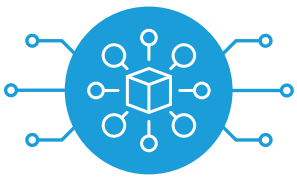
G20 Global Smart Cities Alliance

WORLD ECONOMIC FORUM



MODEL POLICY

Public Sector Asset Use

Cities can facilitate network deployment by making their assets and land available to network providers[1] – and foster true public-private partnerships. Both cities and network providers can benefit from the use of local authority assets in this way. Simplifying the interactions between cities and the telecommunications industry promises to significantly accelerate the expansion of existing wireless networks and connectivity and, by extension, support local economic growth and digital inclusion in cities across the world.

This policy aims to provide:

Guidance on how to host communications infrastructure on city property, supported by real-world examples with models and approaches to consider

Insights on shaping collaborations with connectivity providers to advance the connectivity and broader smart city objectives

Guidance on the processes for landlords and communications operators to follow when considering siting digital communications infrastructure on city property

This is a wide-ranging policy, reflecting the importance and scale of improving urban digital infrastructure – and the multiplier effect that positive urbanization has on a number of other areas, including rural-urban linkages. It includes asset and portfolio management, budgetary aspects and shaping collaborative public-private partnerships. However, the policy reaffirms the strong position of cities: with assets and infrastructure made available to drive meaningful improvements in connectivity. Depending on local context, some cities may be able to explore all aspects of the policy in their entirety – while others may require collaboration with the national government or other stakeholders.

Contents

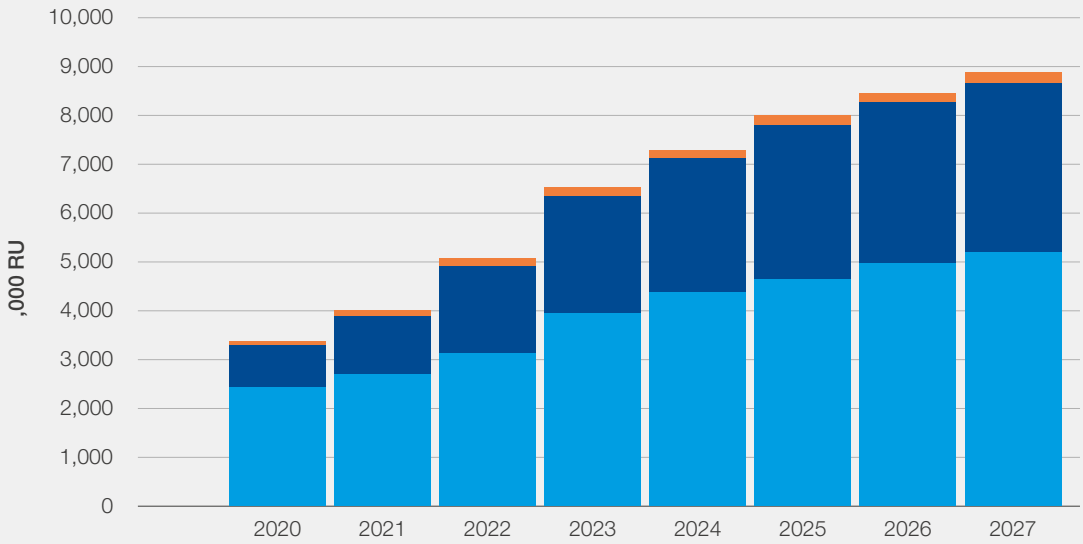
Background

Connectivity – the wired and wireless foundations of our digital economies and digital societies – is increasingly as essential a utility for cities as electricity, gas and water. This importance was reaffirmed during the COVID-19 pandemic when high-bandwidth activities such as remote education and remote working became commonplace.

The pandemic also highlighted broader trends, including the risk of widening the digital divide.[2] Online and digital content is increasing in size and complexity (with associated increases in data consumption), more capable devices are becoming increasingly accessible, and digital products and services are playing even more central roles in daily life. From video streaming to video calls, explorations of emerging technologies such as the internet of things (IoT) and artificial intelligence (AI), and the role of digital channels as key tools for public service delivery. In 2022, the total data "created, captured, copied and consumed globally … is 97 zettabytes, a number projected to grow to 181 zettabytes by 2025".[3] This also requires a shift from focusing on network coverage to focusing on network capacity (and quality-of-experience).

