements, areas of significance, and local jurisdiction criteria.

Lighting

MFPs often provide safety and amenity lighting within public spaces. Luminaires and accessories can be mounted within or on the MFP and their selection will influence the type and size of components to be installed on or within the MFP. All lighting and associated products should conform and be installed in accordance with to relevant Australian Standards (see Resources at the end of this guide).

5G or small cells

The MFP can serve multiple telecommunications functions; for example it can:

- host connectivity equipment to service the surrounding area, such as wireless services
- host smart connected devices that require connectivity to function, such as smart lights, CCTV cameras, air quality sensors and traffic monitoring.

The rollout of 5G, particularly the mmWave portion of the 5G spectrum, is likely to increase the amount of telecommunication infrastructure required in public space. MFPs can house the small cells necessary to support this roll out and the owners of the poles may have an opportunity for revenue by leasing access to the poles to telecommunication providers.

Current estimates indicate that in dense urban environments, small cells per individual mobile network at a maximum of 200m apart (and less in highly trafficked areas) may be required to properly service consumers. These small cells require a line of site between the cells and the mobile handset, as well as power and connectivity. These requirements make a network of MFPs an ideal location to house these devices in public space. The facilitation of networks of MFPs may have the following benefits for small cell deployment:

- lower the overall cost and disruption to the community of 5G deployments by greatly minimising the need for later extensive capital works in the public domain to lay conduit and replace footings
- reduce unsightly deployments by facilitating 5G small cell deployment neatly within poles or in an aesthetically cleaner manner on poles
- reduce street clutter by reducing the overall number of poles
- secure the support of telecommunications companies for a deployment approach that is easier, quicker and less costly, and more acceptable to the responsible local government and community.

However, small cells may not always be appropriate. Consideration should be given to physical limitations, such as space and heating effects, and electromagnetic energy cumulative emissions of multiple cells being the equivalent of a larger mobile facility. Examples of small cell housing on MFPs are shown in Figure 2.

Figure 2 examples for small cell housing

Active and passive sharing

A single MFP may have the ability to support the small cells of two or more telecommunications companies. Sharing of infrastructure by suppliers may be:

- **passive:** where providers share mobile network infrastructure like transmission, power, cables, ducts, cooling systems, and towers, but where each operator still installs its own antennas and electronic equipment
- **active:** where providers jointly invest in and share antennas, electronic equipment and possibly spectrum.

Neutral hosting

An emerging option for local governments or place owners is facilitating or appointing a neutral host. This has potential additional benefits beyond those that come from encouraging the sharing of poles.

Neutral hosting can better allocate the burden of managing the forthcoming 5G telecommunications deployment to a party with expertise in this field. The third party may be able to help other telecommunications providers deploy more quickly at lower cost while also maximising the potential revenue for local governments because of their industry expertise.

Placement

The MFP location should consider the following factors:

- a safe place to install
- proximity to power and connectivity networks
- sensing and data collection capability
- any adjacent obstructions, such as building infrastructure and trees
- urban design elements specific for the place.

The proposed treatment for greenfield and upgrades to brownfield developments, is that at least one full-capability MFP is installed (or planned) at each intersection and/or every 200 to 250 metres, and at each sharp bend along the road network. This is proposed to support small cell installation and other Smart City applications. Where required, intervening poles, which can either be narrower MFPs with a basic offering or standard poles, can be installed in between the full-capability MFPs.

Footings

A wide range of MFP products are currently on the market, which have different functionality, technical specifications and design approaches, and continue to evolve.

The MFP footing design is dependent on factors such as the soil conditions, MFP weight and wind loading, and existing ground services such as plumbing, gas and drainage. These footings will require site-specific calculations and potentially a geotechnical report to be carried out by appropriately qualified and experienced engineers prior to installation.

Consideration should be given to footing designs that will accommodate a larger diameter MFP in the future. This is particularly important:

- at intersections, to accommodate different future traffic or road needs
- where there are sharp bends in the road because telecommunications equipment functionality is dependent upon line-of-sight.

Electrical and telecommunication conduit considerations

The number and size of conduits allowed for in the footing design will be determined by the intended services that the MFP will deliver or could deliver in the future and the physical limitations, such as the maximum allowable diameter.

Proposed number of conduits

The proposed treatment for each MFP is that allowance should be made for a minimum of four conduits:

- two conduits for power (to accommodate power in and power out)
- one conduit for fibre
- one conduit for mobile communications.

Poles at intersections may also require an additional conduit for traffic controls or cables. Consideration should also be given to future service needs when installing the maximum conduit capacity.

Diameter of conduits

Factors that can influence the conduit diameter and that should be considered when procuring an MFP include:

- internal diameter of the MFP
- services supplied to the MFP
- services supported by the MFP
- wiring rules
- space for future expansion.

The proposed provision of two power conduits to all MFPs may allow local governments to support street lighting and other higher energy-consuming devices on the MFPs, which may need to be separately supplied, metered or billed, and be able to be isolated. This could include, for example, separate power supply for EV charging and 5G telecommunications infrastructure.

The proposed provision of two communication conduits to all poles will support a variety of smart places functionality and provide spare conduit to facilitate the deployment of future technologies.

Consideration should be made to have conduits terminated to a pit beside the MFP. However, this is not always practicable and will depend on cost and the type of MFP being installed.

Conduits should enter the pole above finished ground level to prevent water ingress to the conduit. All conduits that enter the MFP should have a minimum bend radius to suit the cable size. There should also be clear identification of the conduits within the MFP such as through labelling, colour or type of conduit.

