Telecom Regulatory Authority of India

Consultation Paper on

USE OF STREET FURNITURE FOR SMALL CELL AND AERIAL FIBER DEPLOYMENT

New Delhi, India

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Stakeholders are requested to furnish their comments to Advisor (BB&PA), TRAI, by 20th April 2022 and counter-comments, if any by 4th May 2022. Comments and counter-comments would be posted on TRAI's website: www.trai.gov.in. The comments/counter-comments may be sent, preferably in electronic form, to Shri Sanjeev Kumar Sharma, Advisor (Broadband and Policy Analysis), Telecom Regulatory Authority of India, on the email id: advbbpa@trai.gov.in with a copy to jtadv-bbpa@trai.gov.in. For any clarification/information, Shri Sanjeev Kumar Sharma, Advisor, (Broadband and Policy Analysis), may be contacted at Telephone No - +91-11-23236119

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CHAPTER 1

INTRODUCTION

1.1. The Digital Communication sector plays a pivotal role in the economic development and social prosperity of a nation. As India leapfrogs to the next level of development, telecom and internet connectivity would play a key role in facilitating technological advancement and in bringing people closer to each other. COVID-19 pandemic has changed the way day to day social and business life transacts.

1.2. Demand for communication services by citizens, enterprises, government offices, industries and educational institutions has pushed the data usage in India to almost 100 times in last 5 years. India is witnessing a rise in the smartphone penetration (percentage of population actively using a smartphone) and has moved up considerably in global smartphone penetration rankings[1]. The user expectation for high speed, high quality, ubiquitous connectivity will grow further with availability of low-cost devices and high-definition contents. The next generation broadband is expected to meet this demand for connectivity not only for common man but also for new industry requirements by supporting host of new manufacturing process through IoT, Artificial Intelligence (AI), Virtual Reality (VR), Network Slicing etc. Together the next generation communication technologies, devices and services can catapult the Indian Economy into the next trajectory of growth. 5G networks and services will support ultra-reliability, low latency, ultra-high speeds, and massive connection densities. Small Cells enable these features of 5G to be exploited

[1]https://newzoo.com/insights/rankings/top-countries-by-smartphone-penetration-and-users/
https://newzoo.com/insights/trend-reports/newzoo-global-mobile-market-report-2018-light-version/

fully and hence, deployment of small cells will play a critical role in success of 5G.

1.3. Most countries are in the process of studying and initiating small cell architecture for 5G rollouts. Several international bodies are also involved in providing resources for developing and creating easy-to-deploy 5G small cell ecosystem. The third-generation partnership project (3GPP), a body united by seven telecommunications organizational partners producing technical specifications and reports for mobile systems, has come out with reports on scenarios and requirements for small cell enhancement. Small Cell Forum, a global membership organization formed with an objective to enable low-cost agile mobile infrastructure alongside scale and diversity, has been contributing to accelerate small cell deployment through various new approaches specified in their technical blueprints, enterprise focused outputs, and guides.

A. What are Small Cells?

1.4. Small cells are low-powered radio access nodes or base stations (BS) operating in licensed or unlicensed spectrum that have a coverage range from a few meters up to a few hundred meters[2].The attributes of small cells (radio, antenna) are compressed such that they are portable and easy to deploy. Small cells intend to provide localized coverage in households and hotspot services especially in areas like city-centres and transport hubs. Small cells provide coverage only for a very short distance and therefore they are installed in a dense or hyper dense manner, i.e., a very large number (even more than 200 per square kilometer) for good geographical coverage to provide highly reliable and high-capacity broadband.

[2]https://www.gsma.com/publicpolicy/wp-content/uploads/2016/12/GSMA_Small_Cell_Deployment_Booklet.pdf

1.5. The Small Cell Forum (SCF)[3] defines small cells as *low-power wireless access points that operate in licensed spectrum, are operator-managed and feature edge-based intelligence*. Another report by the SCF on "5G Small cell architecture and product definitions"[4] states that a *small cell is a cellular base station that transmits & receives 3GPP-defined RF signals (include 2G, 3G, 4G (LTE and its variants) and 5G (NR) signals) with small power and small form factor.* The term 'small cells' comprises femtocells, picocells and microcells and the use cases include indoor and outdoor deployment.

1.6. Physically, small cells can be characterized as small or medium base stations (<38 dBm), having an antenna installation height typically ≤10m above ground (or indoor floor level), operate on licensed spectrum in low (<1Ghz), mid(1-6Ghz) and high(>6Ghz) bands, consumes low/medium power(5-400W) and have relatively smaller dimensions, integrated packaging (built-in antennas) and are convection cooled.[5]

1.7. Small cells encompass (but are not limited to) femtocells, microcells and picocells. Additionally, the SCF uses the term metro cells to cover femtocells, picocells and microcells that serve high-capacity metropolitan areas and are installed in street furniture or building walls. The term or type of small cells used in each of the sectors or use cases vary in terms of the power requirement, size of radio, coverage area, other specifications, and deployment scenarios. Various reports use different criteria to classify these cells and the use of these terms is not very consistent. Nonetheless,

[3] SCF is a global membership organization committed to supporting agile, low-cost mobile infrastructure through small cells. SCF develops the technical and commercial enablers to accelerate small cell adoption and drive wide-scale densification. (https://www.smallcellforum.org/)

[4] https://scf.io/en/documents/238_5G_Small_cell_architecture_and_product_definitions.php

[5] https://www.standict.eu/sites/default/files/2021-02/Global5G.org_D3.3%20Report%20on%205G%20Standardization%20and%20Verticals%20v1.0_1.pdf

an effort has been made to provides information on the differences between the various types of small cells in Table 1.1.

Table 1.1: Aspects differentiating various types of small cells

ASPECT	Femtocell	Picocell	Microcell	Metrocell
Coverage of distance	10m to 20m	50m-100m	100m-1000m	up to 2km
Transmit power range	10mW – 200mW	250mW - >2W	2W -20W	May be above 20W
Deployment scenario	Home, offices	In-building, offices, shopping malls, train stations, aircraft etc	malls, hotels, stations, or transportation hubs, rural areas	High-capacity metropolitan areas
Cost	Low	Low	Medium	Medium/High
Location	Indoor	Enterprise/public indoor areas	Outdoor, Occasionally indoor	Outdoor
Installation	Customer/ Operator	Operator	Operator	Operator
Support user	4 to 16 users	32-64 users	Up to 200 users	Maybe above 200 users
Backhaul	Wired, Fiber	Wired, Fiber	Wired, Fiber, Microwave links	Wired, Fiber, Microwave links
Access mode	Closed Subscriber Group (CSG)	Open to all users	Open to all users	Open to all users

(Sources - Small Cell Forum[6], Study paper by ICEICE2017[7], Study paper by FUJITSU Network Communications INC [8], Article by RF Wireless World[9], 3G4G Small cells Blog[10])

Advantages of small cells

1.8. Small cells have an edge over macrocells in terms of stronger cellular coverage, relatively low-cost of deployment, low latency, and presence of location awareness capability. An added advantage is their ability to achieve scale rapidly as they can be aligned to the requirements of each use case or sector because of their smaller form factor. Some other advantages of deploying small cells are as follows:

[6] http://scf.io/en/documents/030_-_Small_cells_big_ideas.php
[7] https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8191847
[8] https://www.fujitsu.com/us/imagesgig5/High-Capacity-Indoor-Wireless.pdf
[9] https://www.rfwireless-world.com/Tutorials/femtocell-vs-picocell-vs-microcell.html
[10] https://www.slideshare.net/3G4GLtd/an-introduction-to-macrocells-small-cells

- Small cells owing to their small form factors, make themselves suitable for being mounted on existing public Infrastructure and **save huge capital expenditure (CAPEX)** which otherwise would have involved erection of towers and other associated infrastructure.
- Use of street furniture like electricity poles, billboards, smart poles, traffic lights etc can result in a win-win situation for service providers as well as the authority that owns street furniture. Deploying small cells on street furniture can **help in improved service delivery** by providing the coverage required for smart services like traffic management, automated street lighting, smart parking, emergency response, public safety, and security; even in hard-to-reach locations.
- A better signal-to-interference-plus-noise ratio (SINR) and smaller coverage footprint (lower number of users) means devices connected via small cells achieve higher throughput compared to macro-cells. The new higher frequency spectrum bands that will be used for deploying 5G services will further help in **high network capacities**.
- Due to lower coverage area, frequency reuse is very high, leading to very efficient utilization of spectrum. Thus, small cells help in **maximizing the spectrum use efficiency** by deriving more value from existing spectrum assets.
- Contrary to visual clutters created by macro radio sites small cell equipment's unobtrusive form factor and relatively small size make them highly customizable, matching the surroundings thus **providing aesthetic visual integration**.
- As small cell works close to devices, the energy consumption of devices will be lower due to lower transmission power. This will result not only in **energy saving** but would also mean that they will support even those embedded IoT devoices for which power consumption is very critical and transmission power is

very-very low like IoT based sensors embedded in roads and pavements.

- Small Cell can be immensely useful for those rural areas, where putting a macro–Radio Site is not commercially viable due to low density of population. At these places Small Cell can act as alternative to macro radio site due to its low CAPEX and OPEX requirements. This will result in a **reduction of the digital divide** as well. Panchayat Bhawans, CSC centers etc. can be such strategic locations where these small cells can be placed offering urban-like high broadband capacity at minimal cost of deployment.

B. Role of Small cells in building robust 5G network

1.9. As India plans to launch 5G, small cells can play a pivotal role in network upgradation and expansion. With the increased uptake of smartphones and the associated insatiable demand for digital services, average traffic consumption per user has increased considerably. For 5G, the constraints of high traffic levels and limited spectrum availability in lower bands, will force use of higher frequency bands for good signal strength, consistent coverage, low latency, and high capacity. However, use of higher frequency bands for 5G rollout will have the disadvantage of shorter coverage as signals in these bands cannot travel through buildings or obstacles. The lower cell radii for the proposed 5G frequency bands will force the need for densification of the network using a large number of small cells. According to the 'Making India 5G Ready' report prepared in August 2018, by the 5G High-Level forum constituted by DoT: "*5G will require massive addition of both above and below the ground infrastructure, both in passive and active categories. These include backhaul radios, antennas, towers, street furniture, and ducts, etc. In the long term, 5G infrastructure densification can exceed 1,000 Base Stations per Sq. Km.*"

Therefore, the use of higher frequency bands for 5G services would require that macro cells be complemented with extensive deployment of small cells so as to support all kinds of uses and applications, at all locations. In longer term a full-fledged 5G network will consist of Macro Base Stations, working in low /mid frequency band, to provide umbrella coverage and many Small Base Stations, working in mid/high frequency band to provide ultra-high broadband capacity, coverage in hard-to-reach areas and enabling low latency services.

1.10. Even in cases where coverage is not an issue, small cells can be used for traffic offloading since the carrying capacity of lower frequencies, used by macro radio sites, are limited. Over the period, further densification of cells will be required to cater to capacity requirements. Considering the lower maintenance cost of small cells, ease of configuration and other benefits that they bring, small cell deployments are likely to grow. The deployment of small cells can thus play a prominent role in the rollout of 5G networks by acting as an economically feasible and sustainable solution to expand network coverage. However, deploying large number of small cells and providing reliable and high capacity backhaul is a challenge both in terms of capital requirements as well as time to roll-out the networks.

C. Street furniture and its importance for small cells

1.11. Primary objective of street furniture is to provide utility services to city dwellers but with little or no change, they can also be utilized to mount small cells for providing telecom services as well. Some common examples of street furniture include utility poles, billboards, lamp posts, traffic signals, and public structures like gazebos, bus stops etc. Availability of existing street furniture in form of millions of streetlights, thousands of bus stops, hundreds of metro pillars can be a boon for economical and fast deployment of small cells. Considering the costs involved, complexity, and time

frames for densification of the proposed 5G network infrastructure, there is a need to put in place a mechanism for using the existing street resources for large-scale deployment of small cells. Street furniture are under various public and private authorities that have administrative jurisdictions in Municipal bodies, Smart City administrations, Government departments, railways, airports, ports and metro train systems, stadia etc. Granting access to street furniture by these controlling authorities at reasonable cost could remove a significant hurdle in 5G small cell deployment in the country. In turn, 5G when deployed on infrastructure owned by these authorities creates a win-win situation where the authorities can be benefited from 5G use cases like smart waste disposal, smart traffic light, smart metering, smart grid monitoring, disaster management, automation, energy management, new streams of revenue generation etc. Facilitating high quality internet-based services for education, health care, citizen services, entertainment, work from anywhere, financial services etc. by way of small cell deployment on the street furniture would be a right step towards building a digitally inclusive society. The use of public street furniture will obviate the need to have greenfield deployment of towers or poles for small cells thus bringing down the capital expenditure and time involved for rolling out the networks and services. Further, the proximity at which these street resources are already placed would ensure that each of the small cells provide strong signal strength and low latency in their respective small cell radii.

