Telecom Regulatory Authority of India

Consultation Paper on

Rating of Buildings or Areas for Digital Connectivity

New Delhi, India

(March 25, 2022)

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Written comments on the consultation paper are invited from the stakeholders by May 04, 2022. Counter-comments, if any, may be submitted by May 18, 2022. The comments and counter-comments will be posted on TRAI's website: www.trai.gov.in.

The comments and counter-comments may be sent, preferably in electronic form to, Shri Asit Kadayan, Advisor (QoS) Telecom Regulatory Authority of India, on email: advqos@trai.gov.in

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LIST OF ACRONYMS

S. No.	Acronyms	Full Text
1	AEC	Architecture, Engineering and Construction
2	AI	Artificial Intelligence
3	AICTE	All India Council for Technical Education
4	AR	Augmented Reality
5	ARC	Area to be Rated for Digital Connectivity
6	BICSI	Building Industry Consulting Service International
7	BCP	Best Current Practice
8	BIM	Building Information Modelling
9	CAD	Computer Aided Design
10	COBIE	Construction Operations Building Information Exchange
11	CoP	Community of Practice
12	CPWD	Central Public Works Department
13	CTI	Common Telecom Infrastructure
14	CTNS	Certified Telecommunication Network Specialist
15	DAS	Distributed Antenna System
16	DCI	Digital Connectivity Infrastructure
17	DoT	Department of Telecommunication
18	IBS	In-Building Solution
19	ICT	Information and Communication Technology
20	iNARTE	International Association for Radio, Telecommunication & Electromagnetics
21	IoT	Internet of Things
22	IP	Infrastructure Provider
23	KPI	Key Performance Indicator
24	LTE	Long Term Evolution
25	LSA	License Service Area

26	LV	Low Voltage
27	MBBL	Model Building Bye-laws
28	M2M	Machine to Machine
29	MEP	Mechanical Electrical and Plumbing
30	MoHUA	Ministry of Housing and Urban Affairs
31	NBC	National Building Code of India, 2016
32	NOC	No Objection Certificate
33	O-RAN	Open Radio Access Network
34	QoS	Quality of Service
35	RAN	Radio Access Network
36	RCCD	Registered Communication Distribution Designer
37	REx	Rating of Digital Connectivity Experience
38	RF	Radio Frequency
39	RoW	Right of Way
40	RWA	Residents Welfare Association
41	SLA	Service Level Agreement
42	TCO	Telecommunication Certification Organisation
43	TEC	Telecom Engineering Centre
44	TIA	Telecommunications Industry Association
45	TRAI	Telecom Regulatory Authority of India
46	TSP	Telecom Service Provider
47	UAV	Unmanned Aerial Vehicle
48	UL	Underwriters Laboratory
49	ULB	Urban Local Bodies
50	URDPFI	Urban and Regional Development Plans Formulation and Implementation
51	VR	Virtual Reality
52	WANI	Wi-Fi Access Network Interface
53	WFH	Work From Home

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Annexures

CHAPTER 1

Digital Connectivity - *Its Value*

1.1 Real value of digital connectivity

1.1.1 Information and Communication Technology (ICT), operating through Digital Connectivity, is the foundation of national growth as it encompasses and impacts performance of all the sectors of the economy. Digital connectivity based on wireless, wired and satellite technologies, played a crucial role in combating COVID-19 pandemic by enabling quick and easy accessibility to health infrastructure and other support systems. It also enabled remote working (work from home) and distance learning (online education), e-commerce and other critical social and economic activities including entertainment during lockdowns and restricted movement.

1.1.2 The value of connectivity and its utility lies in the cost of access to other entities and its reliability. Connectivity is associated with interaction between social and economic agents through a network. When the cost of building connectivity infrastructure is lower than the value it offers, full connectivity would be realized without any external interventions. If full connectivity is not achieved, then barriers holding it back need to be identified and addressed.

1.1.3 Also, mere connectivity is not enough; what is required is "meaningful connectivity" which is defined by the Alliance for Affordable Internet as "quality internet access". We need to ensure sustainable connectivity to individuals and businesses through digital economies and societies and by enabling large bandwidth to meet requirements of remote

working and distance learning. As per the website of Infrastructure Asia[1], even when 5G is being introduced, 56% of all mobile subscribers around the world and 65% of all subscribers in the Asia Pacific region will continue to use 4G connections till 2025. Further 12% of users in Asia Pacific will still be relying on 2G or 3G technologies.

1.1.4 New, innovative and agile financing and regulatory mechanisms, with new enablers and a holistic perspective, are required to upgrade the present digital infrastructures to promote access for all with an assured service quality. The governments including state governments and local self-governments, telecom regulator, cross-sector regulators and various infrastructure authorities will be required to play a dynamic and collaborative role for strengthening broadband and digital services. They will also be required to facilitate seamless accessibility of connectivity in various service areas, buildings and residential societies for delivering an assured quality of services at an affordable cost so as to support a vibrant and competitive market.

1.2   Challenges faced in achieving real value of digital connectivity

The challenges in creating digital connectivity are discussed below:

1.2.1 Successful implementation of any kind of infrastructure project requires a comprehensive and strategic approach, and more so, for the digital infrastructure. It requires coordination across various activities i.e. right from allocation of telecom resources such as spectrum[2], permissions for creation of necessary ecosystem for manufacturing, procurements and import of equipment and devices to fulfill demand and expectations of the market and consumers and also balancing the commercial interests of landowners and telecom service providers/infrastructure providers. The

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[1]   https://www.infrastructureasia.org/en/Insights/The-catalytic-role-of-digital-connectivity#:~:text=We%20also%20need%20to%20get%20the%20basics%20right.,still%20be%20relying%20on%202G%20or%203G%20technologies.

[2] the radio frequencies that enable mobile connectivity

legislation and policies are expected to ensure that no one (and nowhere) is left unconnected; all are digitally literate; and everyone has equitable access and ownership of appropriate devices.

1.2.2 There is a significant financing gap in digital infrastructure. Such gap can be defined as the difference between funding required to create Digital Connectivity Infrastructure (DCI) across various regions and establishments and actual investment made. Due to increasing demands for more and more bandwidth at higher speeds requiring additional investment in new technologies, spectrum and infrastructure, this gap is increasing further. As such, government is required to take urgent steps in devising suitable policies to attract private sector investments for creation of a conducive eco-system with appropriate financial and non-financial incentives.

1.2.3 Challenges are also being faced in smooth roll out of digital infrastructure due to dependence on multiple entities managing the premises or a notified area, such as a state, city or local administration, and Property Manager[3] when it comes to approval and access. Telecom is a capital-intensive sector and requires significant upfront investment in rolling out of network for digital connectivity. The entities, responsible for granting permissions and rights to Telecom Service Providers (TSPs) to set up infrastructure, have a tendency to see this as an opportunity to earn additional revenue, rather than an opportunity to develop DCI so as to ensure good digital services to various stakeholders and attract investments in their regions, cities, towns, villages, which can boost their economies.