In response to these increasing demands, public and private organizations are looking to increase the effectiveness of their connectivity infrastructure.[4] However, this poses very real challenges in the context of cities. Continued rollout of 5G – a likely 10-15 year investment for many mobile network operators – will require significant increases in the amount of network infrastructure: from new cell-sites, to other innovations such as small-cell deployments. In higher-density urban locations, the gap between cells may need to be less than 100 metres. One analysis notes that the mobile industry expects to see an increase from the 13,000 small-cells installed in 2017 to over 800,000 by 2026[5] – with some industry sources noting that there could be more than 3.5 million small cells in cities by 2027.[6]

Figure 1: New deployments and upgrades of small cells and distributed antenna systems (DAS) by environment 2020-27 (by numbers of radio units deployed or updated)



	2020	2021	2022	2023	2024	2025	2026	2027
Rural and remote	64	77	125	154	165	176	191	198
Urban	825	1,190	1,780	2,400	2,750	3,150	3,300	3,450
Enterprise	2,489	2,753	3,184	4,002	4,422	4,662	5,020	5,280

Note: Figure 1 predicts a compound annual growth rate of 15% in global small cell deployment from 2020 to 2027, totaling nearly 36 million radios.

Source: Small Cell Forum, *SCF Market forecast report*, 2023, https://www.smallcellforum.org/scf-market-forecast/.

Similarly, fibre-optic broadband rollout is increasing in pace – with over 12% growth rate year-on-year.[7] Fibre is an important component of both household and business connectivity but also provides the foundational "backhaul" to connect 5G and other wireless infrastructure to the mobile network operator's core network. Coordination between these actors (and sub-contractors and other partners) is a considerable administrative undertaking for cities – and can sometimes be an inequitable process, with cities having less control over the location and extent of network infrastructure installation.

New technologies alone will not fix the urban digital divide. New business models and ways of working in the connectivity industry are also having an impact. On the consumer side, there is a growing demand for an increased choice of in-network providers – with operators responding by improving network capacity and coverage. Within the industry itself, numerous operators are selling, sharing or rationalizing network infrastructure in order to fund investments in 5G and other technologies. This includes the growth of Open RAN – disaggregating the radio-access network (RAN) to incorporate modular components and technologies from a wide range of new vendors while adhering to global industry-wide standards.[8] Neutral host models are also creating new opportunities, particularly in the context of private networks.

Changes in ways of working also need to extend to policy-making and city service delivery. Land and hosting options for updated and new digital infrastructure pose significant considerations for cities. Lack of space, challenges in securing rights-to-land, and minimizing disruption to residents and businesses are some of the issues encountered by city policy-makers and network operators. However, cities also often have considerable asset portfolios – from ducts to rooftops, street furniture and even social housing and other buildings. These are valuable platforms for improving the extent and quality of coverage – with cities able to lead the rollout of connectivity to support the lives and livelihoods of their residents. This policy highlights how cities can be central and leading actors in rolling out connectivity.

1 The fundamentals of public sector asset use

Effective public sector asset use first requires a shift in how the city engages with connectivity (and connectivity providers) – from being reactive to taking a more proactive approach in identifying and setting the terms of public-private partnerships. As part of this, the city needs to recognize its strengths: it has the most important assets, including enviable and city-wide property and platforms – and the associated rights and permissions to host crucial connectivity infrastructure. Cities are also the closest administrative actor to communities, residents and customers.

1.1 This shift in dynamic improves the leadership and stewardship role of the city. An asset reuse policy enables the city to guide connectivity deployments – including actively participating in infrastructure planning and rollout – and maximize property and asset investment and management. All for the benefit of residents, and their livelihoods. The city should have a clear vision relating to connectivity, and its benefits – and work to ensure connectivity providers and other actors are true partners in achieving this vision.

1.2 Digital infrastructure comprises of seven distinct categories:[9] real estate, public assets, infrastructure, equipment, operations, services and wireless spectrum. Public sector asset use allows the city to shape the first six to our benefit, while also informing policies and implementation regarding wireless spectrum. In particular:

a. **Real estate:** Cities are responsible for often considerable parcels of land or real estate – and are also responsible for identifying, categorizing and allocating land or other locations for digital infrastructure deployment or other uses.

b. **Public assets:** Cities have a portfolio of useful platforms for connectivity – including streetlights, street furniture and public buildings – and can simplify the process for connectivity providers to lease or use this infrastructure.

c. **Infrastructure:** Cities can often play a leading role in deploying digital infrastructure (including fibre-optic connectivity or small cells) – but also lead the coordination of network deployments across providers.

d. **Equipment:** Cities support operators to upgrade and manage network infrastructure, including potentially ensuring interoperability in some contexts.

e. **Operations:** Cities ensure adherence to health and safety and other priorities – and in some cases setting out and maintaining performance, service and security standards for network providers.

f. **Services:** Cities can drive focused connectivity deployments and interventions to ensure that no one is left behind – including tackling “not spots” and ensuring underserved populations are served. Cities can also be consumers of connectivity, including through broadband, mobile and IoT.

g. **Wireless spectrum:** Adhering to national policies regarding spectrum allocation and use and also demonstrating innovations regarding spectrum (e.g. allocation for specific pilots, trials and use cases). The city may also want to advocate for shared or locally-licensed spectrum to explore city-specific use cases.