It is recommended that the electrical and communication conduits are laid in the same trench, with the electrical conduits directly below the communication conduits at the depths specified in the relevant design guidelines or Australian Standard. It is also recommended that these conduits be in close proximity to the footing as shown in Figure 3, which illustrates that the conduits could be on either side of the footing.

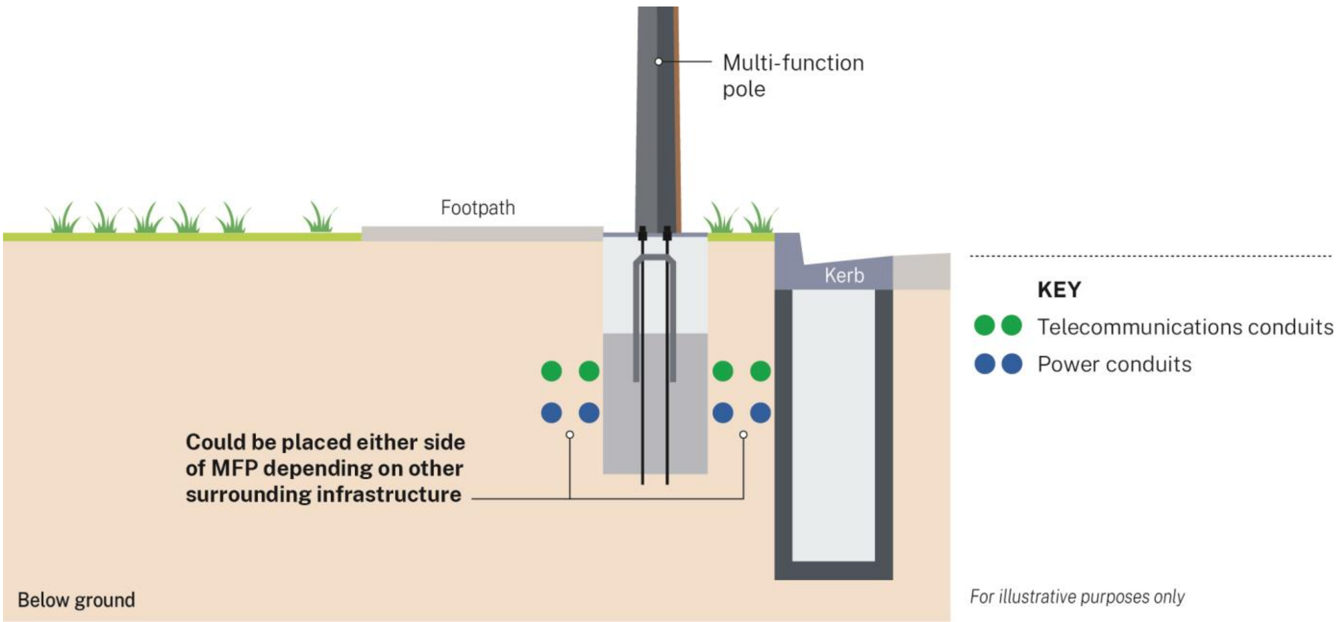

Figure 3 Communications and power close to MFP

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

- Standards Australia -Standards & Legislation Store APAC –SAI Global Infostore
- AS 1554.1 Structural steel welding, Part 1: welding of steel structures
- AS/NZS 1594 Hot-rolled steel flat products
- AS/NZS 1664 (series) Aluminium Structures
- AS 1874 Aluminium and aluminium alloys –Ingots and castings
- AS 3678 Structural steel –Hot rolled plates, floorplates and slabs
- AS 4100 Steel Structures
- AS/NZS 1554 (series) Structural Steel Welding
- AS/NZS 1163:2009 Cold-formed structural steel hollow sections
- AS/NZS 1170 (series) Structural Design Actions
- AS/NZS 4600 Cold-formed Steel Structures
- AS/NZS 4677 Steel Utility Services Poles
- AS 1231 Aluminium & aluminium alloys –Anodic oxidation coatings
- AS 1874 Aluminium and aluminium alloys –Ingots and castings
- AS 3715 Metal Finishing –Thermoset powder coatings for architectural applications of aluminium and aluminium
- AS 3894.3 Site testing of protective coatings, Method 3: Determination of dry film thickness
- AS 3894.9 Site testing of protective coatings, Method 9: Determination of adhesion
- AS 4312 Atmospheric Corrosivity Zones in Australia
- AS 4506 Metal finishing -Thermoset powder coatings
- AS/NZS 2312 (series) Guide to protection of structural steel against atmospheric corrosion by the use of protective coatings
- AS/NZS 4680 Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
- AS / NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring rules).
- AS/NZS 3015 Electrical installations –Extra-low voltage power supplies and service earthing within telecommunications networks.
- AS 1768 Lightning Protection Systems
- AS / NZS 60598.1Luminaires, Part 1: General requirements and tests
- AS / NZS 60598.2.3 Luminaires, Part 2.3: Particular requirements –Luminaires for road and street lighting
- SA / SNZ TS 1158.6 Lighting for roads and public spaces, Part 6: Luminaires -Performance
- AS/NZS IEC 61000.3 (series) Electromagnetic compatibility (EMC)
- IES –LM79-08 Electrical and photometric measurements of solid-state lighting products
- IES –LM80 Approved method: Measuring luminous flux and color maintenance of LED packages, arrays and modules

- IEC 62262 Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
- IEC TR 62778 Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires
- IES LM84 Approved method: Measuring luminous flux and color maintenance of LED lamps, light engines, and luminaires
- IEC 60529 Degrees of protection provided by enclosures (IP code)
- AS 1170.4 Structural design actions, Part 4: Earthquake actions in Australia