1.12. To make street furniture suitable for small-cell networks, it must be able to accommodate power, antenna and associated fiber and other cabling equipment. In addition, good design and engineering is crucial for successful small-cell deployments on street furniture. Heat dissipation criteria, battery backup considerations and structural integrity concerns such as safe loading and wind resistance capacity are some of the other possible requirements for

efficient deployment. A fast and cost-effective RoW permission process from controlling administrative authorities (CAA) would be the first step, followed by ensuring presence of electricity and proper backhaul facilities at the street furniture. It is necessary to ensure that RoW permission process keeps pace with the new emerging requirement. Only then, the deployment of small cells on the public assets can be accomplished smoothly.

1.13. Small cell based 5G networks which support higher speeds will necessarily require high capacity backhaul. Unfortunately, the fiber penetration in India is still not adequate and most of the existing macro sites are still not having fiber backhaul connectivity. According to estimates, fiberization of macro sites itself is hovering around 30% in India. Use of alternate means of data connectivity like Microwave, FSO (Free Space Optics), satellite etc. for backhaul will limit the capabilities of small cells as these mediums can support limited bandwidths. There is a need to have fiber backhaul support not only to effectively deploy small cells, but also to increase current fiberization levels of macro cell sites. As laying underground fiber is costly and time consuming, there is a need to find a deployment model which is light on Capital expenditure (CAPEX) as well as operational expenditure (OPEX) requirement. Developed countries like Japan and Europe have rolled out aerial fibers as part of their broadband plans due to its relatively quick and easy installation characteristics. In India also aerial fiber deployed on street furniture can be a viable solution for quickly providing reliable high-speed fiber backhaul to small and macro sites.

D. Role of Small Cell and Aerial Fiber Deployment on Street Furniture for the success of Smart Cities

1.14. Smart cities are designed with all modern features established in a sustainable manner to accelerate the quality of life through connected communities, advance infrastructure, mobility, and

ambience. They aim to improve the physical, economic, social and governance structure and aid in generating more job opportunities and delivering faster services. They also generate a ripple effect for faster development of adjacent areas. Some of the infrastructural requirements and smart solutions common to smart city development are robust optical fiber connectivity, Wi-Fi, intelligent traffic management, smart parking, energy efficient street lighting and Integrated City Command & Control center.

1.15. The smart cities mission which was launched in 2015 by the Ministry of Housing and Urban Affairs had selected 100 cities for the mission. The purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to smart outcomes[11]. Some of the core infrastructure elements in a Smart City would include adequate water supply, assured electricity supply, sanitation, including solid waste management, efficient urban mobility and public transport, robust IT connectivity and digitalization, sustainable environment, safety and security of citizens, and state-of-art health and education service delivery. The strategic components of the Smart Cities Mission are city improvement (retrofitting), city renewal (redevelopment) and city extension (Greenfield development) plus a pan-city initiative in which Smart Solutions are applied covering larger parts of the city.[12]

1.16. 5G networks in general and small cells in particular will play a pivotal role in Smart Cities development, due to its capacity to offer next generation solutions to meet the needs of Smart City dwellers. Many Smart City applications may run on next generation network-based Internet of Things (IOT). Intelligent Transport Management System, environment sensing, water and waste

[11]https://smartcities.gov.in/

[12]https://mohua.gov.in/cms/smart-cities.php

management smart networks are other key focus areas for Smart Cities. A 5G network with Small Cells can transport data from a massive number of small IoT devices embedded in roads and pavements to City Control Center which will result in better traffic management by reducing the idling time at traffic lights.

1.17. 5G would unleash the potential of smart cities by powering Artificial Intelligence, M2M communications and other advanced technologies and both these would go hand in hand. The need for high bandwidth and a secure & dependable data flow for the massive IOT and provision of smart services like public safety even in hard-to-reach locations such as underground car parks or pavements stress the need for 5G connectivity. The 5G use cases that smart cities can implement, will help them in adopting innovative approach to promote sustainable and inclusive cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions.

1.18. Use of street furniture for the development of smart solutions can help deliver bundled services to its citizens at an optimized cost. The need to establish different structures for the provision of each of the smart services can be avoided by sharing available street furniture structures and equipping them to cater to technology requirements. For example, smart poles can cater to needs of providing multiple services such as Wi-Fi hotspots, Digital Billboard, CCTV, Sensor, Public Address, mobile small cells. For the same they have to be designed with a capacity to accommodate the equipment required for these services along with power and backhaul connectivity (either optical fiber or wireless).

1.19. Fiberization of radio access networks is essential in the provision of 5G services as well as for catering to the digital connectivity needs of smart city administration like CCTVs, Sensors, Public Address systems etc. As has been discussed previously, Aerial

fiber, a method of deployment of overhead fiber cable, is a backhauling solution that can be used for digital connectivity needs. It is easy to manage, poses no requirement to dig or create new ducts as is the case with underground cables, enables the reuse of existing poles and thereby reduces installation costs, and speeds up deployment. Accordingly, Department of Telecommunications (DoT) has issued amendment to The RoW 2016 rules in 2021 to facilitate provisioning of over-ground lines which includes aerial fiber. Street furniture structures such as streetlight and smart poles can support laying of aerial fiber and can be ideal choice for the deployment of small cells and laying of aerial fiber. Central Government has already announced the GatiShakti program that marks a paradigm shift in decision making to break the silos of departmentalism. Smart city administrations and other Government authorities who have control over the street furniture should also proactively come forward to make the existing and planned street furniture compatible to have co-sharing capabilities to cater to needs of providing multiple services. A synchronous decision making will help the nation to create a world-class infrastructure at lower costs and in less timeframe.

1.20. Realizing the importance that 5G technology can play in adopting smart solutions, some of the smart city administrations have proactively approached the Authority (TRAI) for pilot rollouts and co-utilization of smart city street infrastructure. The local authorities have shown eagerness to pursue innovative approaches to small cell deployments to support smart services.

1.21. The deployment of small cells on street furniture however has certain challenges that needs to be addressed. The SCF in collaboration with 5G Americas and GSMA had listed the following

deployment challenges in its report[13] titled "Small cell siting: regulatory and deployment considerations", 2017:

- Streamlining the regulatory approval for small cell equipment
- Scaling the planning application process to support large number of cells
- Securing sufficient suitable sites with power and backhaul
- Cost of installation
- Radiofrequency compliance
- Administrative complexity

(Source: SCF report on small cell siting)

E. Need for the present consultation

1.22. The aspects that need to be considered for the deployment of small cells on street furniture, inter-alia, include identifying the suitable street furniture based on availability of backhaul and power, deployment heights, load bearing capabilities of street furniture for mounting suitable equipment, scalability, and public concerns related to local approval, aesthetics, and safety. The ease of deployment and right of way issues like procedure and charges to deploy or rent the street furniture will also need to be dealt. Further, some other issues like sharing of the street furniture amongst various users, permissions needed for power supply under state electricity laws, exemptions or bulk permissions for small cell deployment etc. will also be required to be addressed.

1.23. TRAI identified the challenge in deployment of small cells especially using street furniture quite early and initiated consultation process with stakeholders and sought their views on how to permit the use of public places and street furniture for effective rollout of 5G

[13] https://scf.io/en/documents/190_-_Small_cell_siting_regulatory_and_deployment_considerations.php

networks by releasing a supplementary consultation in May '21. The objective was to understand the process which can be used by local bodies to grant permissions for use of street furniture and the associated policy and regulatory interventions. The Authority issued a Consultation Paper on **"Roadmap to Promote Broadband Connectivity and Enhanced Broadband Speed"**[14] dated 20.08.2020, and a Supplementary CP on the same on 19th May 2021. The Authority then finalized its recommendations on 31st August 2021, which broadly cover the following topics:

i. Revised definition of Broadband,
ii. Broadband Proliferation,
iii. Broadband Speed Enhancement,
iv. Infrastructure Creation, and
v. Incentives for Proliferation of Fixed Line Broadband.

1.24. The recommendations related to infrastructure creation, among other things, contained detailed discussions on *"Access to Street Furniture."* The criticality of Street Furniture for enhancing broadband data capacity and for mobile indoor coverage was discussed in the paper. It was mentioned that access to street furniture in an orderly, non-discriminatory, and transparent manner is paramount for the success of 5G. Therefore, the Authority had sought the views of stakeholders on how to permit the use of public places and street furniture for effective rollout of 5G networks by releasing a supplementary consultation. The Authority felt it was pertinent to understand the process which can be used by local bodies to grant permissions for use of street furniture and the associated policy and regulatory interventions, so the following issues were raised in the supplementary CP:

i. What are key issues and challenges in getting access to public places and street furniture for installation of small cells? Kindly provide the State/ City wise details.

[14]https://trai.gov.in/sites/default/files/Recommendations_31082021.pdf

ii. *How to permit use of public places and street furniture for the effective rollout of 5G networks? Kindly suggest a uniform, simple, and efficient process which can be used by States/Local-Bodies for granting access to public places and street furniture for installing small cells. Kindly justify your comments.*

1.25. In its broadband recommendations dated 31st August 2021, the Authority has mentioned that "*Evolving a proper regulatory framework to support the deployment of small cells will enable the industry and the Government to deliver the digital connectivity expectations of citizens and pave the way for 5G deployment. The policy/framework regarding the use of public places and street furniture should be fair, transparent, and effective, ensuring standardized guidelines for small cell size, power, space, quantity etc. are defined to make street furniture ready to deploy small cells. Many countries have adopted criteria for exemption that can be used for deployment of new antennas. For instance, the height of the installed antenna and the Effective Isotropic Radiation Power (EIRP) metric are being used as criteria for frequency exposure certification exemption and simplification of approval process for permission. The International Electrotechnical Commission (IEC) has developed detailed classes of small cell products and installations, which are also reflected in ITU recommendations. As per GSMA, where small cell installations comply with the power and installation parameters provided therein, they should be deemed to comply with the frequency exposure limits without further requirements. This exercise requires a detailed consultation for recommendations on standardization and exemptions of the small cells from permissions required from different authorities like exemption criteria based on height of antenna and EIRP and hence can be taken up separately by the Authority….As per the GSMA report on Small Cell deployment, a nationally standardized procedure and criteria is much required based on international best polices/recommendations that benefits the operators through simplified administration and help deploy*

small cells more efficiently for gaining improved connectivity. The stakeholder comments based on the policies adopted by the US, EU, UK, Japan, Australia, etc. specific to these countries could be taken as pre-consultation inputs by the Authority and the same required to be further deliberated through a dedicated consultation process keeping in view the Indian laws and Rules.

1.26. In view of the aforementioned deliberation in the broadband recommendations dated 31st August 2021, the Authority has decided to bring out this consultation paper. It is important to understand that small cell deployments that are interconnected are also termed distributed antenna systems (DAS) or in-building systems (IBS) where they provide service within an existing structure. These low range small cells are typically deployed in indoor environments of apartments, stations, airports, commercial centers etc. Small cells that are typically deployed in outdoor environments are often embedded in street furniture such as lighting fixtures, advertisement panels, bus shelters or street signs. Low power outdoor small cells are also mounted on building rooftops or on structures available outdoors within apartment and commercial building complex. This consultation paper focuses on issues related to outdoor small cell deployments and also on facilitating use of street furniture for the same. As far as Indoor deployments are concerned, Authority is addressing the issue of in building access through a separate consultation process.

1.27. Accordingly, through the present Consultation Paper (CP), the Authority intends to seek inputs from stakeholders on issues related to outdoor small cell deployments and use of street furniture for small cell and aerial fiber deployment for the successful rollout of next generation networks in the country. The CP has been structured into five chapters. Chapter 1 introduces the background of the topic and sets context for the present consultation. Chapters 2 discusses the international experience in

the development of small cells and street furniture access for 5G infrastructure creation. Chapter 3 deliberates on the existing issues in accessing street furniture. Chapter 4 lists outs various street furniture designs for small cell and aerial fiber deployment and pictorially depicts them for better understanding of stakeholders. Chapter 5 summarizes the issues for consultations.

CHAPTER 2

INTERNATIONAL EXPERIENCE

2.1 As countries all over the world are in the process of launching 5G services, small cell deployment has been an integral part of this plan. Different countries have adopted varying measures for right of way provisions and frameworks for access to street furniture considering the technical and physical requirements, and existing regulatory provisions in that country. Many countries have adopted criteria for exemption that can be used for deployment of new Small Cells. For instance, the height of the installed antenna and the Effective Isotropic Radiation Power (EIRP) metric are being used as criteria for certification exemption or process simplification. The International Electrotechnical Commission (IEC) has developed detailed classes of small cell products and installations. Such installations that comply with the power and installation parameters provided therein can be deemed to comply with the exposure limits without any additional requirements.

I. United States

2.2 The Federal Code of Communication (FCC) 2018 order[15] of the United States uses the term "Small Wireless Facilities" (SWF) to describe small cells. SWF are defined in terms of the physical, visual specifications and radiofrequency emissions. The right of way for these facilities is provisioned in the declaratory ruling and third report and order released in 2018 by the FCC for Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment.