1.3 However, these seven areas also highlight the considerable collaboration needed between the city, network providers and operators, and other stakeholders – and the need to build capacity and awareness at the city level. This is discussed later in the policy.

1.4 An initial step for public sector asset reuse is to undertake a thorough mapping and assessment of city assets – these could include land, public buildings (such as youth and sports centres, recreation facilities, public libraries and social housing), open spaces (such as parks) and other assets (street furniture, utility poles, streetlights, etc.). Mapping and assessment should include current and planned assets, including programmes of retrofitting. This mapping should also consider the inclusion of assets owned by private sector providers and other partners,[10] with data provided during procurement processes or broader collaborations.

1.5 Connectivity providers can use this data to shape their future and proposed plans for city-based rollouts – effectively giving the city options on which projects to pursue first. Particularly relevant information can include:

a. Type of infrastructure and key dimensions

b. Location of site or infrastructure

c. Relevance of the site (e.g. adherence to telecommunications regulations and viability for network use)

d. A recent risk assessment.

1.6 This assessment can also be undertaken in collaboration with connectivity providers in order to streamline the identification of relevant assets (e.g. underground ducts, dark-fibre networks, utility poles at suitable heights, street furniture in areas of low connectivity, etc.).

1.7 Similarly, the city should focus on streamlining permitting and use of real estate and assets in order to minimize or remove additional administrative burdens encountered by connectivity providers (and city staff). This could include accelerated or expedited approvals and zoning processes – within the bounds of national or other legislation.

1.8 Recognizing that permits or permissions provide a valuable revenue stream for the city, connectivity providers should explore opportunities to mitigate this loss. This could include revenue-sharing opportunities, in-kind contributions (including free or heavily-subsidized connectivity to key city assets), or broader collaborations. More widely, the city should also look to the longer-term benefits of improved connectivity when calculating shortfalls in immediate permitting or permissions income.

1.9 The city should also play a leading role in ensuring the usefulness, availability and quality of these assets. This includes keeping the above mapping current where possible (including aligning or incorporating it into broader asset management processes) but also carrying out proactive maintenance (including reporting processes).

1.10 The city should also establish a framework for coordination, organization and sharing of assets. This would improve the efficiency of interactions and collaborations with connectivity providers (and other entities). This should also extend to the broader use of assets – for example, shared use (e.g. multi-operator versus single-operator) and targeted use of assets (e.g. to tackle market failures, connectivity not-spots, high-bandwidth areas linked to city priorities, etc.).

1.11 The city should also ensure:

a. That there is a clear and transparent process for providers to apply for access to city assets (including developing standardized operating procedures, model or template agreements,[11] etc.)

b. Promotion of multi-tenant and shared infrastructure use

c. Balance is afforded between the rollout of connectivity and managing the aesthetics (and other sensitivities) of local areas

d. That every effort is made to minimize any additional street furniture or other assets installed for the purpose of hosting digital infrastructure.

1.12 By definition, leveraging public assets can bring digital infrastructure closer to the lives and livelihoods of city residents. Recognizing this, the city and connectivity providers should also focus on ensuring positive public engagement and sentiment regarding digital infrastructure installations. This could include discussions with community groups to explain new installations, targeted outreach to highlight the benefits (and extent) of increased coverage and connectivity, and clear and accessible communications channels to build a feedback loop with residents.

1.13 More broadly, the city should take a strategic approach to connectivity. Public sector asset reuse is one tool in the digital infrastructure toolkit. The city should also engage with wider decisions about investment and ownership of connectivity – including commercialization of existing assets (or broader revenue raising or cost-recovery), neutral-host solutions, public-owned networks, etc. This also extends to positioning digital infrastructure as a central priority and enabler for policy and other outcomes – with dedicated resources and support. Resources such as the United Nations People-first Public-Private Partnerships Evaluation Methodology for the Sustainable Development Goals can provide useful guidance.[12]

2 Relationship to wider city policy, strategy and initiatives

Asset reuse through urban infrastructure is an inherently cross-city policy. It requires collaboration across real estate and property, asset management and other teams. However, this broad focus also provides an opportunity for asset reuse to lead to a wide range of positive outcomes and strategic priorities – including several beyond-direct improvements in connectivity.

2.1 The city should reaffirm the importance of connectivity for achieving key city outcomes – and proactively tackle any concerns from internal or external stakeholders regarding digital infrastructure. For example, perceived security concerns from sharing ducting or other city assets. From the outset, the city should undertake a broad mapping of goals, objectives and other priorities where improved connectivity could play a role. As an example, this could include:

a. **Tackling market failures:** using asset reuse to incentivize the rollout of connectivity in underserved areas.

b. **Improving connectivity not-spots:** targeting areas with coverage gaps or bandwidth challenges through the strategic use of public assets.

c. **Urban redevelopment or regeneration:** leveraging public assets in priority areas to amplify the impact of city investment.

d. **Driving inclusion:** siting infrastructure in lower-income or marginalized areas in order to increase the benefits afforded by digital.