1.3   Earlier initiatives to improve connectivity are falling short of needs and expectations
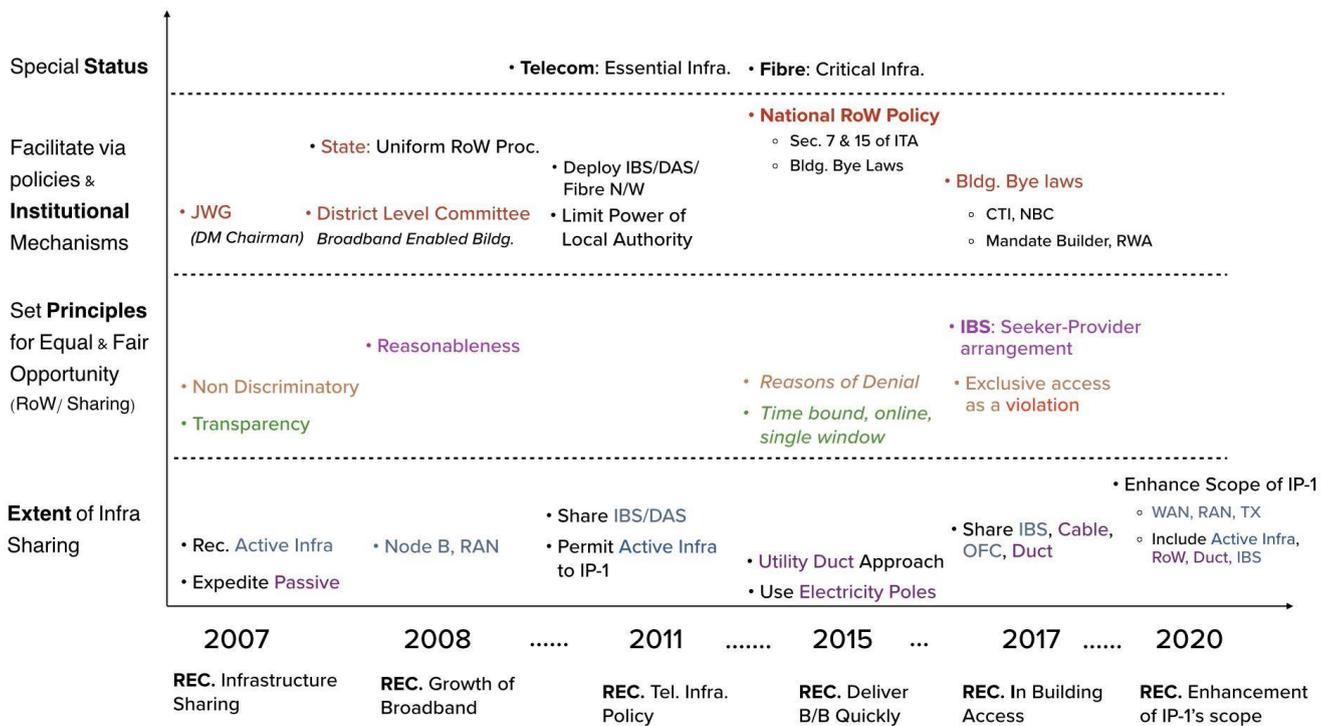
1.3.1   In the past, Telecom Regulatory Authority of India (TRAI) has taken various initiatives to address the concerns related to improve telecom connectivity. In this regard, several recommendations were given to the

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[3] As explained in **Annexure I**

Department of Telecommunications (DoT). DoT has also taken action in respect of the recommendations made by the TRAI.

Figure 1.1: Key Recommendations made by TRAI

	2007	2008	......	2011	....	2015	...	2017	......	2020
	REC. Infrastructure Sharing	REC. Growth of Broadband		REC. Tel. Infra. Policy		REC. Deliver B/B Quickly		REC. In Building Access		REC. Enhancement of IP-1's scope

1.3.2 Summary of key recommendations made by the TRAI in this regard are presented in a nutshell in figure 1.1. A detailed note on various relevant recommendations of TRAI is given in **Annexure II**.

Further, recent comprehensive recommendations covering aspects of Broadband, Right of Way (RoW), Street Furniture and some aspects of In Building Solutions (IBS) are dealt in para 1.7. Infrastructure Providers (IPs) were enabled to provide connectivity in cost-optimal manner by recommending infrastructure sharing of passive infrastructure and subsequently, sharing of active infrastructure. Principles for equal and fair opportunities in sharing of infrastructure and RoW were set. Institutional mechanisms were established to facilitate creation of DCI. It was also recommended that telecom should be given a special status as an essential

infrastructure and fiber as critical infrastructure. Some of the important initiatives taken by DoT, TRAI and other agencies are:

a) National Building Code of India, 2016 (referred as NBC hereafter) included a chapter on requirements to enable ICT (Vol-II Part 8, Section 6).

b) Indian Telegraph RoW Rules 2016 and Indian Telegraph Right of Way [Amended] Rule 2021 notified in year 2016 and 2021 respectively by Department of Telecom.

c) Model Building Bye-Laws framed in 2016 by Town and Country Planning Organisation under Ministry of Housing and Urban Affairs for the states/UT to consider.

d) Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines 2014, to implement provisions of 73rd and 74th Constitutional Amendment Act (CAA).

e) Infrastructure Providers (IPs) were allowed to share infrastructure.

f) In March 2020, TRAI in its "Recommendations on Enhancement of Scope of Infrastructure Provider Category-I (IP-I) Registration" recommended that the expanded scope of the IP-I registration should include to own, establish, maintain and work all such infrastructure items, equipment and systems which are required for establishing Wireline Access Network, Radio Access Network (RAN), and Transmission Links (Para 3.3).

1.3.3 These policy interventions have helped in improving connectivity. However, all these efforts have fallen short in achieving desired level of digital connectivity. Infrastructure Providers have helped in improving quality in number of buildings but there is still a huge gap in meeting the demand of the users as only selective buildings have been covered by the IPs in comparison to all other buildings which might require similar solutions or models. The interest of an IP in serving a building or premise would depend upon the business opportunity it offers. Many times, it creates possibilities of monopolistic situations when exclusive rights are

given to a particular IP to serve a building or an area. Subsequently, if outcomes are not aligned with the objectives for which rights were given, the value of the connectivity is lost not only to the property managers but also to the people who stay or pass through these buildings or areas.