2.3 As per the order, numerous courts and prior FCC cases have recognized that the state and local fees and other charges associated

[15]https://docs.fcc.gov/public/attachments/FCC-18-133A1.pdf

with the deployment of wireless infrastructure can unlawfully prohibit the provision of service. Therefore, the order has articulated various approaches to determining the types of fees and clarified that fees are only permitted to the extent that they are non-discriminatory and represent a reasonable approximation of the locality's reasonable costs. The order shortened the FCC timelines (from 150-90 days) to allow only 60 days for reviewing the application for attachment of a Small Cell using an existing structure and 90 days for the review of an application for attachment of a Small Cell using a new structure. It also specifies the three types of fees that can be collected so as to aid deployment in a cost-effective manner:

1)RoW access fees,

2) fees for the use of government property in the RoW such as light poles, traffic lights, utility poles, and other similar property suitable for hosting Small Cell as well a

3) application or review fees and similar fees imposed by a state or local government as part of their regulation of the deployment of Small Cell inside and outside the RoW can be imposed if

a) they are a reasonable approximation of the state or local government's costs,

b) only objectively reasonable costs are factored into those fees, and

c) the fees are no higher than the fees charged to similarly situated competitors in similar situations

2.4 The FCC determines that the failure of a state or local government to issue a decision on a SWF siting application within the presumptively reasonable time periods (60, 90) above will constitute a "failure to act" and amount to a presumptive prohibition on the provision of personal wireless services. Therefore, it is expected that the state or local government issues all necessary permits without further delay.

2.5 The physical and visual specifications of small cells are detailed in the order along with the radiofrequency emission specification. The building permits exist at a fee based on the cost to the Government of processing that application. For street furniture access, new, existing and replacement light poles, traffic lights, utility poles, and similar property suitable for hosting Small Wireless Facilities are provisioned and state/local Govt own or control these areas and recurring charges as per section 253 or section 332(c) can only be levied.

2.6 Since the US comprises a lot of states, the state legislatures have enacted their own small cell legislation that streamlines regulations to facilitate the deployment of 5G small cells. These laws take into consideration the unique circumstances of their state and local environment, but baseline principles can be established and are consistent with wireless industry standards, including streamlined applications to access public rights of way, caps on costs and fees, streamlined timelines for the consideration and processing of cell siting applications. An example of a state legislation is the case of California' bill that authorizes the local publicly owned electric utility or local government to deny an application for use of a streetlight pole or traffic signal pole, as applicable, because of insufficient capacity or safety, reliability, or engineering concerns subject to certain conditions.

II. European Union

2.7 Digital transformation is more crucial than ever to national economies following the outbreak of the pandemic. The EU believes 5G networks in particular represent a 'pillar of socio-economic development for Europe', enabling new services in healthcare, cleaner energy, and education, while supporting post-virus recovery and enabling industries to compete effectively with the US and China. The faster rollout of denser networks of small cells that are closer to customers is especially important for the development of

smart cities, transport systems and manufacturing.[16] Accordingly, the EU has adopted regulations to accelerate 5G network installations by simplifying the deployment of small cell antennas that provide the last mile for 5G networks. The regulation defines the physical and technical characteristics of small cells, setting strict limits on their size and power, exempting them from planning permits (while retaining national oversight) and addressing their appearance to make them less visible.

2.8 The European Union, by means of the European Electronics Communication Code (EECC), 2018[17] has adopted a set of regulations to simplify the deployment of "Small area wireless access points (SAWAP)", the term used to refer to small cells in the report. Article 58 of the code provisions that the competent authorities shall not unduly restrict the deployment of SAWAP, and that member States shall seek to ensure that any rules governing the deployment of the same are nationally consistent.

2.9 The physical and technical characteristics of 5G small cells are specified in the EU, Commission Staff Working document, 2020[18]. The report defines two categories of small cells (fully integrated and visible) and also specifies installation classes based on power, emission, and coverage criterions:

- Class E0 is for touch compliant SAWAPs of very low power (below 250 mW EIRP) which is inherent to home Wi-Fi routers as well as cellular equipment (i.e., part of a mobile network).
- Class E2 specifies a higher power limit of 2 W EIRP and a safety distance threshold of a few centimeters from people as provided in the standard. This category favors SAWAP deployment in narrow urban spaces, both indoors and outdoors, which imply close proximity to people.

[16]https://www.gsma.com/futurenetworks/latest-news/eu-regulations-set-to-accelerate-deployment-of-5g-small-cell-antennas/

[17]Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (Recast)Text with EEA relevance. (europa.eu)

[18]swd-2020-0139-en.pdf (uni-mannheim.de)

- Class E10 specifies a power limit of 10 W EIRP and requires in all cases a specific minimum antenna height above the public walkway in order to ensure a minimum distance to people. Under this class, the height of 2.2 meters of the lowest radiating part of the antenna above the general public walkway is specified. It allows for wider coverage of a few hundred meters, supports increased mobility and enables economically viable wireless broadband services and vertical applications outdoors at very high (mm-wave) frequencies.

2.10 The EU Member States have made different choices in the parameters (location, mounting, total size, power, antenna) used to define eligibility for exemption from local permits. Article 57 of the EECC provisions the right for operators to access any physical infrastructure controlled by national, regional, or local public authorities, which is technically suitable to host SAWAP or which is necessary to connect such access points to a backbone network, including street furniture, such as light poles, street signs, traffic lights, billboards, bus, and tramway stops and metro stations. In 2020, the European Union has adopted regulations[19] to accelerate 5G installation by simplifying the deployment of small cell antennas that provide the last mile for 5G networks. The Regulations not only specifies the physical and technical characteristics of small cells, but also, facilitate a permit-exempt deployment regime.[20]

III. Australia

2.11 The Australian Communications and Media Authority and the Department of Communications have put in place several policies to facilitate infrastructure deployment, including reductions in planning requirements for small-cell deployments in the public

[19]https://digital-strategy.ec.europa.eu/en/news/commission-adopts-implementing-regulation-pave-way-high-capacity-5g-network-infrastructure

[20]https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R1070&from=EN

space, and the removal of barriers between license types to facilitate the re-allocation of incumbent spectrum holders.

2.12 The Mobile Phone Base Station Deployment Industry Code[21] (C564:2020) does not give a specific definition to small cells, but states that Mobile Phone Radio Communications Infrastructure (MPRI), which is a low impact facility, includes small cells. The physical and technical characteristics of the MPRI along with the exemptions and powers of the carriers to deploy 'low impact facilities' without the scrutiny of State and Territory laws and Council approval is enshrined in the Telecommunications (Low Impact Facilities) Determination 1997 (the Determination), which was amended in 1999, 2018 and 2020.

2.13 As per the C564:2020, the clause for small mobile phone radio communications infrastructure which includes microcells and small cells requires that the carriers must notify the council of the proposed installation, the manager, owner, occupier, and community sensitive locations in proximity of the proposed site. A timeframe to make comments, which must be at least 10 business days after the date on which the notice is given is also to be followed. Finally, the carrier is expected to have regard to any submissions received during the comment period from the Council and public. The code also mentions that the carrier must ensure that its written procedures for new site selection for MPRI (which includes small cells) has regard to the objective of avoiding community sensitive locations (residential areas, childcare centres, schools, elderly care centres, hospitals, and regional icons) and that the deployment in areas of environmental significance is under the scrutiny of state laws /council approval.

2.14 The Mobile Phone Base Station Deployment Industry Code (C564:2020) has not provisioned for use of street furniture for 5G deployment. But the work[22] on the "Inquiry into the deployment,

[21]https://www.commsalliance.com.au/__data/assets/pdf_file/0018/62208/C564_2020.pdf

[22]https://www.aph.gov.au/Parliamentary_Business/Committees/House/Communications/5G/Report

adoption and application of 5G in Australia" by the House of Representatives Standing Committee on Communications and the Arts in 2020 has mentioned that street furniture in cities such as 'lamp posts, park infrastructure and buildings' can be used as an opportunity to leverage the existing assets for small cell deployments.

IV. Hong Kong

2.15 The Office of the Communications Authority (OFCA) of Hong Kong terms small cells as "Radio base stations" (RBS) and defines them as a structure including a cabinet not bigger than 5 meters x 4.5 m x 3.5 m (LxWxH) and antenna not bigger than 0.6 m x 0.6 m x 2.5 m (LxWxH), excluding pole, for planar shape or 0.8 m diameter for circular shape and located at the side or on the rooftop of a building for the provision of public telecom services to serve the local district[23].

2.16 No Right of Way has been provided for the use of Radio base station (RBS) for 5G rollout specifically, but guidelines and a One-stop Application Procedure (OSAP) has been provided for the installation of RBS at rooftops, building and restricted areas for serving all generations of services. Office of the Communications Authority (OFCA) had launched a pilot scheme in March 2019 to open more than 1000 suitable government premises for Mobile Network Operators (MNO's) to install RBS with a streamlined approval process. The OFCA report 2019-20 mentions that MNOs will be further assisted under a "demand-led" model to identify and gain access to additional suitable government premises for installation of RBS.

2.17 With regard to street furniture, OFCA has been working closely with the industry to identify suitable street furniture for the installation of radio base stations, such as public payphone kiosks, sheltered

[23]https://www.coms-auth.hk/filemanager/statement/en/upload/138/gn_201024.pdf

bus stops, smart lampposts, etc. Specific guidelines on the use of sheltered bus stops and public payphone kiosks for the installation of RBS for provision of public mobile services have been laid down in 2020 and 2021, respectively.

V. Others

2.18 The Infocomm Media Development Authority (IMDA) in **Singapore** has directed "mobile installation spaces" —typically rooftop spaces reserved for telecommunication equipment— be provided to network operators by building developers and owners free of charge. In **Japan**, operators can install 5G base stations on 208,000 traffic lights[24] across the country and the Government has proposed that the costs of using the traffic lights for 5G deployments be shared between operators and local administrations. Moreover, traffic lights are planned to be equipped with communication functions for traffic data collection & processing and emergency communication. In Seoul (**South Korea)**, 5G networks were established on subway lines being used as street furniture[25]. In **Egypt**, no building permits are required for small cell deployments subject to meeting RF guidelines. As per the Wayleave Right under the Telecommunications Act 2003 of **Austria**, the providers of a communications network can exercise wayleave rights on public property, such as streets, footpaths, public places, and the airspace above, free of charge and without special authorization. The specific exercise of this right must be coordinated with the administrator of the public good (e.g., the municipality) but the providers of public communication networks can also have the right to claim wayleave rights to private property subject to certain conditions. Small cell infrastructure has also been deployed in 'smart lampposts' which also serve as electric vehicle charging stations in city of Guimarães

[24]https://www.japantimes.co.jp/news/2019/06/14/business/tech/japan-install-5g-network-relay-devices-traffic-signals/

[25]https://seoulz.com/a-comprehensive-guide-to-5g-in-south-korea-outlook-for-2021/

in Portugal.[26] In a paper release on 5G action plan for **Denmark**, the Danish Energy Agency has mentioned about their plans for issuing guidelines (including best practice examples) for public authorities on how to deal with applications for permission to set up telecommunications infrastructure[27].

2.19 The details regarding the technical and physical characteristics of small cells, the RoW provisions for the use of small cells and access to street furniture, administrative exemptions, restrictions, based on experience of those countries that have created a formal directive or order for 5G and small cells are compiled in the table contained in **Annexure-I**.

[26]https://www.5gcity.eu/2019/07/04/ubiwhere-accelleran-league-finals/

[27] https://ens.dk/sites/ens.dk/files/Tele/5g_action_plan_for_denmark.pdf

CHAPTER 3
ISSUES IN ACCESSING STREET FURNITURE FOR SMALL CELL AND AERIAL FIBER DEPLOYMENT

A. Right of Way (RoW) Issues and adequacy of current provisions in ROW rules 2016

3.1. Right of Way (RoW) is a term defining *"the legal right, established by usage or grant, to pass along a specific route through grounds or property belonging to another."* RoW for Telecom Service Providers (TSPs) and Infrastructure Providers (IPs) is governed by Indian Telegraph Act, 1885 and rules made there under. Obtaining affordable and timely RoW permissions has always been a concern for the TSPs/IPs in India. A wide variation exists in the charges levied, timeline to grant permissions, and application procedures across the various states and local body/agencies. Obligation for cross-sector collaboration and approvals from various departments like electricity, forest, railways, transport etc. add to the time, cost and efforts required to get permissions. The Government has tried to solve the problem by way of notifying the Indian Telegraph Right of Way (RoW) Rules[28] (the rules) on 15th November 2016 that aimed to ensure a uniform adoption of RoW rules across all the states and streamlining of process of RoW approvals. The salient features of the above DoT notification, inter-alia, include the development of an electronic application process, timeline of 60 days for granting of permission, listing of required documents, and onetime fee to rationalize the administrative expenses across the country.