e. **Shaping innovation:** leveraging assets to improve network density in order to support high-bandwidth activities (e.g. 5G services, connectivity testbeds, digital hubs, etc.).

f. **Achieving social outcomes:** recognizing the importance of connectivity for residents and their lives and livelihoods – as well as its broader roles (digital public service delivery, communication, education, etc.).

g. **Boosting livelihoods support:** for example, collaborating with connectivity providers to upskill local residents in network skills or digital economy roles.

h. **Leveraging under-used assets:** for example, the growing interest in "edge" applications – and infrastructure such as edge data centres – could require the increased presence of digital assets closer to residents. The city may want to be intentionally broad in thinking here, including considering "spare" spaces in community assets such as public toilets as locations for infrastructure.

2.2 Asset reuse can also lead to wider outcomes. For example, improving the sustainability of the city through minimizing street-works, which can create air and noise pollution. This impact can be amplified in combination with other policies, such as *Dig Once*.[13] Similarly, considerations regarding asset reuse should extend both to current and future assets, including programmes of retrofitting and refurbishment.

2.3 The improved collaboration between connectivity providers and the city that asset reuse enables can also lead to broader benefits. Asset reuse can accelerate the rollout and extent of connectivity, providing the city with greater insight and data from digital infrastructure – potentially improving outcomes in digital inclusion, water consumption, energy management and other areas.

2.4 It can also lead to more expansive partnerships. For example, driving opportunities for network slicing to focus on key urban use cases or private network opportunities. The latter could include focused connectivity solutions for schools, community centres or other public buildings being used to host network infrastructure – or even to drive city-wide network opportunities.[14]

2.5 Public sector asset reuse should also align with existing asset management processes. For example, engaging with incumbent streetlight teams, asset maintenance staff, highways teams and public housing officers. This can improve the rollout of infrastructure, minimize complications and also reduce the risk of issues such as resident confusion.

2.6 Similarly, asset reuse should also seek to leverage broader city processes. This could include collaborating with redevelopment teams in the municipality as they fix or revitalize real estate or other assets – including installing digital infrastructure during this process. This should also extend to such teams considering the connectivity potential arising from investments in new or refurbished buildings or other public assets.

2.7 The city should continually assess their connectivity requirements in order to future-proof its assets. In particular, the city should consider the connectivity requirements of core functions such as traffic signals, CCTV, car parks, on-street parking, schools, etc. This strategic approach can often align with and encourage commercial rollout and public-private collaboration.

3 Governance and process for accountability and compliance

As highlighted above, implementing public sector asset reuse requires extensive collaboration across and beyond the city administration. In particular, partnership with a wide range of city teams and also network and connectivity providers. Successful collaboration is founded on a clear definition and understanding of roles and responsibilities and accompanying governance processes to ensure the effective use of public assets.

3.1 Governance will initially be shaped by existing structures and processes – for example, the existence of any telecoms unit, management board or similar. However, the broader nature of public sector asset reuse will also likely require some bespoke aspects within existing processes. Even if an existing structure is already in operation, the city may also consider:

a. Appointment of a connectivity champion at the most senior levels of the organization, recognizing that digital infrastructure is a key tool to achieve urban outcomes

b. A single point of contact to lead internal and external engagement, with a mandate and credibility across key teams and departments within the city

c. Representation by key community leaders on any governance committee or structure to ensure representation of resident perspectives

d. Representation from across the city administration (e.g. highways and traffic management, asset management, public housing teams, etc.) to ensure alignment in the delivery of public sector asset reuse – and visibility of planned works or other undertakings that could be leveraged to accelerate the rollout of connectivity.

3.2 Similarly, governance should be led by clear monitoring and evaluation – drawing on the goals, objectives and other priorities that connectivity can enable. These metrics would be agreed within the administration. Contractual and other mechanisms – such as concessions – may also be needed to ensure adherence to processes (by providers, but also internal stakeholders). In addition, these metrics would be designed in conjunction with a broader monitoring and evaluation process that identifies data sources (e.g. network coverage data, resident feedback surveys, etc.).

3.3 The implementation of a "shot clock" approach (a fixed deadline for the approval of digital infrastructure deployment) could offer substantial benefits for both connectivity providers and the overall rollout of connectivity. Industry actors have highlighted the importance of shot clocks in promoting more efficient and expeditious permitting processes,[15] thereby enabling the acceleration of infrastructure build-outs like the deployment of 5G wireless technology. This approach puts healthy pressure on city officials and local governments, driving them to negotiate with providers over the terms of infrastructure projects in a timely manner, thus promoting faster decision-making processes.

3.4 The city should also develop and clearly document a process to resolve disputes between connectivity providers and stakeholders within the city administration – including broader teams (e.g. asset managers, etc.). This should be accompanied by effective monitoring and enforcement by the city.