1.3.4 Improving quality of connectivity would always be in the business interest of any TSP as it leads to higher usage of the network and opportunity to earn more revenue. Market forces are expected to play a role in continually improving the quality without any specific external intervention. However, it might not work if things are not within the control of TSPs who are made responsible to provide a network and also, in many cases, where return on the investment is negative or not attractive enough. There is also a possibility that the end user is ready to pay for good connectivity and if the returns are attractive, the service provider may invest in improving the quality.

1.3.5 Digital connectivity which meets the expectations of end users is not a one-time exercise. It requires regular expansion and upgradation of already laid out infrastructure to cater to increasing demand and adopt new generation technologies. Exponential rise in demand requires frequent augmentation of network capacity. The issues highlighted in previous para, though handled and resolved during laying of the infrastructure for the first time, will keep on reappearing every time expansion or upgradation related activity is taken up. Such cropping issues are to be dealt during entire life cycle, as every issue cannot be fully envisaged in the initial phase of creation of digital connectivity.

1.3.6 Evolution of network technologies and advancements in digital tools may offer new opportunities to players participating in creation of digital connectivity infrastructure. In case of in-building solutions, typical functions such as network designing, network implementation, network evaluation etc. may be done by different entities in a loosely coupled but in a cohesive manner. Features and capabilities of 5G and Open Radio Access Networks (O-RAN) may help in this and may also help to redefine role of

players. Regulatory framework would require identifying new entities and facilitating them to play an active role.

1.3.7 Therefore, there is a need to develop an ecosystem where new entities, tools and marketplaces can help in speeding up roll out of digital connectivity infrastructure and carrying out capacity augmentation, as and when needed. There is also a need to identify and remove obstacles so as to facilitate smooth functioning of the market for the benefits of all the stakeholders including consumers.

1.4 Incentives need to be aligned across chain of entities delivering service

1.4.1 With changes in network technologies and its convergence, it is becoming difficult to pinpoint single element/ factor responsible for poor quality of experience. As was the case in circuit switched networks earlier, now quality does not depend only on radio access technologies, especially after introduction of Internet Protocol (IP) based technology operating on packet-switched networks and smart devices with internet-based applications. Various other factors such as devices, mid-haul networks, back-haul networks, core network, applications, content delivery networks, etc. also have bearing on the quality of experience.

1.4.2 As mentioned above, in a chain of entities involved in delivering the services to the consumer, it is extremely difficult to identify who is responsible for poor quality performance. Perception of quality to a consumer is usually not done in objective manner, based on observations at a given moment or place. It is subconscious observations of the consumer over a period, which impacts his or her decision on good or bad quality of services. Characteristics of services like intangibility, heterogeneity and inseparability make the task of quality assessment and responsibility of separating out elements or factors more difficult.

1.4.3 Rather than identifying a particular entity in the chain as the culprit, it would be better to create an ecosystem where incentives are aligned in

such a manner that all stakeholders make concerted effort to improve connectivity and enhance quality.

1.5   Studies by TRAI to identify the issues in improving quality

TRAI has conducted many studies to assess the quality and identify challenges in connectivity and solutions to tackle the challenges. Main findings of two of these studies are summarized below:

1.5.1 Measurement of wireless data speeds

In February 2018, TRAI published a White Paper on "Measurement of Wireless Data Speeds"[4] which highlighted variations in the data speed with time and geography. It also highlighted challenges in presenting performance of wireless data networks in terms of a single value for a larger geographical area and this value remaining valid for a longer period. This white paper highlights issues involved in measuring wireless data speed via crowd source apps. The paper also highlights that the measurements of quality of broadband with different methodologies and in different contexts may give different results. Criteria set during processing of measurement data such as filtering criteria, aggregation criteria impact network level assessments and give different results. Every approach of measurement and assessment of quality may have its own objectives and purposes. Study also noted that there are app providers in the market who are measuring quality and publishing results. But these app providers are not putting their measurement and assessment methodologies in public domain. To have a better understanding and interpretation of reported results in appropriate manner, it is required that all app providers do proper documentation about the methodologies adopted by them and put such documentation in public domain also.

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[4] https://trai.gov.in/sites/default/files/measurement_wireless_data_speed.pdf

1.5.2 Mobile network QoS at Delhi airport and Dhaula Kuan

TRAI also published a report in March 2019 on "Mobile Network QoS at Delhi Airport and Dhaula Kuan"[5] wherein various issues were identified that need to be addressed to improve the quality of services. In both the cases, TSPs were facing challenges in providing good quality of telecom services because of factors beyond their control.

This report highlighted that agencies such as GMR (the Concessionaire for development, operation, and management of Airports), Ministry of Defence (MoD), or Delhi Metro Rail Corporation (DMRC) enter into contract agreements with third parties to install and operate DCI through competitive bidding process. The telecom service providers obtain services from these third-party infrastructure providers who have monopoly power by virtue of the contract awarded. Such monopolistic attitude may impede investment in upgrading or expanding the infrastructure to match requirements of new technology introduced by TSPs. Further, upgradation of infrastructure by the infrastructure providers to meet new challenges would entail significant CAPEX and OPEX. If such scenario is not captured in the contract awarded to IPs and they have to take a call on their own, in this respect, post facto access of such infrastructure to TSPs is likely to be more expensive. This scenario requires a complete review of the terms and conditions framed while selecting IPs by property managers. In addition, for quick roll out of good quality services, infrastructure consistent with technology requirements should be available to TSPs on non-discriminatory and transparent basis and at reasonable costs. As such, property managers who are governing specific buildings or areas or venues need to play the role of facilitators. Further, there is a need to develop a mechanism which ensures that third parties having exclusive rights to provide infrastructure also meet the QoS requirements.

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[5] https://www.trai.gov.in/sites/default/files/QoS_PMO_Airport_Report_06032019.pdf

1.6 Obstacles for market in improving QoS

Some of the impediments or obstacles in deploying various options available to service providers for improvement of quality of services are illustrated below:

1.6.1 A TSP approaches property managers directly to allow access to the premise for the deployment of mobile infrastructure. In this approach, typical hurdles faced by the TSP are:

a) Either property managers do not offer right of way for the said premises; Or

b) They offer the same with unfair and discriminatory terms and conditions.

1.6.2 Alternatively, IPs approach property managers to build networks and later on connect with TSPs. This leads to two interfaces, one between property managers and IPs and another one between IPs and TSPs. In this approach, typical hurdles faced by TSPs are:

a) Property Managers may set selection criteria for IPs or TSPs at unreasonable reserve price, fees and charges; or

b) Winner IP may create monopoly over building infrastructure and do rent seeking; or

c) IP may risk its investment as all TSPs might not be ready to get connected.