3.2. As per the SCF report 2017 on small cell siting[29], getting huge numbers of small cells into the right sites in a timely and

[28]https://dot.gov.in/actrules/indian-telegraph-row-rules-2016

[29]https://scf.io/en/documents/190_-_Small_cell_siting_regulatory_and_deployment_considerations.php

affordable manner is important, but to date, processes at several levels remain a bottleneck. These include approvals and certification for small cell equipment, approvals for site usage and deployment, infrastructure and spectrum sharing rules, radiofrequency compliance rules etc. Since the architecture of small cells differ from macro cells and these are mostly to be deployed extensively in both outdoor public and indoor areas and are expected to be potentially installed on street furniture which are under the control of state /local Government and other administrative authorities, they present additional challenges. It needs to be ensured that the ROW permissions for small cells are not affected due to tedious application processes, delayed/denied permissions by the authorities, site restrictions, and arbitrary charges.

3.3. To address the issue of laying aerial optical fiber cables, DoT has already notified the Indian Telegraph Right of Way (Amendment) Rules[30], 2021 in October 2021 to incorporate the provisions related to nominal one-time compensation and uniform procedure for establishment of overground telegraph line in the Indian Telegraph Right of Way Rules, 2016. The amount of one-time compensation for establishment of overground telegraph line will be maximum one thousand rupees per kilometer. Documentation for RoW application for overground telegraph line has been made simple. Also, there will be no fee other than administrative fee and restoration charges for establishing, maintaining, working, repairing, transferring, or shifting the underground and overground telegraph infrastructure.

3.4. As learned from experiences all over the world and in view of the stakeholder's inputs, the Authority recognizes that the issue of RoW permissions can potentially hamper the proliferation of

[30]https://dot.gov.in/sites/default/files/Gazette%20Notification%20dated%2021-10-2021-IT%20RoW%20%28Amendment%29%20Rules%2C%202021_1.pdf?download=1

small cells in India. The adequacy of provisions of existing RoW rules needs to be ascertained for the use of street furniture for deployment of small cells and telecom infrastructure. In case some separate specific provisions are needed for the same, the necessary amendments to rules will be required to be issued. It also needs to be ascertained that the amendment of October 2021 to RoW rules in respect of overhead telegraph lines is adequately addressing the issue of deploying aerial fiber or some further policy intervention is required.

3.5. No specific provisions are present in the majority of the Tower Infrastructure policies of various States/UTs for seeking permissions for deployment of small cells at public places. The process of the permissions, RoW charges for the use of street furniture and laying of aerial fiber vary across the different states of India. The variations in the fees imposed by each of these states suggest that there is a need to ensure that all states are aligned with the RoW rules and the process/charges prescribed there under. While some of the states like Madhya Pradesh, Chhattisgarh, Bihar, Orissa have proactively come out with very less charges for granting ROW permissions and are charging around Rs 100 per pole per annum for aerial OFC deployment, some others are charging prohibitive fees impacting rollout of digital infrastructure there. The excessive and non-uniform fees levied at various stages of RoW permissions across different states, if made applicable for small cells that will be deployed in hundreds of thousands, will hugely increase the capital expenditure and operational expenditure of the service providers thereby seriously hampering the roll out of next generation networks.

3.6. The states must ensure that the street furniture available with them is readily made available for use as mounting infrastructure for Information & Communication Technology (ICT) services. The

administrative authorities in-charge of the street furniture must look at a bigger picture of economic development where ICT services become enabler and should, therefore, fix minimal charges for sharing of street furniture. Digital economy would be contributing to 1 trillion dollars out of the envisaged 5 trillion-dollar economy of the country. Therefore, by enabling ICT infrastructure and services the State Governments and administrative authorities should be looking at a contribution of almost 20% to their economy and, therefore, revenues from sharing of infrastructure should not be deciding criteria.

3.7. Since small cells are expected to be deployed in large number using different street furniture equipment, obtaining permission for each cell site and from different tiers of authorities/bodies can be tedious, accordingly there is a need for simplifying the RoW process and come out with alternate ways and means. Some of these have been discussed in the following paragraphs-

a) One possibility is the development of an online bulk approval process. Inclusion of small cells under a simplified rule system/RoW based on standardized size, installation, and deployment specifications, in place of the present practice of multiple approvals for building/ street furniture permits is suggested for a faster and streamlined approval process.

b) Identifying and cataloguing the diversity of suitable street furniture across the country and earmarking certain public infrastructure (municipality buildings, post offices, bus, and railway stations, etc.) to have dedicated spaces that allow service providers to deploy small-cell architecture, can ease the administrative process for local authorities. The Service/Infrastructure Providers will not be required to take separate individual permissions for use of such

spaces. They can rather pay the desired rentals and use these spaces for deploying small cells.

c) Another approach has been taken in Japan and South Korea where traffic signals, metro lines, etc. were identified as street furniture in regions where they were highly concentrated and were mandated for use for deployment of small cells. Mandatorily allowing such street furniture for deploying small cells on sharing basis at fixed nominal rentals will ease the approval process. The Service/Infrastructure Providers may not apply for individual site permissions and can simply intimate and deploy the small cells on identified street furniture and pay fixed nominal rentals.

3.8. Metro Lines, airports, ports, railway stations are some of the establishments that will require deployment of small cells in order to provide high quality customized services. There is a mounting pressure world over on metro train authorities and airport management authorities to improve passenger handling efficiency and offer best in class passenger experiences. For the same they are experimenting new automation processes using next generation Communication Networks. From improved on-board monitoring systems to trains equipped with IoT connected sensors and more, the coming years will usher in a new era of highly connected metro trains. One of the major problems of Metro Trains is deterioration of communication services due to very high speeds and large number of users packed in small trains. Next generation networks are tailor-made to deal with this situation as they can handle lakhs of devices in same area simultaneously and with greater speeds and increased data transfer. The 5G network supports virtualization to enable separate network slices (a physical network, logically partitioned in set of independent networks) configured to meet specific KPI

(Key Performance Indicators) requirements of Metro train systems. It is no longer a "one size fit all type of network". This means Metro Trains can operate better systems and offer passengers better experience that is not possible today and improve its operational efficiency manifold.

3.9. Similarly, world over port management authorities is experimenting new automation processes on 5G networks to improve cargo handling efficiency. They have come forward to help TSPs build 5G networks so that the cargo handling processes can be automated using next generation networks. Port of Qingdao China, one of the top ten busiest ports, have collaborated to upgrade manually operated harbor to automated one using 5G networks and services. One of the key findings of the field trial at Qingdao Port is up to 70 percent of labor costs can be saved when a harbor uses the 5G automation upgrade, compared to traditional harbors with a fully automated harbor.

3.10. Airport administrative authorities are also experimenting new services and process automation using next generation Communication Networks. 5G networks are being deployed by TSPs for airport authorities for the same. For example, Chengdu Tianfu International Airport has launched 5G-based smart travel services, such as VIP recognition, luggage tracking, and AR map navigation using indoor small cells of a major vendor combined with 5G distributed Massive MIMO software functions. With 5G airports can operate better cargo systems and offer passengers better experience.

3.11. Be it metro system, port, airport or any other such establishment, a major issue in deployment of small cells in these locations is the exorbitant Right of Way charged by the respective administrative authorities. The RoW Rules 2016 clearly defines the applicability of the rules as "***Applicability***- *The appropriate authority shall exercise the powers under these rules on an*

application for establishment and maintenance of underground or overground telegraph infrastructure by any licensee on whom the powers of the telegraph authority have been conferred by notification under section 19B of the Act, subject to any conditions and restrictions as may be imposed in such notification." The rules further define "**appropriate authority***" means the Central Government, respective State Governments, local authority or such authority, body, company, or institution incorporated or established by the Central Government or the State Government, in respect of property, under, over, along, across, in or upon which underground or overground telegraph infrastructure, is to be established or maintained, vested in, or under, the control or management of such appropriate authority*. From these clauses, the rules appear to fully cover Central Government departments and their entities. Despite that for areas such as metro stations, defence cantonment, airports, bus stops, railway stations etc., the respective agencies or departments levy exorbitant rental charges, remarkably high annual increments in rental charges, additional miscellaneous charges, and huge security deposits. In addition to these charges, onerous conditions (like non-refund of deposits in case of cancellation of site due to reasons not in control of applicant) are imposed by some authorities. For faster and cost-effective rollout of next generation technologies, these issues will be required to be resolved.

3.12. In some cases, it has been seen that various State and Central entities have come out with Request for Proposals (RFPs) for giving exclusive rights of way. World Bank has recommended that for governments, sharing is an opportunity to expand the knowledge society faster and at lower costs.[31] The study further discusses that the traditional model of asset sharing is now complemented by two new types of infrastructure sharing:

[31]https://thedocs.worldbank.org/en/doc/533261452529900341-0050022016/original/WDR16BPInfrastructureMutualisationGarcia.pdf

infrastructure mutualization and infrastructure collaboration. Mutualization is sharing of a common infrastructure by all service providers, while collaborative infrastructures house different networks or are jointly constructed with other linear infrastructures, such as electricity lines or roads. Thus, the Right of Way of street furniture should be on shareable basis and exclusivity must be avoided at all costs.

3.13. Based on the above discussion the Authority seeks views of the stakeholders on the following questions:

Q.1: Is there a requirement for any modification in existing RoW Rules as notified by DoT to accommodate small cell deployment on street furniture? If yes, please provide the changes required.

Q.2: Have the amendments issued in 2021 to RoW rules 2016 been able to take care of the needs of aerial fiber deployment? If not, what further amendments can be suggested? Please provide exact text with justification.

Q.3: What are the suggestions of stakeholders for aligning RoW policies issued by various other Central Government Bodies with existing DoT RoW policy?

Q.4: Whether it should be mandated that certain public infrastructure (municipality buildings, post offices, bus, and railway stations, etc.) be earmarked to have dedicated spaces that allow service providers to deploy macro/small cells? If yes, what are the possibilities and under what legal framework this can be done? What should be the terms and conditions of use of such infrastructure? Please provide detailed inputs with justifications.

Q.5: Can some of the street furniture like traffic lights, metro pillars etc be earmarked for mandatory sharing between controlling administrative authority and Telecom Service/Infrastructure providers for deployment of small cells and aerial fiber? Does existing legal framework support

such mandating? What should be the terms and conditions of such sharing? Please provide details

Q.6: How can infrastructure mutualization and infrastructure collaboration be ensured to avoid exclusive rights of way? What legal provisions can support mandating these? Provide full details.

B. Permission exemptions for certain categories of small cells

3.14. A few countries have also adopted criteria based on power emitted and deployment heights for giving exemption from permissions for deployment of small cell. In Australia, the Telecommunications (Low Impact Facilities) Determination 1997 deals with the mounting of antennas on existing buildings and structures without the scrutiny of State and Territory laws and Council approval if the facility satisfies the physical and locational characteristics to be called low impact.

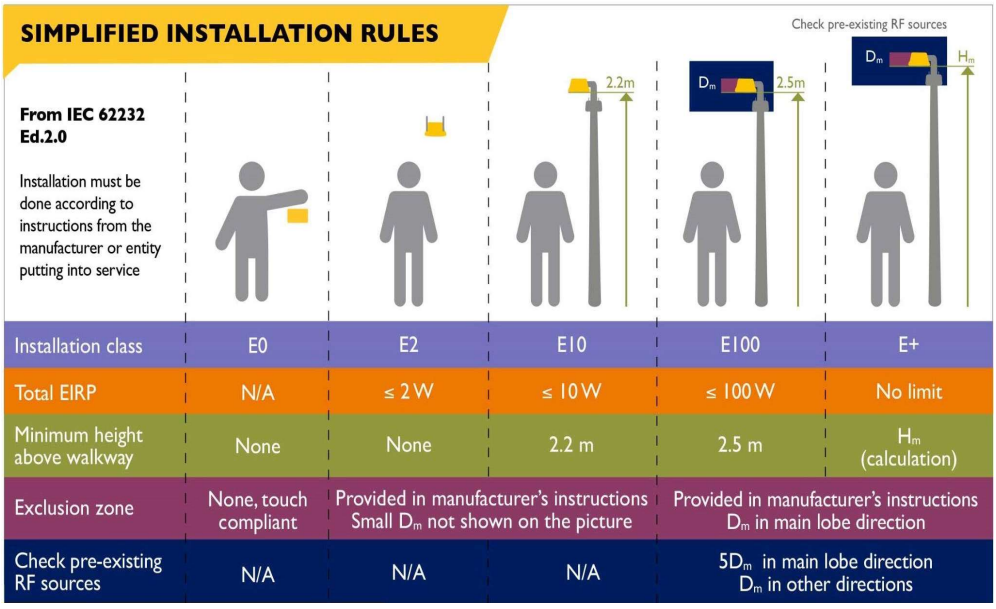
3.15. Since the power emission of small cells are lower compared to macrocells, it can be argued that the cell sites which are installed at certain height clearances and emit lower than a specified power, a generic declaration and certification of the equipment at a national/regional/local level can be adopted to avoid additional documentation and time-consuming processes.