3.5 The city should also clearly set out all requirements and expectations for public sector asset reuse – from management of assets to planning regulations, minimum connectivity requirements – and health and safety,[16] and other requirements that connectivity providers must adhere to.

3.6 Recognizing the importance of strong community relations, the city should also set out clear aesthetic requirements and related guidelines for the installation of any digital infrastructure. To minimize approval processes and administrative resources across all of the above requirements and expectations, the city may consider compiling key requirements or non-negotiables and allow discretion over some elements.

3.7 In addition, the city may want to consider developing a standard set of fees or charges for the use of public sector assets – and for the wider process of collaboration. This "rate card" could include items such as attachment rights, power, duct access, fibre leasing, ground lease rights and other aspects.

3.8 These processes should also drive coordination and collaboration between stakeholders to accelerate the improvement of connectivity outcomes while also minimizing or removing disruption and other negative effects. Installations should not negatively impact existing utilities or assets or the work of other utilities or other connectivity providers. The city could also explore broader "behaviour change" approaches, such as levying fees for works undertaken during traffic-sensitive times.

4 Interdependent engagement for trust and value creation

Public sector asset reuse can lead to positive outcomes for all stakeholders – particularly if the above roles and responsibilities are well defined. It can result in wide-ranging value creation: from improving the rollout of connectivity, including for underserved populations, to supporting the management, maintenance and sustainability of public sector assets. More broadly, it can have wider positive multiplier effects by reducing the equipment required for network installation.

4.1 The city should aim to provide as much clarity as possible with regard to real estate and public sector assets that can be used for digital infrastructure. This includes cataloguing and maintaining public assets (and simply and transparently sharing this list with providers),[17] simplifying access and leasing agreements (including improving rights-of-way), streamlining permitting processes (including leveraging city assets), proactively engaging with providers to enable a holistic and strategic planning approach, and recognizing the commercial realities of network rollout. Where assets are owned by private sector providers or other partners, the city should engage with these partners to identify how such assets can be used for the benefit of ensuring improved connectivity to residents.

4.2 Network providers should adhere to all safety and environmental standards and broader requirements set out by the city, including aesthetic and other priorities or considerations. This should also extend to collaborative working with other stakeholders (including from across the city administration and from other providers or other actors present at or around any asset). They should also engage with broader city or political processes, including resident communication and monitoring and reporting. Commercial sensitivities are recognized, but providers should aim to provide the city with visibility regarding local network planning and rollout – at strategic and operational levels within the local authority. Connectivity providers should also recognize the often legislative or other defined timescales and frameworks in which public officials operate.

4.3 In particular, residents' interests must be kept at the forefront. This includes investing in efforts to highlight the relevance and importance of public sector asset reuse for lives and livelihoods – including demonstrating and showcasing improvements in coverage and making such collaborations tangible and relevant to the lives and livelihoods of residents. Related to this, a resident "sensing" effort could also be undertaken to identify local digital priorities and other aspects that may need to be prioritized for digital infrastructure rollout. This could come in the form of surveys, interviews or community group engagement.

4.4 Recognizing the complexity of delivering connectivity to all residents and communities, stakeholders should maintain an open and productive dialogue to identify opportunities to ensure that no one is excluded from coverage. This could include promotion of open-access technologies, multi-operator deployment (including active or passive sharing), identifying opportunities for focused interventions (including subsidies or in-kind support), more extensive public-private partnerships or more specialized structures such as special-purpose vehicles.

4.5 Similarly, all actors should remain alert to new or additional opportunities to achieve mutual and broader value. For example, shared tenancy revenue and public ownership of network slices to deliver municipal use-cases.

5 Relationships with industry, utilities and provider stakeholders

The digital infrastructure landscape is becoming increasingly complex, and further technology developments – particularly the disaggregation and modularity that 5G potentially enables – also lead to a new range of actors and stakeholders. This reaffirms the importance of collaborative working between providers. Similarly, public sector asset reuse will bring providers into greater contact with utility, real estate, asset managers and other stakeholders.

5.1 Building on city requirements, connectivity providers should continue to minimize the impact on streetscapes and communities by collaborating with asset managers and other stakeholders to ensure installations are sensitive to local aesthetics and other requirements. This may include broader engagement (e.g. with communities and other stakeholders in heritage or special locations) and designing equipment to better meet the needs and realities of urban installation.

5.2 Drawing on best practices set out in *Dig Once*[18] and other approaches, providers should aim to collaborate with broader stakeholders to minimize disruption caused to residents and communities. For example, aligning works and other schedules – but also looking to future-proof installations (and other works) wherever possible.

5.3 Connectivity providers should endeavour to work in a professional manner alongside other contractors, utility companies and other service providers. This will include adhering to all health and safety guidelines and other requirements set by the principal contractor (or similar) on the site.

5.4 During desktop and other reviews conducted by connectivity providers and other partners, providers should proactively engage with the city (asset managers and related actors) to improve asset management. For example, flagging cluttered or complex environments, damaged infrastructure or assets, or other issues.