1.6.3 Issues which are common in both the approaches are:

a) There may be resistance to grant permission as processes of deployment of network cause inconvenience to the residents and also many times it results into defacing of the property.

b) Desired level of quality is not achieved as best designs or plans get compromised depending on the revenue potential or business case of

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TSPs or IPs.

c) Practically it is impossible to change an IP even when it is not maintaining the system, expanding, or upgrading digital connectivity infrastructure to meet the rising expectations and demand in timely manner.

1.6.4 In addition to the issues related to deployment of the infrastructure, it is also important to consider other aspects that impact initiatives to improve the digital connectivity and the revenue from the area where connectivity is to be improved. Also, cost and market dynamics are quite different in case of in-building mobile services from typical in-building wireline services as-

a) practically, mobile tariffs cannot be increased in a particular area where more investment has been made to improve digital connectivity over there.

b) in-building connectivity might require relatively large capital investment to replace the old infrastructure with more sophisticated networks, needed to meet expectations of the users.

c) TSPs and IPs who bear the cost to build good quality digital connectivity based on digitally simulated models, have a risk of low returns both in terms of value of the connectivity and its quality.

1.7 Recent initiatives taken by the Government to improve connectivity

1.7.1 In October 2021, DoT amended RoW rules to allow Access Providers to lay overground telegraph lines.

1.7.2 In a recent significant and transformational recommendation on *"Roadmap to Promote Broadband Connectivity and Enhanced Broadband speed"* released on 31st August 2021, TRAI recommended the following:

a) Similar to the Access Service authorization, passive as well as active infrastructure sharing should be allowed under the Internet Service

License and Internet Service authorization under the Unified License (UL) and UL (VNO) licenses. (Para 7.5) (The Authority reiterated its earlier recommendations issued in the context of "Proliferation of Broadband through public Wi-Fi networks" dated 9th March 2017)

b) Enactment of National RoW Policy (Para 7.11)

c) Creation of National RoW Portal with role-based workflow for RoW permissions (Para 7.14)

d) Inclusion of RoW permissions in Institutional Mechanism envisaged in National Broadband Mission & reconstitution of committees for better oversight (Para 7.13)

e) Uniform restoration charges for open trench and pits (Para 7.15)

f) Broadband Readiness Index (BRI) score linked incentives for States/ UTs for implementing RoW reforms (Para 7.21)

1.7.3 TRAI, further, in the same recommendations i.e. *"Roadmap to Promote Broadband Connectivity and Enhanced Broadband speed"* recommended the following:

a) Incentivization for establishment of common ducts and posts for fiberisation & sharing with service providers on non- discriminatory basis (Para 7.19)

b) Exemption of RoW charges by State Govt/UTs for next five years for laying of common ducts and posts, similar to the exemption granted under BharatNet project (Para 7.20)

c) Establishment of 'Common Ducts and Posts Development Agency (CDPDA)' for planning and development of common ducts and posts infrastructure across the country (Para 7.23)

d) Notification of design and standards for common ducts and posts by Telecom Engineering Centre (TEC) (Para 7.25)

e) Formulation of policy for cross-sector collaboration with other utility providers like roadways, railways, water, electricity, gas etc. for co-deployment of common ducts (Para 7.26)

f) Establishment of common ducts be made integral part of smart city development plan (Para 7.27)

g) Geographical Information System (GIS) mapping of all the passive infrastructure to facilitate sharing (Para 7.31)

h) Target linked financial incentives in the form of License Fee (LF) exemption for proliferation of fixed-line broadband services in urban and rural areas (Para 7.32)

i) A pilot DBT (Direct Benefit Transfer) scheme in rural areas for proliferation of fixed-line broadband subscribers (Para 7.34)

1.7.4 In the recommendations on *"Roadmap to Promote Broadband Connectivity and Enhanced Broadband Speed"*, dated 31st August 2021, Authority also deliberated on the draft addendum to Model Building Byelaws (MBBL)-2016, by Town and Country Planning Organization of Ministry of Housing and Urban Affairs, to include provisions for In-Building Solutions (IBS). MoHUA has asked for comments of TRAI vide letter dated 6th July 2021. It was mentioned in the Para 3.49 of the said recommendations that Authority is in the process of identifying and addressing all issues afresh relating to digital connectivity infrastructure inside the buildings. It was also mentioned that the consultation with stakeholders on these issues would be carried out separately. The Authority in its reply to draft addendum to MoHUA dated 8th February 2022, acknowledged various points captured in draft amendments and observed that processes and methodologies in respect of design, deployment and quality check of the digital connectivity infrastructure proposed to be created are yet to be clearly brought out. It was also mentioned that some legal frameworks are also to be worked out for recognizing various entities involved/proposed to be involved in creation of digital connectivity

infrastructure and their roles and responsibilities are also to be spelt out either in Bye Laws or in NBC or at any appropriate document which should be recognized and referred by all concerned. The copy of the letter along with draft addendum is attached at **Annexure-III**.

1.7.5 Also, in para 4.48 of these recommendations, it was highlighted that the Authority is aware of the concerns expressed by the stakeholders regarding restricted access to residential societies and complexes. And to address this issue in totality, the Authority is intending to have consultation with stakeholders separately.

1.8   Possible options and way forward

1.8.1 The business case of excellent connectivity looks different for different areas/pockets. Among various options to deal with the problem, following options can be considered:

a) As mentioned in the para 1.7, an appropriate law can be enacted to ensure deployment of mobile and broadband infrastructure more efficiently and effectively as recommended by TRAI *in "Roadmap to Promote Broadband Connectivity and Enhanced Broadband speed" released on 31st August 2021* (Para 7.11). Such law should also include issues related to IBS as well.

b) As mentioned in para 1.7, develop an ecosystem that enables and encourages collaboration among players to improve the quality as recommended by TRAI in *"Roadmap to Promote Broadband Connectivity and Enhanced Broadband speed" released on 31st August 2021* (Para 7.14 (iii))

c) Formulate stringent norms of quality and enforce them in an effective manner.

1.8.2 Also, the right combination of above options, with some changes in the responsibility matrix, might be helpful to improve in-building connectivity. Value chain coordination might happen if incentives are properly aligned. It may also require players other than TSPs and IPs, who

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capture the resulting value of digital connectivity, to participate in sharing of costs and risk of investments.

1.9   Scope of consultation

1.9.1 The scope of this Consultation Paper is to deliberate on policy interventions and explore possibility of new regulatory framework which may be required for facilitating TSPs and IPs in improving digital connectivity inside buildings, specific areas, specific transport corridors, public transport hubs etc. This is required as TSPs or IPs are dependent upon other entities for improvement of connectivity and quality of experience. Deliberation on probable policy interventions or new regulatory approaches also includes creating an ecosystem that might be required to design, deploy, operate, expand, and upgrade digital connectivity infrastructure inside such buildings and areas. Another primary focus of this specific consultation is to develop a methodology to measure and evaluate quality of experience in such areas and buildings and empower end users to get requisite infrastructure for digital connectivity, whether on their own, or via agents working in their interest, or by creating pressure on relevant entities.