3.16. Product compliance and product installation compliance of the base station can be evaluated using a range of factors such as maximum radiated power, minimum loss between transmitter and passing people and, network performance (transmission and reception). In addition, different criteria may be applied for indoor versus outdoor installations operating at the same EIRP. Based on the technical documentation (transmitted power, typical antenna gains and compliance boundary dimensions) of the small cell designs, installation classes *(a set of acceptable transmitter-mounting locations and permissible radiated powers*

(EIRPs) which have been calculated to comfortably ensure compliance with exposure limits) can be defined. Installation for these classes can be made eligible for permit exemption.

3.17. IEC 62232 and ITU-T K100[32] have defined base station installation classes[33] that are applicable to small cells deployed in countries. Each installation class is based on simple criteria such as the equivalent isotropic radiated power (EIRP) of all equipment at the site or installation height. Figure 3.1 shows the Installation rules developed by IEC 62232 Ed.2.0. and adopted by the SCF. The SCF and GSMA further suggest the adoption of these classes to reduce administrative complexities for both the authorities and operators.

Figure 3.1: IEC Simplified installation rules for small cells



(Source: SCF and GSMA)

3.18. Article 57 of the EECC of the EU, provisions for the exemption of all kinds of buildings from permits as long as the small cells satisfy certain conditions as spelt out by COMMISSION IMPLEMENTING REGULATION (EU) 2020/1070 of 20 July 2020.

[32]https://www.itu.int/rec/T-REC-K.100-202106-I

[33]https://scf.io/en/documents/012_IEC_equipment_classes_infographic.php

This document specifies the characteristics of small-area wireless access points pursuant to Article 57 paragraph 2 of Directive (EU) 2018/1972 of the European Parliament and the Council establishing the European Electronic Communications Code.[34] As has been discussed in previous chapter, in European Union, Article 57 of the EECC provisions the right for operators to access any physical infrastructure controlled by national, regional, or local public authorities, which is technically suitable to host "Small area wireless access points (SAWAP)" or which is necessary to connect such access points to a backbone network, including street furniture, such as light poles, street signs, traffic lights, billboards, bus, and tramway stops and metro stations. For definition of SAWAP, EU has considered that the lowest product installation classes E0, E2 and E10 defined in EN 62232:2017 are relevant to be SAWAPs. These specify an overall emission power limit not exceeding 10 W of equivalent isotropic radiated power (EIRP) (applicable to E10) as well as class-dependent requirements. For Class E10 that specifies a power limit of 10 W EIRP, in all cases a specific minimum antenna height above the general public walkway, is required in order to ensure a minimum distance to people. Under this class, the height of 2.2 meters of the lowest radiating part of the antenna above the general public walkway ensures a distance of at least 20 cm of the main antenna lobe from the human body of a 2 m tall person.

3.19. The regulation defines the physical and technical characteristics of small cells, setting strict limits on their size and power, exempting them from planning permits while retaining national oversight. Article 57 operates to prevent "competent authorities" (which would include, for example, local authorities) from making the deployment of small area wireless access points subject to

[34]https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R1070&from=EN

any individual permits. Moreover, Member States must ensure that local and national authorities offer access to operators to street furniture (like lampposts and street signs) for the installation of wireless access points on fair, reasonable and non-discriminatory terms, with a single point of contact.

3.20. In addition, EECC provisions also mention that a volume range of 20-30 liters is sufficient to accommodate SAWAP's components (i.e., antenna arrays, power supply, cabling connections, etc.). Further, visual characteristics have also been defined in the provisions. SAWAP sites should have a proportionate size relative to the overall size of the supporting structure, coherent shape, neutral colors, and concealed cables, and should not, together with other SAWAP that are already installed in adjacent sites, create aggregate visual clutter. In Egypt also no building permits are required for small cell deployments subject to meeting RF guidelines.

3.21. As the small cell use case expands to the residential and commercial areas, one of the major bottlenecks to the deployment of small cells in such areas would be the restrictions imposed by the Resident Welfare Associations (RWA's) or private owners of the commercial spaces. The restrictions also take the form of exorbitant charges imposed for getting access to these places. Ensuring the removal of such restrictions to the TSP's/IP's and following a no fee regime and employing the practice of deemed approval can be an option. Given the background of the installation classes already defined by IEC 62232 Ed.2.0, there is a scope for India to adopt the internationally defined classes for its small cells similar to the adoption by the European Union.

3.22. Based on the above discussion, the Authority seeks views of the stakeholders on the following questions:

Q.7: Should there be permission exemption for deploying certain categories of small cells at all places or all categories of small cells at certain places (Like apartments etc.)? What legal framework will support such exemptions?

Q.8: What should be the criterion/ conditions (like power, height etc.) and administrative procedure for implementing such exemptions? Please provide exact text with detailed justifications

Q.9: For Small Cells that do not fall under the exemption category, should there be a simplified administrative approval process (like bulk approvals etc.) for deployment? If yes, what should be the suggested process? If not, what should be the alternative approach?

C. Power related issues for deploying small cells on street furniture

3.23. Uninterrupted power supply is one of the primary requirements for functioning of small cells and therefore street furniture like electric poles, bus shelter, billboards, gazebos, traffic lights that already have electric connection can be best suited to host small cells. This can be an economically efficient solution as no extra capital expenditure is required to make electricity provisions. However, some sort of power backup will be required to be hosted in the equipment that will be mounted on the street furniture. For integrating the requirements in designs from the beginning would require collaboration with controlling administrative authorities (CAAs). This can save costs for the CAAs and TSPs/IPs. A well-integrated or camouflaged design will also improve overall aesthetics and reduce the visual pollution. For areas where electricity supply is disrupted or not available, installation of Solar Panels with battery backup can be an option.

not all Street Furniture may be suitable for installing solar panels due to additional wind loads.

3.24. Different small cell configurations have distinct physical categories and therefore suitability of street furniture needs to be assessed for different type of small cell equipment. Table 3.2 provides the technical specifications including physical dimensions, weight of different configurations of available small cell equipment:

Table 3.2: Technical Specifications including Physical Dimensions, Weight of different small cell configurations of a leading OEM

Equipment	Output Power	Weight	Power consumption Typical	Dimensions	Remark
Type 1	55dBm EIRP	10Kg	210W	325x 270x 115 MM	Operates on AC
Type 2	4x5 W - 4 x 20 W	6kg -12 Kg	110W	295X 270X 55MM 245X 345X 130MM	Operates on AC
Type 3	2 x 5 W	6kg - 7kg	84W - 125W	247x 327x 120MM	Operates on AC
Type 4	2 x 20 W	12Kg	285 W	220x380x162 MM	Operates on AC
Type 5	NA	10Kg	200W	482.5x50x463 mm	Operates on 48V DC

(Source: DOT and TEC Committee reports)

3.25. It has been pointed out to the Authority by some of the stakeholders that some of the DISCOMs do not allow giving separate connection or installing electricity meters on street furniture. Some DISCOMs do not treat the street furniture as a commercial address. Others have policy of giving one connection at one address and their processes or IT system do not allow installing another connection at same street furniture location. Even subletting of existing power connection is not allowed by DISCOMs by installing submeters. All these problems will be

required to be addressed. Pre-paid connections to street furniture can be a satisfactory solution. A sum of Rs 22,500 crore has been earmarked as Central Government grant for installation of 25 crore smart prepaid meters across the country under the Rs 3-lakh-crore scheme for power distribution entities (DISCOMs) recently approved by the Cabinet.

3.26. Further, to facilitate faster rollouts, the requirement of taking power connection on several poles or street furniture can be facilitated through process of bulk approvals. Further, DISCOMs can adopt One DISCOM-One Bill-One Payment policy for all Business users that use electricity connections at multiple locations including telecom sector service/infra providers.

3.27. Another issue is affordability of the power. State Electricity Regulatory Commissions prescribe different rates for commercial, industrial, utility, billboard etc. connections as can be seen from table below that gives Electricity tariff schedule for FY 2020-21 as issued by DERC[35]. The rate for public utilities is Rs 6.25/unit whereas the same for advertisement & hoardings is Rs 8.50/unit. Commercial/ Billboard tariffs can affect the viability of a cell site. Telecom sites should be provided electricity connection under utility tariff. SERCs (State Electricity Regulatory Commissions) can be requested to incorporate the same in their tariff orders. In addition, electricity consumption at each telecom site can also be allowed to be aggregated and offset with green power (solar, wind, hydro etc.) generated at distant locations. This will help in reducing the over-all carbon footprint for the sector.

[35] http://www.derc.gov.in/sites/default/files/Tariff%20Schedule%202020-21.pdf

Table 3.3: Electricity tariff schedule for financial year 20-21 as issued by DERC

Sr. No.	CATEGORY	FIXED CHARGES	ENERGY CHARGES				
1	**DOMESTIC**						
1.1	**INDIVIDUAL CONNECTIONS**		**0-200**	**201-400**	**401-800**	**801-1200**	**>1200**
			Units	**Units**	**Units**	**Units**	**Units**
A	Up to 2 kW	20 Rs. /kW/month	3.00 Rs./kWh	4.50 Rs./kWh	6.50 Rs./kWh	7.00 Rs./kWh	8.00 Rs./kWh
B	> 2kW and <= 5 kW	50 Rs. /kW/month					
C	> 5kW and <= 15 kW	100 Rs. /kW/month					
D	>15kW and <= 25 kW	200 Rs. /kW/month					
E	> 25kW	250 Rs. /kW/month					
1.2	**Single Point Delivery Supply for GHS**	150 Rs. /kW/month	4.50 Rs. /kWh				
2	**NON-DOMESTIC**						
2.1	Upto 3kVA	250 Rs. /kVA/month	6.00 Rs. /kVAh				
2.2	Above 3kVA	250 Rs. /kVA/month	8.50 Rs. /kVAh				
3	**INDUSTRIAL**	250 Rs. /kVA/month	7.75 Rs. /kVAh				
4	**AGRICULTURE**	125 Rs. /kW/month	1.50 Rs. /kWh				
5	**MUSHROOM CULTIVATION**	200 Rs. /kW/month	3.50 Rs. /kWh				
6	**PUBLIC UTILITIES**	250 Rs. /kVA/month	6.25 Rs. /kVAh				
7	**DELHI INVERNATIONAL AIRPORT LTD. (DIAL)**	250 Rs. /kVA/month	7.75 Rs. /kVAh				
8	**ADVERTISEMENT & HOARDINGS**	250 Rs. /kVA/month	8.50 Rs. / kVAh				

Based on the above context, the following questions arise:

Q.10: What power related problems are envisaged in deploying small cells on street furniture? Please provide full details.

Q.11: What viable solutions are suggested to address these problems? Please provide full details.

D. Need for standardization of equipment/installation practices for small cell mounted on street furniture

3.28. For deploying small cells on street furniture, apart from obtaining right of way and ensuring availability of power, one must also

look at suitability of the street furniture for mounting the equipment. Standardized designs can help control administrative authorities to easily assess the suitability of street furniture from point of view of load/wind bearing capabilities, ground/other installation clearances and aesthetics. Standardization of small cell equipment would not only aid in this aspect but will also help the TSPs/IPs to keep control and optimize resource utilization. Standard equipment designs can also help in gaining the trust of end-users by following proper functional aspects and ensuring QoS requirements. Presently, there are no guidelines for specific design requirements and standards that are required to ensure quality of performance, safety, aesthetic issues on the usage of small cells on street furniture. If the equipment used by the operators is to be approved and certified before site planning, the deployment of small cells at a large scale can be costly and time consuming. Therefore, the issue of a highly fragmented equipment ecosystem needs to be properly addressed. If standards for designs of small cell equipment are spelt out, this can help in easy acceptance of controlling administrative authorities and faster rollouts.

3.29. Harmonization of standards and issue of the design guidelines to work across the small cell markets can benefit the TSP's and ISP's by reducing the Time to Market (TTM) for rolling out 5G services in India and benefit controlling administrators by way of dealing with a simplified administrative process. The Small Cell Forum, in its various other reports over the years also suggests broad solutions to tackle the above challenges. Still there has been no consonant approach between countries on the design, specifications, or structure on which the small cell equipment might be installed.

3.30. However, there can be arguments against this approach. Adoption of standard equipment or Installation practices may not

help in solving problems of fragmentation of the equipment market, as there is lot of variation/customization in designs of street furniture itself and every installation may be required to be tailored to meet specific conditions such as quality and design of Street Furniture, power related issues etc. Presently there are many global private players like Ericsson, Samsung, Nokia, Huawei, CommScope etc. manufacturing small cell BTS equipment which vary by their designs, configurations, power requirements etc. As per the present landscape of India, the type of small cells expected to deploy varies as per the requirements of service providers and use cases. The design of 5G outdoor small cells by service providers are currently under development and the finalization of exact specifications may take time as the current specifications are subject to changes (in dimensions and power specs) based on future developments. Standard designs for mounting equipment may not be able to accommodate several types of equipment available. It may also kill the innovation and ingenuity in finding site specific solutions.