5.5 The city should also look to proactively engage industry and other private sector partners wherever possible. This includes leveraging existing platforms and channels, such as business and industry forums.

5.6 Ultimately, all stakeholders should commit to recognizing the overall purpose of this work – to improve the lives and livelihoods of city residents through improved connectivity. With this in mind, negotiations and discussions must be open, transparent, recognize the sometimes-divergent realities and positions between stakeholders and groups, and not combative. All stakeholders, and the city, should also commit to sharing best practices wherever possible. Including documenting case studies, embedding processes that have worked well, and highlighting lessons learned.

6 Technical measures to underpin asset reuse

Digital infrastructure comprises a wide range of different technologies and equipment. From fixed-line technologies, such as fibre, to wireless mobile infrastructure – including the towers, base stations, small and large cells, and other ancillary infrastructure. This extensive toolkit requires the city to be technology-agnostic wherever possible: focusing on the needs and digital outcomes of its residents and not led solely by technology. Facilitating network deployment through asset reuse requires a comprehensive approach to ensure that the city's assets are leveraged effectively and efficiently. The following technical measures can underpin asset reuse and support the hosting of fixed and wireless infrastructure, as well as small-cell hosting.

6.1 To deploy broadband infrastructure on public assets, such as billboards, bus and tram shelters, building frontage, camera poles, digital signs and streetlights, the assets must meet certain technical requirements. These requirements[19] include providing line of sight or near line of sight for high-quality coverage, supporting power and data connections for backhaul, and ensuring the protection of the equipment and the public.

6.2 As highlighted above, the first step for the city is to conduct an inventory of its assets, including buildings, street furniture and public rights-of-way. This inventory should identify the assets that can be used for hosting telecommunications infrastructure and their technical specifications, including the structural capacity, power availability and access to fibre connectivity. The inventory should also identify assets owned by private sector providers and other partners.

6.3 Wherever possible, the technical requirements for hosting telecommunications infrastructure should be standardized to ensure consistency across the city. Standardization should include the design and construction standards, access requirements and approval processes for equipment installation and maintenance.

6.4 Access to fibre connectivity is critical for hosting telecommunications infrastructure. The city should ensure that any fibre infrastructure is available to network providers and should facilitate access to the infrastructure by streamlining the permitting process and reducing the associated costs. This also includes aligning with policies such as *Dig Once*[20] to connect assets at the same as installation.

6.5 Small-cell hosting is a key enabler of 5G networks, and the city needs to consider specific technical considerations for hosting small cells. These considerations include the availability of backhaul connectivity, the location of the small cell to minimize interference, and the ability to power the small cell.

6.6 Radio frequency (RF) planning is essential for ensuring that the wireless infrastructure is deployed optimally to provide the required coverage and capacity. The city should work with network providers to conduct RF planning to identify the optimal locations for the infrastructure, taking into consideration the existing infrastructure, topology and demand. Similarly, connectivity providers should be collaborative in this process – recognizing the need to balance network requirements with community needs.

6.7 Digital infrastructure requires power, and the city should ensure that there is a reliable power source available for the infrastructure. In addition, the city should consider the availability of backup power, such as generators, to ensure that the infrastructure remains operational in the event of a power outage.

6.8 Digital infrastructure is critical infrastructure, and the city should work with connectivity providers to ensure that the infrastructure is secure. This includes physical security measures, such as securing the equipment cabinets and enclosures, and cybersecurity measures, such as implementing firewalls and encryption. This also includes IoT security and the need for ensuring compliance with regulations pertaining to critical infrastructure.[21,22]

6.9 Digital infrastructure requires regular maintenance and upgrades to ensure that it remains operational and meets the evolving needs of the network providers and the city. The city should establish clear processes and procedures for maintenance and upgrades, including timelines, notification requirements and approval processes.

6.10 Cities have an inherent interest in providing high-quality mobile network infrastructure to support their own needs and functions, such as public safety and monitoring of the environment and traffic congestion. However, it is important to balance the deployment of infrastructure with fundamental municipality priorities for an aesthetically-pleasing and high-quality environment, as well as an orderly planning process and revenue recovery.

6.11 The following table outlines a range of technical considerations for digital connectivity infrastructure for each type of public asset that can be leveraged for broadband deployment. It does not aim to be exhaustive.