1.9.2 Finally, when TRAI makes recommendations on this subject, such recommendations will be required to be integrated with the recommendations made in the above mentioned recommendations so as to create holistic framework for digital connectivity infrastructure in the country.

1.10 Structure of the Consultation Paper

The consultation paper is divided in eight chapters.

Chapter 1 presents efforts made earlier to improve digital connectivity and what is still holding back to achieve real value of digital connectivity.

Chapter 2 presents salient points of the monograph document published by the TRAI in September 2020. This chapter also presents measures suggested in the monograph to build a good quality network.

Chapter 3 presents the existing legal framework for construction of buildings, development of an area and roll out of DCI. It presents role of State, local authorities, panchayats in formulating laws and bye laws related to buildings. It also presents role of union in formulating model building bye laws, providing building codes or specifications. This chapter also provides details about relevant provisions under Indian Telegraph Act.

Chapter 4 deliberates on the creation of ecosystem to build a digital connectivity network. This chapter presents new entities and players such as property managers, DCI designers, DCI engineers, DCI evaluators etc. who may be required to be identified as important players in building digital connectivity infrastructure inside buildings.

Chapter 5 presents introduction of rating system of buildings from perspective of digital connectivity that may nudge property managers to improve digital connectivity infrastructure. It also presents benefits of introducing rating to various stakeholders. While focus is on voluntary adoption of rating, however it also presents ways to accelerate adoption of rating.

Chapter 6 presents requirement of new regulatory framework to institutionalize the new ecosystem. It deliberates on how new entities presented in the Chapter 4 may be identified in the regulatory framework. The scenarios in which rating might be required to be made as mandatory are also discussed. It further, deliberates on requirement of introducing certification process to award rating and associated terms and conditions.

Chapter 7 deliberates how rating may be carried out. It deliberates on terminologies and elements of process that might be required to rate the digital connectivity inside building. It also deliberates on objective and subjective methods of assessment of quality. Issues related to combining data obtained from multiple sources are also deliberated in this chapter.

Chapter 8 summarizes the issues for consultation.

1.11 Disclaimer

The issues raised in consultation paper may have questions related to non-telecom entities, which do not mean to infringe in the domain of other organizations. These are included to identify the bottlenecks and issues in creation of good quality digital connectivity infrastructure in any building or an area or a cluster of buildings or a complex, herein after referred as buildings etc. and are limited to facilitation of same to the prospective service providers or infrastructure providers or solution providers and developers.

CHAPTER-2

Salient Points from the Monograph - *Quest for a Good Quality Network*

2.1 Findings of case studies by the TRAI

2.1.1 TRAI conducted several case studies across the country with the focus on residential apartments and societies. Based on these studies, a Monograph on "*Quest for a good quality network inside Multi-Storey Residential Apartments- Reimagining ways to improve quality*"[6] was published in September 2020. The key findings of the case studies are summarized below:

a) Traditional method of evaluating quality of service has followed a two-pronged approach: (i) to collect statistics from the network and (ii) to make field measurements. The values so collected are compared with defined benchmarks. Field measurements include crowdsourced data collected from user devices by means of an app, like TRAI's MySpeed[7].

b) The hypothesis behind the method is that improving the accuracy of measurements and tightening the benchmarks would automatically lead to improvement in the quality. Largely, it has served the purpose so far.

c) However, this approach is similar to traditional methods of evaluations which are mainly dependent on standardized testing as the means for improving quality. Here it may be noted that, beyond a point, it is individualized testing and individualized teaching that

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[6] https://www.trai.gov.in/sites/default/files/Flipbook_Monograph_22092020.pdf
[7] https://www.trai.gov.in/portals-apps/trai-apps

deliver better outcomes.

d) Thus, the monograph[8] suggests a blended approach in improving the network that is using both general interventions as per traditional methodologies, as well as solutions that are specific to users' requirements. It also advocates involvement of users in defining and achieving the optimum outcomes for themselves.

2.2 Need to revisit current approaches for designing and finalizing solutions

2.2.1 Case studies revealed that assumptions usually made by the network designers and implementers are not fully and perfectly converted into anticipated performances at all locations. These are mainly due to varying ground conditions and differential expectations of individual users. Hence, it is practically difficult to ensure that network deployed and implemented behave exactly the same way as it was designed and to ensure that variations at the stage of implementations do not impact the quality for which it was designed. Some of the assumptions which do not provide foolproof solutions to all kinds of users, are listed below:

2.2.2 Use of alternate technologies such as Wi-Fi may solve problems of all the stakeholders. Actually, requirements may vary from stakeholder to stakeholder.

2.2.3 By providing connectivity at the doorstep, good connectivity inside the apartments is guaranteed. Actually, connectivity may vary from place to place inside the building or even inside the rooms.

2.2.4 Meeting the telecom and ICT related specifications of National Building Code would fully serve the needs of telecom service providers and would satisfy the requirements of the end users.

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[8] Monograph on *"Quest for a good quality network inside Multi-Storey Residential Apartments- Reimagining ways to improve quality"*

2.2.5 It is further to be noted that in case of wireless communications, there is no guarantee that the designed solution will work until and unless it has been validated comprehensively and in a given context. Actual requirements may vary from building to building and context to context in which it is used. Hence, designing the network at the construction level itself or looking at the infrastructure de-novo in case of existing building is a must. Also, validation need not be done only at the design stage but also at subsequent stages such as after deployment when network is being utilized.

2.2.6 Model designs do not work

For most of the requirements, NBC specifications are suggestive and advisory, and wherever requirements are hard coded, it takes away the flexibility to change the requirements in context of latest developments in the technology domain. For example, rooms with specific dimensions and in specific numbers for the purpose of digital connectivity infrastructure may not fit well in the requirements to accommodate different needs of the equipment of different service providers. Prescriptive approach may ensure compliance but not best fit and cost-optimal solutions.

2.2.7 Digital information exchange and modelling may help in better assessment

Considerations in digital infrastructure design may vary with the type or class of buildings. Compliance to the general principle may not assure desired quality. Currently, there is no mechanism to validate the design of the network against the requirements. Telecom, especially wireless networks, have complicated characteristics to be considered for validating the claims. In-building infrastructure adds to this complexity. In addition to domain experts, there would be requirement to use professional tools that simulate the environment and predict the quality of services. Such tools may require building related information in digital forms with adequate details like the kind of structure and characteristics of materials

from the point of view of propagation of the radio waves.