3.31. Based on the above context, the following question needs to be addressed:

Q.12: Is there a need for standardizing the equipment or installation practices for next generation small cell deployment on street furniture? If yes, what are the suggested standards and what should be the institutional mechanisms for defining, and complying to them?

E. Need for cross sectoral collaborations & Institutional coordination

3.32. Faster and cost-effective deployment of small cells on street furniture would primarily depend on collaboration with CAAs,

especially when using publicly owned sites. Each State and Union territory have their own byelaws and processes, the deployment of small cells and aerial fiber on street furniture can be held back by a cumbersome and outmoded process. One of the primary problems for the deployment of small cells would be rules and processes which are not devised for the small cell equipment or with vast numbers of units in mind. The complexity of administrative processes such as identifying and approving a large number of sites, securing planning permissions and dealing with taxes and fees may vary largely across different regions.

3.33. Small cell deployment on street furniture can make substantial progress only if the industry works in conjunction with regulatory bodies. Consequently, significant new approaches are needed in the regulatory and administrative processes which govern mobile deployments. Thus, it is essential to put in place cross sectoral collaborative and coordination mechanisms to adopt simplified, smoother, and streamlined procedures or a unified permit regime so that small cells can be deployed at required pace and scale to deliver maximum benefits.

3.34. National and State Level Broadband Committees have already been proposed by the Government in the National Broadband Mission[36] (NBM). The NBM i.e., Rashtriya Broadband Abhiyan was developed in December 2019 to operationalize the 'Broadband for All' objectives of NDCP. The committees are composed of officials from the DoT HQ, DoT-LSAs and State (PWD/Urban development/Forest and Environment/IT) together. As the Government has already taken action to constitute these broadband committees across various LSAs, they are expected to cater to the need for a collaborative institutional mechanism between Centre, States, and Local Bodies for addressing all RoW related Policy and execution issues. It can be argued that these

[36]https://dot.gov.in/sites/National%20Broadband%20Mission

collaborative institutional mechanisms are already in place and can serve the purpose for small cell and arial fiber deployment using street furniture also. However, these committees do not have representations from other government/public institutions that control street furniture such as airport authorities, port trusts, metro/railway authorities.

3.35. In view of the above background Authority seeks views of stakeholders on the following:

Q.13: Is there a need for a specific mechanism for collaboration among local bodies /agencies for deployment of small cells and aerial fiber using street furniture? If yes, what mechanisms should be put in place for collaboration among various local bodies/agencies involved in the process of permissions with TSPs/IP1s and to deal with other aspects of Small Cell deployment?

Q.14: Kindly suggest an enabling Framework that shall include suggestions about the role of various authorities, rules of coordination among them, compliance rules and responsibilities, approval process, levies of fees/penalties, access rules etc.

F. Sharing of street furniture

3.36. 5G infrastructure demands a huge densification of small cell sites. If each individual operator deploys their own equipment over the street furniture structure to differentiate on the depth and quality of coverage, it would lead to issues relating to power supply, permission, aesthetic, and monetary aspects. To solve this concern, the existing 4G tower sharing practice by the operators in India can be adopted for street furniture usage as well to enable economies of scale and enhance affordability.

3.37. As already mentioned by the Authority in its recommendations[37] on the roadmap to promote broadband connectivity and enhanced broadband speed, the Government can consider expanding the scope of the IP-I category registration to include sharing of active infrastructure to non-licensed service providers who deploy small-scale architecture in these infrastructure elements. And to ensure sufficient power supply to the small cell sites, sharing of nearby power sources and generation units can be undertaken. Active infra sharing will expand the scope for small cell site sharing.

3.38. Small cell deployment on street furniture by TSPs who have already started doing so, are based on inhouse designs supporting only single operator deployment. Telecom equipment designs supporting multi-vendor deployments are generally used by infrastructure providers in India. Exploring deeper collaboration practices and bringing in regulations that permit or even oblige sharing agreement between mobile operators can help the Indian small cell deployment scenario.

3.39. Sharing of small cells using the Multi-operator Radio Access Network (MO-RAN) architecture where only the base station equipment is shared while the core network is proprietary to each network provider is a possibility. In MO-RAN, the cell coverage area is independent and have dedicated radio frequencies assigned to each mobile operator. This provides scope for each operator to control cell level, interference and decide their own optimization parameters. In MO-RAN, two or more operators operate on different spectrum, and this is the feature that differentiate MO-RAN from MO-CN (Multi operator Core Network) which is another popular RAN sharing approach where the operator with frequency spectrum shares the allocated spectrum

[37]https://trai.gov.in/sites/default/files/Recommendations_31082021.pdf

with other operators. If IP-I players are allowed to deploy active infrastructure owned by themselves, under a MORAN model, non-telco players (IPs) can allow TSPs to significantly minimize deployment costs, especially by sharing expensive 5G base station equipment. In many markets especially in developing markets in Asia, Africa, Middle East, Latin America and some markets in Europe, spectrum pooling is not allowed, hence MORAN-based sharing is a popular model

3.40. The adoption of Open-RAN (Radio Access Network) standards that support interoperation between vendors' equipment and offer network flexibility at a lower cost can further help the case of sharing.

3.41. Based on the above discussions on the scope and background of small cell sharing and worldwide practices, the following questions arise:

Q.15: How can sharing street furniture for small cell deployment be mandated or incentivized? What operational, regulatory, and licensing related issues are expected to be involved in sharing of small cells through various techniques in the Indian context and what are the suggested measures to deal with the same?

CHAPTER 4

Various Street Furniture Designs for small cell and aerial fiber deployment

4.1 An exploration to public spaces design and analysis of the innovative and technological scope of street furniture facilities can help in creating a comfortable and pleasant solution to the deployment of small cells. As quoted by a study[38] on "Smart Technical Street Furniture Design," 2017 published in the 'Academic Research Community Publication', smart Street Furniture has become a symbol for the concept of smart Cities and public places that use technology to enhance services, reduce costs and resource consumption to enable residents to engage more effectively, actively with each other among places in which they live and work. As street furniture comes in different shapes and sizes, the reference model for planning and implementation should be tailored such that it meets the local or national innovation characteristics.

4.2 Telecom infrastructure design firms globally have come up with aesthetic designs for street furniture such as camouflaged monopole/street pole, fake chimneys, bus stops, solar trees to host small cells. Similarly major telecom OEMs have also designed small cell solutions which are ideal for airports, railway /metro stations, shopping malls, commercial parking spaces, and public hotspots. Solutions have been designed that can be plugged into any existing streetlight, draws power from existing photocell pockets and is virtually invisible from the street level. It comes packed with a fully integrated 4*4 MIMO antenna system and includes power supply compatible for all streetlights.[39] In India also, street structures such as smart poles are being used

[38]https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3056712

[39]https://www.ericsson.com/en/small-cells/outdoor-coverage/street-solutions

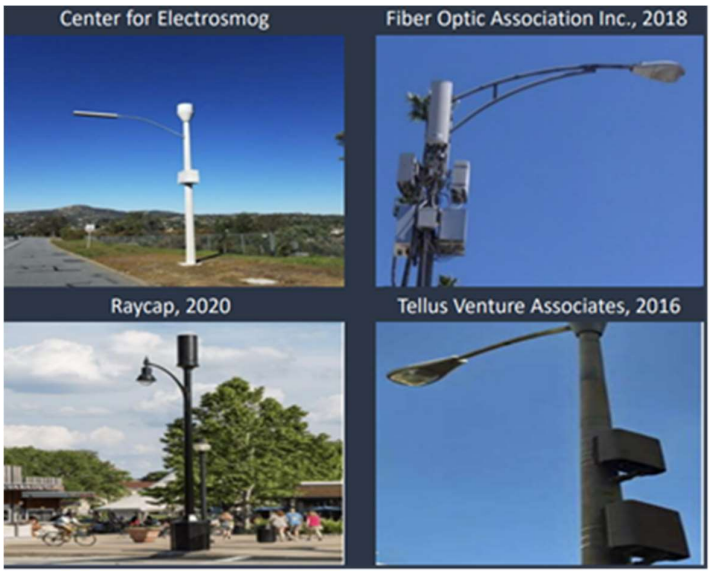
in Delhi, Dahod, Chennai, Mangalore etc. and smart bus stops have been used in Aurangabad and Kolkata.

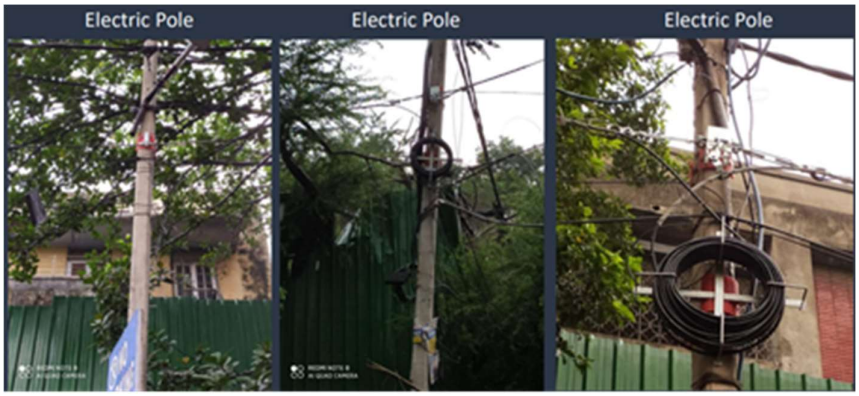
4.3 IPs and TSPs have shared various street furniture structures deployed both in India and worldwide during discussions with the Authority. This chapter aims to provide examples of street furniture designs adopted worldwide as shared by the stakeholders that can act as a guide to provide an objective picture for developments in the context of India.

A) Streetlights or Electric poles or Utility poles

4.4 Integrating 5G small cells into streetlights are one of the most ideal and feasible solutions considering its benefits of optimum height, presence of an existing electrical infrastructure, and that they do not add an additional structure into the public right of way. Streetlights come with electricity, and they are often in close proximity to fiber for backhaul. The pervasive nature of streetlights, i.e., the convenient location near homes, businesses, enterprises and even in rural areas adds to the advantage of ensuring ubiquitous coverage. The following figures represent examples of small cell deployments in street furniture as shared by the various stakeholders.

Source: Input from COAI and Ericsson





Source: Input from DIPA

Source: Input from GSMA

Maintenance free Earthing and Strip to poles with SC

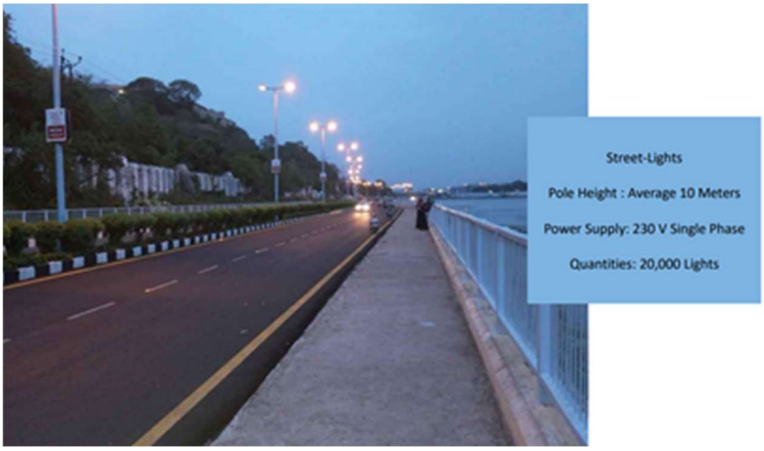
Utility Pole ready with Mount and Enclosures

Pole Mount (1 M) for 2 Small Cell supporting 180 Degree Orientation

Demo Site with 2 Small Cell Installed

Source: Input from ATC

Source: Input from COAI

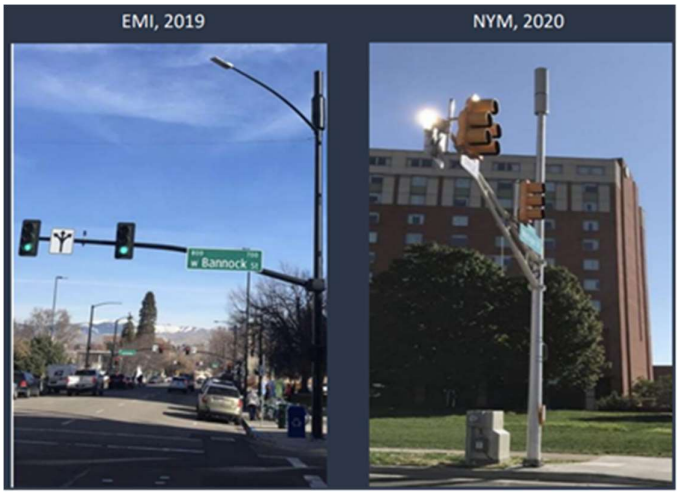


Source: Input from Bhopal Smart City

B) Traffic Signals

4.5 Although Traffic signals are less abundant in terms of location, they are a good option when one needs to reinforce coverage at locations where other cells do not have sufficient coverage. They can also cater to large number of users stopped at signal or in vicinity. The optimal height, relatively simple installation are factors that make it a reliable option. Traffic signals are easy to make and aesthetically pleasing. Following figures show the small cells installed on traffic signal posts.