Table 1: Public infrastructure assets and requirements

Public asset	Technical requirements
Streetlights	Sufficient structural support for mounting equipment (e.g. small cells, antennas)
	Access to power source
	Compliance with safety regulations[23]
	Minimal visual impact[24]
Utility poles	Sufficient height and structural support for mounting equipment
	Compliance with safety and clearance regulations
	Coordination with other utilities sharing the pole[25]
	Access to power source
Public buildings	Access to rooftops, façades or interior spaces for equipment installation
	Sufficient structural support
	Compliance with building codes and safety regulations
	Coordination with building management for access and maintenance

Table 1: Public infrastructure assets and requirements continued

Public asset	Technical requirements
Public rights-of-way (e.g. sidewalks, streets, alleys)	Compliance with local regulations for trenching, micro-trenching or aerial installations for fibre optic cables
	Minimization of disruptions to traffic and pedestrians
	Coordination with other utilities and stakeholders
	Restoration of rights-of-way upon completion of work
Public parks	Compliance with park regulations and environmental standards
	Preservation of park aesthetics and minimization of visual impact
	Coordination with park management and local communities
	Access to power source
Transport assets (e.g. bridges, tunnels, subway stations)	Use of existing infrastructure (e.g. bridges, tunnels, subway stations) for equipment installation and fibre routing
	Compliance with transport agency regulations and safety standards
	Coordination with transport agencies and stakeholders
	Access to power source

Definitions

Public sector assets: The resources owned and controlled by the national or local government or public sector entities. These assets can include physical assets such as buildings and land, infrastructure and equipment.

Digital infrastructure: The physical and virtual components that enable the transmission of data and information between devices and networks. This includes technologies such as broadband networks, cellular networks and satellite systems that provide high-speed internet access and support the exchange of data.

Access agreements: A legal contract between two or more parties that outlines the terms and conditions for accessing a specific resource or property. This can include details such as the purpose of access, the duration of access, any fees or charges associated with access, and the rights and responsibilities of each party.

Ducts (or conduits): The tubes or channels that are used to enclose and protect cables or wires. These can be made of various materials, such as plastic or metal, and are commonly used in the construction of telecommunications and electrical infrastructure.

Small cell: A type of low-powered cellular base station that is used to extend and improve the coverage and capacity of wireless networks. Increasingly used in relation to 5G network rollout.

Rights-of-way: A legal right to pass over or through a specific piece of land. This can include the right to use a specific path or road or the right to install and maintain infrastructure such as pipelines or cables.

Backhaul: The transmission of data from a local network or device to a central network or the internet.

Appendix

A Further reading

DCIA Digital Integration Toolkit **(United Kingdom)**
This toolkit provides guidance for both industry and government departments on agreements to use public sector assets to host digital communications infrastructure.

Draft Template Small Cell Agreement, **Glasgow City Council (Scotland)**
This document is a template for a small cell agreement from the city of Glasgow.

Reference for Deploying Telecoms Equipment on Street Assets
– Telecom Infrastructure Project
The document provides a comprehensive guide for municipalities and telecom operators on the commercial, legislative and technical trends in small cell deployments, discussing the benefits, principles of deployment, legislative support, various deployment solutions, barriers and the evolution of network technology.

5G Strategy Western Sydney City Deal **(Australia)**
Enabling the rollout of 5G digital infrastructure, with a focus on key principles such as sharing infrastructure.

Infralink Toolkit **– Scottish Futures Trust**
The Infralink Toolkit provides balanced and transparent tools that work at a national level, building off existing operating leases, valuations, case law and data.

5G Technical Assessment Report **– Mississauga (Canada)**
This report identifies the required information to make informed decisions for 5G deployment, including processes, fees and governance through master agreements.

Rollout of Small Cells for 5G Network by Leveraging Street Furniture
– Telecommunication Engineering Centre (India)
This document discusses the rollout of 5G small cells and the use of street furniture in urban areas.

State of California Local Permitting Playbook **– Broadband for All**
This playbook discusses the preparation for the deployment of broadband infrastructure in California.

People-first Public-Private Partnerships Evaluation Methodology for the Sustainable Development Goals **– United Nations**
An evaluation methodology for scoring and evaluating public-private partnership projects that aspire to be described as “people-first”.

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About the G20 Global Smart Cities Alliance

Established in June 2019, the G20 Global Smart Cities Alliance on Technology Governance unites municipal, regional and national governments, private-sector partners and cities' residents around a shared set of principles for the responsible and ethical use of smart city technologies. The World Economic Forum, the International Organization for Public-Private Cooperation, serves as secretariat for the alliance.

Through the Alliance, global experts from government, private-sector partners and civil society are compiling and analysing policies from around the world to identify model policies necessary for successful, ethical smart cities.

You can find more model policies and more details about the alliance at: https://globalsmartcitiesalliance.org/.

Endnotes

1. And other collaborations where the use of public sector assets could deliver improvements to civic services (e.g. providers of electric vehicle charging infrastructure).

2. For example, more than three-quarters of American households without in-home or wireless broadband subscriptions are in urban or metropolitan areas: Fishbane, Lara and Adie Tomer, "Neighborhood broadband data makes it clear: We need an agenda to fight digital poverty", *Brookings*, 6 February 2020, https://www.brookings.edu/blog/the-avenue/2020/02/05/neighborhood-broadband-data-makes-it-clear-we-need-an-agenda-to-fight-digital-poverty/.