2.3   Based on above discussion, key questions which arise, on the approaches to be adopted for realizing full value of connectivity, are**:**

   a) Are there technological solutions with exclusive processes which allow stakeholders to work in a cohesive manner?

   b) Can they help providers to form partnerships?

   c) Can they help players to collaborate and start acting in concert to resolve issues?

   d) Can they help in discovering common interests, keeping infrastructure in its best form during the entire life cycle?

   e) Whose responsibility is it to lay technological solutions?

   f)   How to be sure that solutions work?

   g) How to ensure upgradation of solutions to meet new requirements?

   h) How to ensure that arrangement is not anti-competitive?

2.4   **Need to develop an ecosystem that empowers end users**

Study reveals that there is a requirement to develop an ecosystem to ensure that stakeholders act in such a manner that a good network gets realized and becomes available in a timely manner. The ecosystem should address following key issues:

2.4.1 Need to address principal-agent problem

As discussed in the monograph, a typical principal-agent problem is faced while deploying a good quality network. The ecosystem should also have provisions to ensure that such representatives act in the interest of providing good digital connectivity to the end users and are not preoccupied with the objective of generation of revenue only.

2.4.2 Need to work on a continual basis for good quality network

Good connectivity and performance requirements may keep on changing and therefore, ecosystem needs to provide for engagement with the stakeholders during the entire life cycle, i.e. conception and expansion, upgradation of the network due to change in technology, change in use of spectrum bands and new solutions. The intent should be to continually work to meet consumer expectations and work in a collaborative manner to unleash the full potential of the connectivity.

2.4.3 Need to enable market to offer best-fit solution

The ecosystem should also enable the market to offer the best solution considering cost savings as well as performance requirements set directly or indirectly by the end users for a range of services. The solution designed and developed may be evaluated against the expectations and demand which may also be captured at disaggregated levels in terms of coverage, capacity, performance etc. While designing solutions, constraints imposed by the property managers need to be considered at the initial stage to avoid multiple iterations which may delay finalizing the solution. It would be in the interest of all stakeholders to get the best fit solution keeping in view time and cost implications.

2.4.4 Need to assess quality for assurance of good quality

Ecosystem should provide assurance by carrying out assessment at different stages of the network. Designing and implementation of network should take into consideration coverage, capacity, and quality of service requirements of the end users. Network design should not be based on mere assumptions of the telecom service providers or infrastructure providers.

2.4.5 Consumers need to be empowered to decide what is best for them

Consumers should be empowered to play an important role in influencing and deciding the shape and form of a network being built to serve them.

Consumers as individuals need to be given an option to get a customized network or they can build premium type of network themselves. Also, Community of Practice (CoP)[9] may be empowered to influence and decide the type and form of network to serve them. In case, networks built for the residential apartment buildings or enterprise buildings, are not managed well, then consumers must have mechanisms to get it right. Business models with incentives, aligned in a manner which encourage installation, operation and management of a network, need to evolve.

In summary, users need to be kept in loop from the beginning of the project when they convey their requirements till the point of time when services start getting delivered. The consequences of poor design and implementation will impact the quality of life and the quality of working from home as telecom world continues to become more and more dynamic. Participation and involvement of the end users and their representatives in designing and implementation of the inbuilding networks may lead to better outcome in form of improved consumer satisfaction.

2.5 Creating an ecosystem to encourage collaborative approach among stakeholders

Building a digital connectivity network requires collaborative partnerships, co-designing and co-creation being some of the broad elements of such partnerships. Authorities and entities, which grant permissions or rights to TSPs to install digital connectivity infrastructures, must appreciate that a good network brings operational efficiencies and offers innovative ways to improve the quality of life of the citizens. Authorities and entities need to become collaborative partners in building the network and reaping benefits from it rather than taxing and charging for laying of such networks. All relevant stakeholders should be

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[9] Community of Practice (CoP) is a group of people who share a common concern, a set of problems, or an interest in a topic and who come together to fulfill both individual and group goals.

involved in co-designing and co-creating telecom networks inside the buildings if the varied needs of various consumers are to be fulfilled in a satisfactory manner.

Broad areas of collaborations can be further classified as follows:

2.5.1 Coherence in planning of networks inside and outside the building

Telecom authorities need to play a key role in assuring that a good quality network is available inside the building as envisaged at the design and deployment stage. Such authorities need to create mechanisms that ensure that in-building network is plugged with appropriate backhaul connectivity from all TSPs present in that area. The alignment should be available in terms of technical match of the components of inbuilding network and backhaul. Also, both inside and outside infrastructure should be ready and available at the same time.

The authorities concerned should also be fully geared up to ensure that infrastructure so created inside building/ in an area, are ready/upgradable to adopt any new/futuristic technologies which may emerge during course of time and may be required/useful to the end users.

2.5.2 Bringing confluence and congruence of efforts to build the network

It is apparent that building a network inside buildings is a complex and multi-dimensional process. This can be effectively addressed only by a coordinated effort between a multitude of agencies such as TSPs, infrastructure providers, property managers, real estate developers, RWAs, authorities granting permissions or facilitating utility infrastructures etc. This collaborative engagement at an early stage of the building project would enable co-designing and co-creation of the networks. On the other hand, if engagement happens at a later stage

which is commonly observed, it imposes many constraints on the design aspect of the network. That is why it is always challenging to upgrade or change the present digital connectivity infrastructure in the existing buildings and areas.

2.5.3 Involvement of stakeholders at the early stage of planning of network

In wireless networks, compromise in the placement of antennas by a mere few meters leads to compromise in the quality of the service. Such compromises are taken for granted by the TSPs and builders on the reasoning that the best has been done while the same is not true. Constraints imposed on designing networks might be in terms of availability of supporting infrastructure at a particular point. Also, various factors like aesthetic aspect, safety perspective, cost of the solution and likely disruption of the daily activities may also impact the decision making by the authorities which grant permissions.

2.5.4 Creating platform that may help in collaboration and developing symbiotic relationship

For early engagement of relevant stakeholders, a platform for interacting and orchestrating a process to deliver a good quality network in time bound manner may be required. Such platforms may offer city or area specific coordination among various local stakeholders. However, re-usability of platform components and access to common repository, which may be the same for larger area, may help in better management of the platform. Such platform should provide at least the following facilities:

a) Marketplace where real estate developers can meet with telecom solution providers and certified professionals to get telecom network designed and deployed.

b) Registration of real estate developers/ property managers with facility to update project specific details.

c) Registration of solution providers and professionals who can help real estate developers to get telecom/ ICT work designed and deployed.

d) Repository of details of the service providers who are offering services in the area along with details on present technologies, and spectrum bands as well as details of upcoming technologies and spectrum bands.

e) Repository of building related information, CAD files along with relevant details required to design the wireless networks. Also, it should have facility to convey back to real-estate developers, the details of digital connectivity design prepared by the stakeholders so as to be considered in the overall building design.

f) Processes to engage stakeholders right from start of the project and then navigate through the requirements at the subsequent stages of the building project for delivery of a good quality network.