Source: Input from Bhopal Smart City



Source: Input from DIPA

C) Bus stops

4.6 Since Bus shelters are generally in areas of high population density and are locations where people tend to gather frequently, they can host small cells to offer good signal ranges and connect people. They also offer flexibility to hide small cells within a shelter or match them aesthetically. Some examples include on the sides or top of advertisement boards, within a box on top of the shelter, within signs depicting the stops that the buses make, etc. Following figures show small cells deployed at bus shelters.

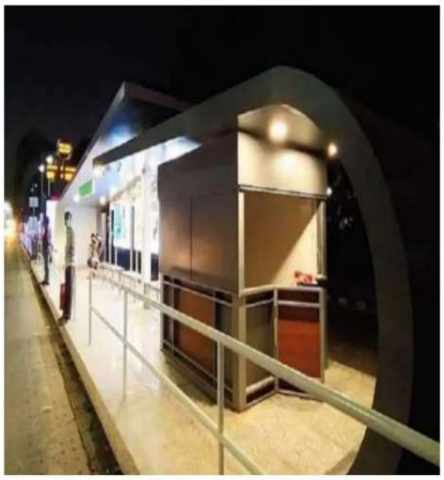
Source: Input from DIPA

Source: Input from Bhopal Smart City

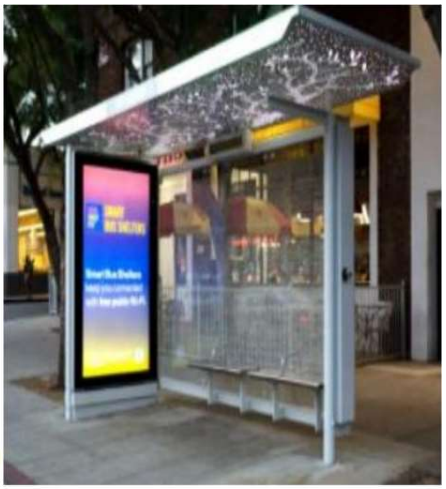
Source: Input from COAI and Ericsson

Dubai, Smart Shelter

Abu dhabi AC Bus Shelter



Smart Bus Stop, Kolkata



Smart Bus Stop, Aurangabad

Source: Input from COAI

D) Kiosks

Source: Input from COAI and Ericsson



Source: Input from COAI

E) Smart poles

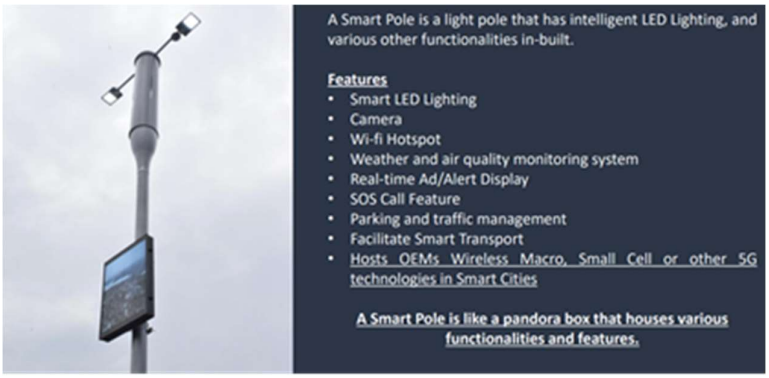
4.7 Smart poles are the modern-day solution that not only act as a structure to place small cells, but also provide a variety of services such as WIFI, intelligent streetlights, environmental sensors etc. They are being adopted actively in urban areas and especially smart city projects.

Source: Input from Bhopal Smart City

Source: Input from COAI and Ericsson

Smart Pole , Dahod | Multipurpose Smart Pole , Chennai | Smart Poles, Mangaluru

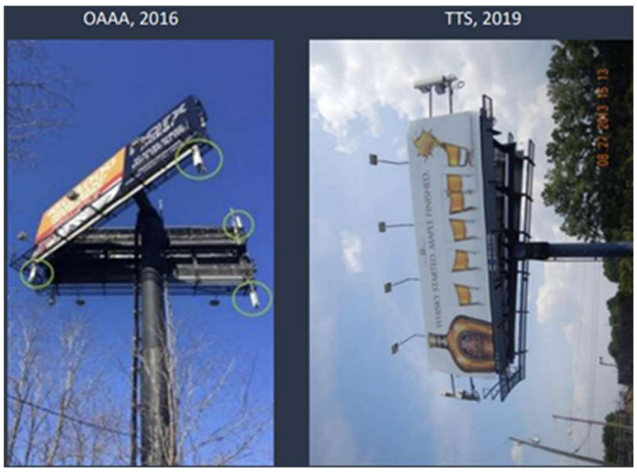
Source: Input from COAI



Source: Input from DIPA

Source: Input from Indus

F) Billboards



Source: Input from DIPA

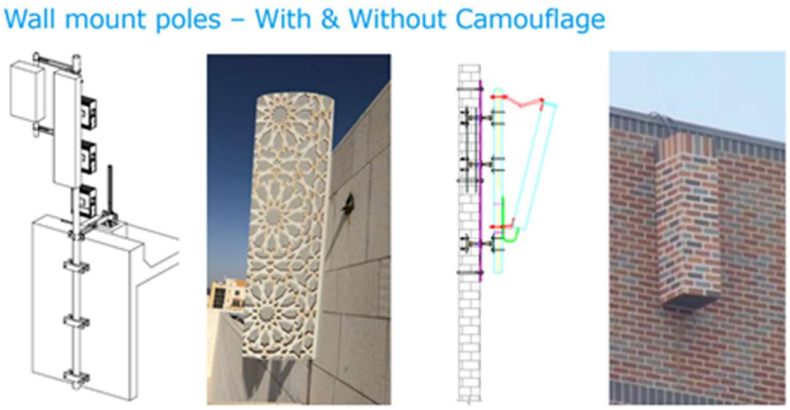
Source: Input from COAI

G) Solar trees

Source: Input from COAI

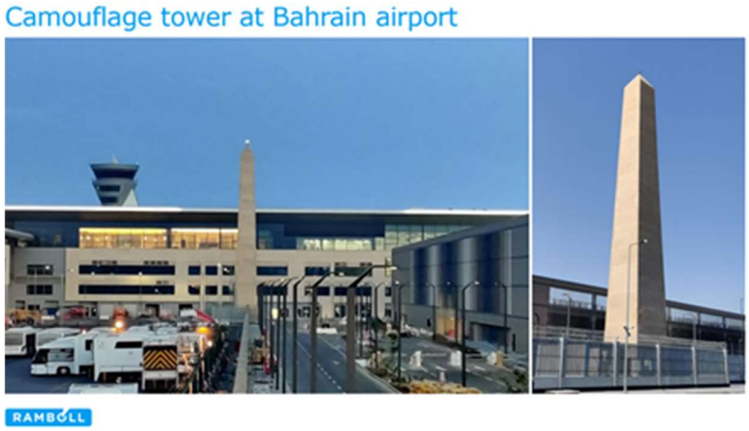
H) Other structures

- **Wall mount poles**



Source: Input from COAI

- **Camouflage tower**

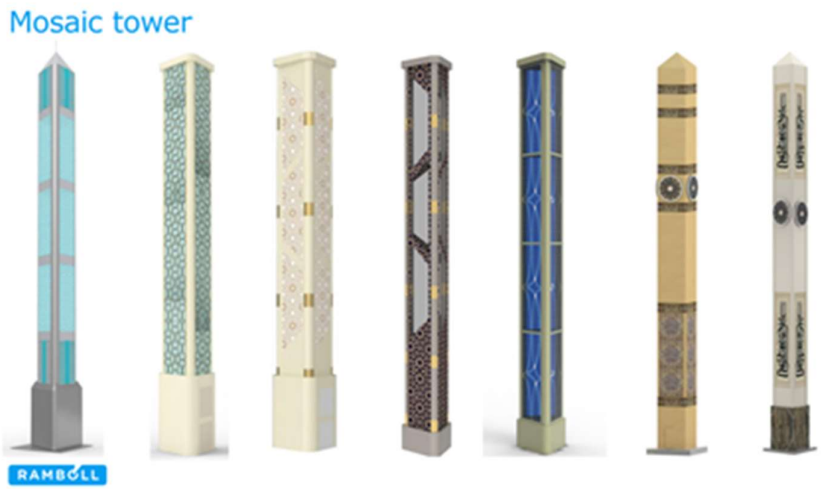


Source: Input from COAI

- **Fake chimneys**

Source: Input from COAI

- **Mosaic tower**



Source: Input from COAI

- **Phone booth**

Source: Input from COAI

- **Underground vault**

Source: Input from COAI and Ericsson

- **Water towers**

Source: Input from DIPA

- **Street road signage**

Source: Input from COAI
(Source: Input from ATC)

4.8 In consideration of the various street furniture structures used and being developed worldwide and in India and with regard to the potential regulatory factors that can affect access to street furniture, the following questions arise:

Q.16: a) Whether there should be any specific regulatory and legal framework to enable Small Cell and Aerial Cable deployment on

(i) Bus Shelters

(ii) Billboards

(iii) Electric/Smart Poles

(iv) Traffic lights

(v) Any other street furniture

Q.17: What should be the commercial arrangements between the TSP's/Infrastructure Providers and street furniture owners for the same?

CHAPTER 5

ISSUES FOR CONSULTATION

Q.1: Is there a requirement for any modification in existing RoW Rules as notified by DoT to accommodate small cell deployment on street furniture? If yes, please provide the changes required.

Q.2: Have the amendments issued in 2021 to RoW rules 2016 been able to take care of the needs of aerial fiber deployment? If not, what further amendments can be suggested? Please provide exact text with justification.

Q.3: What are the suggestions of stakeholders for aligning RoW policies issued by various other Central Government Bodies with existing DoT RoW policy?

Q.4: Whether it should be mandated that certain public infrastructure (municipality buildings, post offices, bus, and railway stations, etc.) be earmarked to have dedicated spaces that allow service providers to deploy macro/small cells? If yes, what are the possibilities and under what legal framework this can be done? What should be the terms and conditions of use of such infrastructure? Please provide detailed inputs with justifications.

Q.5: Can some of the street furniture like traffic lights, metro pillars etc be earmarked for mandatory sharing between controlling administrative authority and Telecom Service/Infrastructure providers for deployment of small cells and aerial fiber? Does existing legal framework support such mandating? What should be the terms and conditions of such sharing? Please provide details

Q.6: How can infrastructure mutualization and infrastructure collaboration be ensured to avoid exclusive rights of way? What legal provisions can support mandating these? Provide full details.

Q.7: Should there be permission exemption for deploying certain categories of small cells at all places or all categories of small cells at certain places (Like apartments etc.)? What legal framework will support such exemptions?

Q.8: What should be the criterion/ conditions (like power, height etc.) and administrative procedure for implementing such exemptions? Please provide exact text with detailed justifications

Q.9: For Small Cells that do not fall under the exemption category, should there be a simplified administrative approval process (like bulk approvals etc.) for deployment? If yes, what should be the suggested process? If not, what should be the alternative approach?

Q.10: What power related problems are envisaged in deploying small cells on street furniture? Please provide full details.

Q.11: What viable solutions are suggested to address these problems? Please provide full details.

Q.12: Is there a need for standardizing the equipment or installation practices for next generation small cell deployment on street furniture? If yes, what are the suggested standards and what should be the institutional mechanisms for defining, and complying to them?

Q.13: Is there a need for a specific mechanism for collaboration among local bodies /agencies for deployment of small cells and arial fiber using street furniture? If yes, what mechanisms should be put in place for collaboration among various local bodies/agencies involved in the process of permissions with TSPs/IP1s and to deal with other aspects of Small Cell deployment?

Q.14: Kindly suggest an enabling Framework that shall include suggestions about the role of various authorities, rules of coordination among them, compliance rules and

responsibilities, approval process, levies of fees/penalties, access rules etc.

Q.15: How can sharing street furniture for small cell deployment be mandated or incentivized? What operational, regulatory, and licensing related issues are expected to be involved in sharing of small cells through various techniques in the Indian context and what are the suggested measures to deal with the same?

Q.16: Whether there should be any specific regulatory and legal framework to enable Small Cell and Aerial Cable deployment on

i. **Bus Shelters**
ii. **Billboards**
iii. **Electric/Smart Poles**
iv. **Traffic lights**
v. **Any other street furniture**

Q.17: What should be the commercial arrangements between the TSP's/Infrastructure Providers and street furniture owners for the same?