3. "Data Never Sleeps 10.0", *DOMO*, n.d., https://www.domo.com/data-never-sleeps.

4. As highlighted in the proposals for the EU Gigabit Infrastructure Act: "A major part of network deployment costs can be attributed to: (i) inefficiencies in the roll-out process related to the use of existing passive infrastructure (such as ducts, cabinets, and antenna installations); (ii) difficulties in the coordination of civil works; (iii) burdensome administrative permit-granting procedures; and (iv) bottlenecks in deploying in-building physical infrastructure". This model policy engages with each of these areas: "Gigabit Infrastructure Act Proposal and Impact Assessment", European *Commission*, 23 February 2023, https://digital-strategy.ec.europa.eu/en/library/gigabit-infrastructure-act-proposal-and-impact-assessment.

5. See: ctia, *The State of Wireless*, 2018, https://api.ctia.org/wp-content/uploads/2018/07/CTIA_State-of-Wireless-2018_0710.pdf.

6. Small Cell Forum: https://www.smallcellforum.org/.

7. See: "OECD broadband statistics update", *Operation for Economic Co-operation and Development (OECD)*, 13 July 2023, https://www.oecd.org/sti/broadband/broadband-statistics-update.htm.

8. See, for example, the Telecom Infrastructure Project's Project Group on OpenRAN: https://telecominfraproject.com/openran/.

9. World Economic Forum, *Delivering Digital Infrastructure: Advancing the Internet Economy*, 2014, https://www.weforum.org/reports/delivering-digital-infrastructure-advancing-internet-economy/.

10. See, for example, "DCIA Data Integration Toolkit", *DCIA Data Integration Toolkit*, n.d., https://data-toolkit.co.uk/.

11. See, for example: "Standardised wayleave", *City of London*, 11 August 2022, https://www.cityoflondon.gov.uk/supporting-businesses/commercial-property-support-and-advice/telecommunications-and-utilities-infrastructure-in-the-city-of-london/standardised-wayleave?_gl=1*1xxv841*_ga*MTIyNTUzMTg4NS4xNjgzODEwNzc2*_ga_*MTY4NTQ5NjA0Ny4xLjAuMTY4NTQ5NjA0Ny42MC4wLjA; "Connected London Resources", *Greater London Authority*, https://www.london.gov.uk/programmes-strategies/business-and-economy/supporting-londons-sectors/connectivity/connected-london-resources?ac-31316=31312#acc-i-57801.

12. See: UNECE, *People-first Public-Private Partnerships Evaluation Methodology for the Sustainable Development Goals*, 2022, https://unece.org/eci/documents/2022/05/working-documents/people-first-public-private-partnerships-evaluation.

13. World Economic Forum, *Model Policy: Dig Once*, 2022, https://www3.weforum.org/docs/WEF_Dig_Once_Model_Policy_2023.pdf.

14. Bhattacharjee, Sushmit, Katsalis Kostas, Osama Arouk, Robert Schmidt et al., "Network Slicing for TSN-Based Transport Networks", *IEEE Access*, 2021, https://www.researchgate.net/publication/351061274_Network_Slicing_for_TSN-Based_Transport_Networks.

15. McGarry, David B., "FCC Permit 'Shot Clocks' Provides 'Predictability' to Wireless Infrastructure Builds: T-Mobile", *Broadband Breakfast*, 8 Novermber 2022, https://broadbandbreakfast.com/2022/11/fcc-shot-clocks-provides-predictability-to-wireless-infrastructure-builds-t-mobile/.

16. All conduit and connectivity installations must adhere to all health, safety and wider requirements and regulations – including local policies and broader best practice in relation to fire risk assessments, health and safety requirements, and engaging with related resources, such as asbestos registers.

17. See, for example, New York City: "Universal Solicitation of Broadband Asset Dataset", *NYC OpenData*, 2 October 2022, https://data.cityofnewyork.us/City-Government/Universal-Solicitation-for-Broadband-Asset-Dataset/2bsr-c6qq. The location of some assets (including fibre and conduits) may require increased data protections, recognizing sensitivity and security.

18. World Economic Forum, *Model Policy: Dig Once*, 2022, https://www3.weforum.org/docs/WEF_Dig_Once_Model_Policy_2023.pdf.

19. See: Telecom Infra Project, *Reference for Deploying Telecoms Equipment on Street Assets*, 2021, https://cdn.brandfolder.io/D8DI15S7/at/qwsh5w878r3qvj3xf4hhbg/TIP_Connected_City_Infrastructure_Reference_for_Deploying_Telecoms_Equipment_on_Street_Assets_v10_FINAL_-_GREEN_-_Public_Access.pdf.

20. World Economic Forum, *Model Policy: Dig Once*, 2022, https://www3.weforum.org/docs/WEF_Dig_Once_Model_Policy_2023.pdf.

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