2.5.5 Above discussion indicates that there is a need to create an ecosystem to build a digital connectivity network. The real estate developers can take care of requirements of digital connectivity right from the planning stage with the help of this ecosystem so as to meet the expectations of the end users in a rapidly changing environment. Further, such ecosystem will ensure that real estate developers account for good digital connectivity requirements in the beginning. Also, such an ecosystem can have mechanisms to get infrastructure updated to meet futuristic requirements.

2.6 Role of National Building Code of India and Building Bye Laws should be to enable new ecosystem

2.6.1 The ecosystem may also enable the market to discover the best network solution for them and at the same time, assessment of the solution inside a building or an area may not be limited to one or a

particular telecom service provider. Assessment may also account for key factors related to reliability, options to choose from multiple service providers etc. Sharing of infrastructure may be driven by various considerations including cost advantage of such sharing.

2.6.2 Eco-systems should offer various options to solution seekers like property managers in helping in choosing a solution provider from the market or building a solution using digital tools or choosing an entity offering to design such solutions. It should also offer options to choose from certified products required to build the solution and to choose from certified professionals to get solutions implemented.

2.6.3 Unlike wireline where connectivity is limited to a specific location, it is very difficult to ensure a good quality network in wireless by simply mandating some requirements as a part of the National Building Code. This may become more challenging in next generation wireless technologies such as 5G, IoT or M2M. Moreover, requirements in terms of aesthetic look, structural issues or any other concerns of residents or building users may also vary from case to case. Even within a building or an area, there may also be variations which may be leveraged to design and deploy the solutions. Therefore, instead of prescribing a specific way to implement a solution, it will be better that the model is focused on outcome and gives liberty to designers and deployers to choose an option of their choices.

2.6.4 The role of the National Building Code of India and Building Bye Laws should be more to give legal backing to the ecosystem required for digital connectivity including associated requirements such as developing solutions using certified products and tools, deploying solutions by certified professionals and evaluation of the network by empaneled or certified agencies.

2.7   More details on outcomes of case studies can be accessed on TRAI's website

Key outcomes of these studies are captured in the Monograph on "*Quest for a good quality network inside multi-storey Residential Apartments-Reimagining ways to improve quality*" released on 22nd September 2020 which is available in public domain at www.trai.gov.in. This consultation paper is based on the outcome of these studies and way forward suggested to address the issues.

CHAPTER 3

Existing Legal framework for Construction of Buildings
and
Roll Out of Digital Connectivity Infrastructure (DCI)

3.1   Digital Connectivity Infrastructure Requirements

3.1.1   The provision of the Digital Connectivity Infrastructure (DCI) inside buildings is dependent on providing unhindered access and giving permission, to deploy DCI in the buildings, by property managers in an indiscriminately and transparent manner and at a reasonable cost. Accordingly, the role of Property Managers becomes very crucial and essential in providing digital connectivity.

3.1.2   It is easier to deploy DCI if necessary civil and electrical requirements to deploy are considered at the time when the buildings are being constructed and provisions for the same are made. Otherwise, it would necessitate to retrofit buildings with the requirements and this task would be costlier and may also not offer optimal solutions. For building related requirements there are relevant acts, building bye laws, and regulations that prescribe minimum or essential requirements. There are designated authorities who are responsible to enforce the same via granting approvals at particular stages of the construction of the buildings.

3.1.3   There is a need to examine the existing legal frameworks dealing with the land and buildings that can be adjusted to consider DCI related requirements. There is also a need to examine requirements of new or additional supporting legal framework given that telegraph related functions are in union list while land and buildings related functions are in state list. Following paragraphs deliberate these issues in detail.

3.2   Existing Legal framework for Land & Buildings

3.2.1   Allocation of powers and functions between Union and States pertaining to buildings

The Seventh Schedule (Article 246) to the Constitution of India defines and specifies allocation of powers and functions between Union & States. It contains three lists: Union List, State List and Concurrent List.

The powers and functions to frame policies and create institutional framework to provide digital connectivity is of Union Government as the Posts and telegraphs; telephones, wireless, broadcasting, and other like forms of communication are part of the Union List. However, provisioning of digital connectivity inside buildings involves many issues that are related to land and buildings. The powers and functions related to land and buildings are vested with states as seventh schedule defines following powers and functions under the State List:

"Local government, that is to say, the constitution and powers of municipal corporations, improvement trusts, district boards, mining settlement authorities and other local authorities for the purpose of local self-government or village administration."

"Land, that is to say, rights in or over land, land tenures including the relation of landlord and tenant, and the collection of rents; transfer and alienation of agricultural land; land improvement and agricultural loans; colonization."

3.2.1.1 Powers, authority and responsibilities of Panchayats

As per the Article 243G, subject to the provisions of this Constitution the Legislature of a State may, by law, endow the Panchayats with such powers and authority as may be necessary to enable them to function as institutions of self-government and such law may contain provisions for the devolution of powers and responsibilities upon Panchayats, at the appropriate level, subject to such conditions as may be specified

therein, with respect to

a. *the preparation of plans for economic development and social justice;*
b. *the implementation of schemes for economic development and social justice as may be entrusted to them including those in relation to the matters listed in the Eleventh Schedule.*

The 73rd amendment to the Constitution enabled States to transfer some functions, including the functions related to land and building to the Panchayati Raj Institutions (PRIs). The amendment envisaged devolution of funds, functions and functionaries to Panchayati Raj Institutions (PRIs). This amendment listed twenty-nine functions in the 11th Schedule of the Constitution (Article 243G of the Constitution) which were to be transferred to PRIs by the State Government. Out of 29 functions listed in the schedule, following two important functions may be relevant from the perspective of DCI inside buildings:

a. *Land improvement, implementation of land reforms, land consolidation and soil conservation.*
b. *Rural housing*

3.2.1.2 Powers, authority, and responsibilities of Municipalities, etc.

As per the Article 243W of the Constitution of India, subject to the provisions of this Constitution, the Legislature of a State may, by law, endow

"(a) the Municipalities with such powers and authority as may be necessary_to enable them to function as institutions of self-government and such law may contain provisions for the devolution of powers and responsibilities upon Municipalities, subject to such conditions as may be specified therein with respect to—

i. *the preparation of plans for economic development and social justice;*

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ii. the performance of functions and the implementation of schemes as may be entrusted to them including those in relation to the matters listed in the Twelfth Schedule.

(b) the Committees with such powers and authority as may be necessary to enable them to carry out the responsibilities conferred upon them including those in relation to the matters listed in the Twelfth Schedule."