ANNEXURE-I (Chapter 2, Para 2.19)

Small cell International Experience proforma (part I of II)

Country	Term used for small cells	RoW for small cells	National/state/local laws	Rooftop/ building related provisions	Restrictions on location of small cells
United States of America (USA)	Small area wireless facilities	ROW for small wireless facilities is provisioned in the Declaratory ruling and third report and order released in 2018 by the FCC for Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment. The order: • Limited fees that local governments can impose for accessing public rights-of-way (ROW), above a safe harbor amount, to a "reasonable approximation" of the costs of processing applications and managing the RoW. • Ordered that "aesthetics requirements are not pre-empted if they are (1) reasonable, (2) no more burdensome than those applied to other types of infrastructure deployments, and (3) objective and published in advance" • Shortened the FCC's timelines for approving permit applications ("shot clocks") to deploy wireless facilities from 90 to 60 days to review applications for installations on existing infrastructure and from 150 to 90 days for all other applications.	As per the 2021 state legislation, more than 30 state legislatures have enacted small cell legislation that streamlines regulations to facilitate the deployment of 5G small cells. These laws take into consideration the unique circumstances of their state and local environment, but baseline principles can be established and are consistent with wireless industry standards, including: Streamlined applications to access public rights of way. Caps on costs and fees. Streamlined timelines for the consideration and processing of cell siting applications.	Building permits are required for personal wireless facilities and small wireless facilities and carries the fee based on the cost to the Government of processing that application. Associating small wireless facilities with structures (building, pole, PowerStation) requires meeting further specified conditions consistent with section 1.1312(e)(2)	Tribal areas
European Union (EU)	Small area wireless access points (SAWAP)	Article 57 of the European Electronic Communications Code (2018) states the following regarding the deployment and operation of small area wireless access points(SAWAP): 1)Competent authorities shall not unduly restrict the deployment of SAWAP and that member States shall	Competent authorities shall not unduly restrict the deployment of SAWAP, and that member States shall seek to ensure that any rules governing the deployment of the same are nationally consistent.	Article 57 of the EECC,2018 mentions that deployment of SAWAP on buildings does not require individual permits as long as the physical and technical characteristics are complied with.	

		seek to ensure that any rules governing the deployment of the same are nationally consistent. 2)Competent authorities shall not subject the deployment of SAWAP with any individual town planning permits or prior permits of those complying with the characteristics in future implementing acts (The physical and technical characteristics such as maximum size, weight, and where appropriate emission power of SAWAP will be specifies by means of future implementing acts) 3)Public authorities shall meet all reasonable requests for access on fair, reasonable, transparent and non-discriminatory terms and conditions, which shall be made public at a single information point and also ensure that operators have the right to access any physical infrastructure controlled by national, regional or local public authorities, which is technically suitable to host SAWAP (in accordance to Directive 2014/61/EU and charges not exceeding administrative charges as per with Article 16)	The EU Member States have made different choices in the parameters (location, mounting, total size, power, antenna) used to define eligibility for exemption from local permits.	But by way of derogation from the specified characteristics, competent authorities may require permits for the deployment of SAWAP on buildings or sites of architectural, historical, or natural value protected in accordance with national law or where necessary for public safety reasons.	Buildings or sites of architectural, historical, or natural value or where necessary for public safety reasons would require permits
Australia	Small cells ('low impact facilities' include small cells and micro cells)	The exemptions and powers of the carriers to deploy 'low impact facilities' without the scrutiny of State and Territory laws and Council approval is enshrined in the Telecommunications (Low Impact Facilities) Determination 1997 (the Determination), which was amended in 1999, 2018 and 2020. As per the Australian Communications and Media Authority (ACMA),Telcos would install and maintain small cells and they don't need a local council or other government to approve their work. But telcos must follow the Mobile Phone Base Station Deployment Code(C564:2020) if the small cell is to be used for mobile services.	Deployment of Low impact facilities are exempt from state and territory laws and council approval	The Telecommunications (Low Impact Facilities) Determination 1997 deals with the mounting of antennas on existing buildings and structures without the scrutiny of State and Territory laws and Council approval if the facility satisfies the physical and locational characteristics laid in clause 5.2 to be called low impact.	The code mentions that the carrier must ensure that its written procedures for new site selection for MPRI (which includes small cells) require it to have regard to the objective of avoiding community sensitive locations (residential areas, childcare centres, schools, aged care centres, hospitals, and regional icons)

		When the small cell is to be used for mobile services, they must notify owners and occupiers before they install. Under this code they must: •tell councils and the public about their plans and when they will install •respond to submissions from councils during the comment period			Deployment in Area of environmental significance is under the scrutiny of state laws /council approval
Hong Kong	Radio base station (RBS)	No Right of Way has been provided for the use of Radio base stations (RBS) for 5G rollout specifically, but guidelines and a One-stop Application Procedure (OSAP) has been provided for the installation of RBS at rooftops, buildings and restricted areas for serving all generations of services. As per the Office of the Telecommunications Authority (OFTA), RBS is defined as a structure including a cabinet and antenna not exceeding a specified size and located at the side or on the rooftop of a building for the provision of public telecom services to serve the local district. The communications annual report 2019-20 states that for the deployment of 5G services in Hong Kong, MNOs would establish a larger number of radio base stations as compared with previous generations of mobile services.		Guidelines have been issued and a one stop application procedure has been set up in 2010 for the submission of applications by public telecommunications operators for the installation of radio base stations for public telecommunications services in buildings and on rooftops	Not permitted in conservation zones such as “Conservation Area,” “Coastal Protection Area,” “Site of Special Scientific Interest,” “Other Specified Uses” annotated “Comprehensive Development and Wetland Enhancement Area.”

Small cell International Experience proforma (part II of II)

Country	Backhaul for small cells	Effective Isotropic Radiation Power (EIRP) provisions for small cells	Electric Power related provisions for small cells	Specific provisions related to					
				Cabinets used for small cells	Bus stops	Lamp Posts	Traffic Lights	Billboards	Any other
USA	No provision in the FCC 2018 order	Specific provision on EIRP is not given in the FCC 2018 order but it is mentioned that small wireless facilities should not result in human exposure to radiofrequency radiation in excess of the applicable safety standards specified in section 1.1307(b)of the FCC 2018 order	No provision in the FCC 2018 order	New, existing and replacement light poles, traffic lights, utility poles, and similar property suitable for hosting Small Wireless Facilities are provisioned and the state/local Govt own or control these areas and recurring charges as per section 253 or section 332(C) can only be levied.					
						YES	YES		

EU	No provision in the EECC 2018 The EU, Commission Staff Working Document ,2020 specifies that the transmission/backhaul(wireless) for SAWAP to not exceed the volume limit 0,4/4-5 L for SAWAP	Article 58 of the EECC on the Technical regulations on electromagnetic field states that the procedures in Directive (EU) 2015/1535 shall apply with respect to any draft measure by a Member State that would impose on the deployment of SAWAP different requirements with respect to electromagnetic fields than those provided for in Recommendation 1999/519/EC EU, Commission Staff Working Document ,2020 specifies different EIRP limits for different installation classes: •Class E0(below 250 mW EIRP) •Class E2 - a higher power limit of 2 W EIRP •Class E10 - a power limit of 10 W EIRP	No electric power related provisions are provided in EECC,2018 and Staff Working Commission report ,2020.	Article 57 of the EECC provisions the right for operators to access any physical infrastructure controlled by national, regional, or local public authorities, which is technically suitable to host SAWAP or which is necessary to connect such access points to a backbone network, including street furniture, such as light poles, street signs, traffic lights, billboards, bus, and tramway stops and metro stations.						
					YES	YES	YES	YES	Street signs Metro stations	

Australia	No provision in the Mobile Phone Base Station Deployment Industry Code (C564:2020)	The Australian safety standards for exposure to radiofrequency electromagnetic energy (RF EME) are set by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). ARPANSA published the Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (ARPANSA RF Standard) in 2002. ACMA states that all mobile phone base stations, including small cells and 5G base stations, must stay within the safe EME levels and that 5G base stations can also go into 'sleep mode' when they are not in use. Audits, investigations and Site inspections are conducted to check the EME levels.	No specific provision has been given in the Mobile Phone Base Station Deployment Industry Code (C564:2020) for 5G small cell deployment. But the infrastructure site selection and design clause in C564:2020 requires the carrier to have an objective on minimizing power whilst meeting service.	The Mobile Phone Base Station Deployment Industry Code (C564:2020) has not provisioned for use of street furniture for 5G deployment. But the work on the "Inquiry into the deployment, adoption and application of 5G in Australia" by the House of Representatives Standing Committee on Communications and the Arts in 2020 has mentioned that Street furniture in cities such as 'lamp posts, park infrastructure and buildings' can be used as an opportunity to leverage the existing assets for small cell deployments.			YES			

Hong Kong	No provision by the Communications Authority regarding the backhaul of RBS for 5G rollout	Under the guidelines for the installation of RBS issued by the OFTA, the applicants are supposed to ensure that the electromagnetic field strength is in full compliance with the requirements specified in the "Code of Practice for the Protection of Workers and Members of Public Against Non-Ionizing Radiation Hazards from Radio Transmitting Equipment" issued by OFTA if the aggregate EIRP of the antenna exceeds 2 Watts.	No provision by the Communications Authority	OFCA (Office of the Communications Authority) has been working closely with the industry to identify suitable street level furniture and public facilities for the installation of radio base stations, such as public payphone kiosks, sheltered bus stops, smart lampposts, etc. Specific guidelines on the use of Sheltered Bus stops and public payphone kiosks for the installation of RBS for provision of public mobile services has been laid down in 2020 and 2021 respectively					
					YES				Payphone kiosks

(Source: Information compiled by the Authority)

List of Acronyms

S. No.	Acronym	Description
1	2G	Second Generation
2	3G	Third Generation
3	3GPP	The 3rd Generation Partnership Project
4	4G	Fourth Generation
5	5G	Fifth Generation
6	AI	Artificial Intelligence
7	AR	Augmented Reality
8	ATC	American Tower Company
9	BS	Base Station
10	CAA	Controlling Administrative Authorities
11	CAPEX	Capital Expenditure
12	CCTV	Closed-Circuit Television
13	COAI	Cellular Operators Association Of India
14	CP	Consultation Paper
15	CSC	Common Service Centres
16	DAS	Distributed Antenna Systems
17	dBm	Decibel Milliwatts
18	DERC	Delhi Electricity Regulatory Commission
19	DIPA	Digital Infrastructure Providers Association
20	DISCOMs	Distribution Company
21	DoT	Department Of Telecommunications
22	DoT-LSAs	DoT-Licensed Service Areas
23	EECC	European Electronics Communication Code
24	EIRP	Effective Isotropic Radiation Power
25	EU	European Union

26	FCC	Federal Code of Communication
27	FSO	Free Space Optics
28	FY	Financial Year
29	GSMA	Groupe Speciale Mobile Association
30	HQ	Head Quarters
31	IBS	In-Building Systems
32	ICCC	Integrated City Command & Control Center
33	ICT	Information & Communication Technology
34	IEC	International Electrotechnical Commission
35	IEC	International Electrotechnical Commission
36	IMDA	Infocomm Media Development Authority
37	IoT	Internet Of Things
38	IPs	Infrastructure Provider
39	IT	Information Technology
40	ITU	International Telecommunication Union
41	LTE	Long Term Evolution
42	M2M	Machine-To-Machine
43	MIMO	Multiple-Input Multiple-Output
44	MNO's	Mobile Network Operators
45	MO-RAN	Multi-Operator Radio Access Network
46	MPRI	Mobile Phone Radio Communications Infrastructure
47	NBM	National Broadband Mission
48	NDCP	National Digital Communications Policy
49	OEMs	Original Equipment Manufacturer
50	OFC	Optical Fibre Cables
51	OFCA	Office of the Communications Authority
52	OFTA	Office of the Telecommunications Authority
53	OPEX	Operational Expenditure

54	OSAP	One-Stop Application Procedure
55	PWD	Public Works Department
56	QOS	Quality Of Service
57	RAN	Radio Access Network
58	RBS	Radio Base Stations
59	RF	Radio Frequency
60	RFP	Request For Proposals
61	RoW	Right Of Way
62	RWAs	Resident Welfare Associations
63	SAWAP	Small Area Wireless Access Points
64	SCF	Small Cell Forum
65	SERC	State Electricity Regulatory Commission
66	SINR	Signal-To-Interference- Plus-Noise Ratio
67	SWF	Small Wireless Facilities
68	TEC	Telecommunication Engineering Centre
69	TRAI	Telecom Regulatory Authority of India
70	TSPs	Telecom Service Providers
71	TTM	Time To Market
72	UK	United Kingdom
73	US	United States
74	VIP	Very Important Person
75	VR	Virtual Reality
76	Wi-Fi	Wireless Fidelity