The 74th amendment to the Constitution enabled States to transfer some functions, including the functions related to land and building to the Urban Local Bodies (ULBs). The amendment came into effect on 1st June 1993 and empowered ULBs to perform 18 functions listed in the 12th Schedule (Article 243W of the Constitution). The amendment sought to create an institutional framework for ushering in democracy at the grass root level through self-governing local bodies in urban areas of the country. Out of 18 functions listed in the schedule, following two important functions may be relevant from the perspective of DCI inside buildings:

a. *Urban planning including town planning; and*
b. *Planning of land-use and construction of buildings*

The powers exercised by municipalities are in the nature of delegated legislation and state legislature can demarcate the ambit of powers of municipalities.

3.2.2   Building bye laws and Development Control Regulations

Under the powers conferred to the States, they have enacted building bye laws and regulations to control and manage functions related to land and buildings. To get a fair idea of typically what bye laws or regulations contain and how they are implemented, the legal framework of one state, namely Gujarat is discussed below. At a broad level, the framework in other states would be similar as far as the issue being discussed here is concerned.

3.2.2.1 The Gujarat Town Planning and Urban Development Act (GTP&UD Act), 1976

Gujarat has enacted '*The Gujarat Town Planning and Urban Development Act (GTP&UD Act), 1976*'[10] under the power conferred by section 3 of the Gujarat State Legislature (Delegation of Powers) Act 1976. Sub-section (1) of Section 3 provides that the state Government may declare any area in the state to be a development area, for the purpose of securing planned development of the area. Sub-section (1) of Section 5 provides for constitution of an authority for such area to be called the Area Development Authority of that development area for carrying out the functions assigned under the Act. Ahmedabad Urban Development Authority (AUDA) is one of the urban development authority constituted in 1978 under the Act to carry out the sustained planned development of the area falling outside the periphery of Ahmedabad Municipal Corporation.

Sub-section (1) of Section 9 provides for preparation of development plan for whole or any part of development area. Clause (m) of sub-section of (2) of Section 12 provides that development plan to have provision to control and regulate the use and development of land within the development area, including specifying conditions and restrictions related to buildings, and other matters as may be considered necessary for carrying out the objects of the Act. Further, clause (c) of sub-section (2) of Section 13 requires that the development plan should have regulations for enforcing the provisions of the development plan.

In pursuance of this, Urban Development and Urban Housing Department, Government of Gujarat has notified *Comprehensive General Development Control Regulations -2017*[10], applicable to the land development and building construction for all development areas in the

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[10] https://townplanning.gujarat.gov.in/act-legislation/common_gdcr.aspx

entire Gujarat State.

Under these regulations the responsibilities of various individuals viz. Architect on Record, Engineer on Record, Structural Engineer on Record, Clerk of Works on Record etc. are defined and minimum qualification & competency is also mentioned. The details on *Comprehensive General Development Control Regulations -2017* are mentioned in **Annexure VII**.

3.3 Role of Union in formulating Building Bye laws and Building Specifications

Building bye-laws are a set of rules under which construction of a building needs to take place. The rules regulate coverage, height, architectural design and safety measures in order to protect buildings against natural disasters such as earthquakes and hazards such as fire as well as structural failures.

Though formulating requirements and enforcing them is the role and responsibility of concerned states, however, central government has played the role of guiding and providing detailed specifications for their consideration and suitable adoption. The Bureau of Indian Standards (BIS) has published the National Building Code of India (NBC) and Town and Country Planning Organisation under the Ministry of Housing and Urban Affairs (MoHUA) has prepared Model Building Bye laws (MBBL).

Building regulations which are enforced in different cities or towns in India are mostly inspired from National Building Code, Master Plan/ Town Planning Schemes and other Indian Standard (IS) Codes. Different State Town and country planning or urban development departments formulate building regulations under state legislation.

3.3.1 Model Building Bye Laws (MBBL)

The first version of model building by-laws was prepared in 2003 by the Ministry of Urban Development when they incorporated provisions of

structural safety, fire safety and barrier-free public buildings. The bye-laws were later revised in 2015 in light of emerging issues such as sanitation facilities for visitors in public areas, conservation of heritage buildings and barrier-free environment for disabled, elderly and children.

Model Buildings Bye Laws, 2016 (MBBL 2016) were issued on 18.03.2016 for the guidance of the State Governments, Urban Local Bodies, Urban Development Authorities, State Town Planning Departments and other Planning Agencies in various parts of the country in revising their respective Building Bye Laws. Typical Stakeholders involved in Consultative Workshop to formulate MBBL were *Central Government agencies/ Institutes* (National Disaster Management Authority, Bureau of Indian Standards, National Building Construction Corporation etc.), *State Government Departments* (Town & Country planning, Urban Development authorities, Urban local bodies etc.) and *Associations* viz. CREDAI & NAREDCO.

The Bye-Laws were circulated to all the State Governments and Union territories and out of 36 States and UTs, wherein 22 States and UTs have undertaken comprehensive revision of their respective Building Bye-Laws since 2004. The Urban Local Bodies and Urban Development Authorities are required to ensure clearances in minimum possible time. Following table provides details of various stages in the construction of a building, type of approval required, approving authority and the sequence of the activity. Clearances indicated at Sl. No. A, B, H, K, L, M, N, O, P, and Q have to be obtained at the local level and all efforts are expected to be made to sanction the building plan using online application procedures.

Timelines of clearances from various authorities

SN	Type of approval	Approving Authority	Stage of project	Normal Duration (Days)	Reduced Duration (Days)	Activity Sequence
A	Intimation of Disapproval (IoD)	Development Authority/ Municipality	Pre-construction	30	5	Start Activity
B	Site & Building Layout approval	Development Authority/ Municipality	Pre-construction	30-60	5	Following A
C	NOC (if near sea/coastal areas)	Coastal Zone Management Authority	Pre-construction	30-60	10	Following B
D	Road access	NHAI/PWD	Pre-construction	30	10	Following B
E	Ancient Monument approval	Archaeological Survey of India (ASI)	Pre-construction	30	10	Following B
F	Environment Clearance	Ministry of Environment	Pre-construction	180	Only for large project	Following B
G	Borewell Registration Certificate	Central Ground Water Authority	Pre-construction	15	5	Following B
H	Fire Fighting Scheme Approval	Fire Department	Pre-construction	30	15	Following B
I	AAI Height NoC	Civil Aviation Department	Pre-construction	30-60	10	Following B

J	Defence Clearance	Ministry of Defence	Pre-construction	180	10	Following B
K	Building Permit Issue (All NOC	Development Authority/ Municipality	Pre-construction		1	Max of after C-J
	sub-total					
L	Electric Substation NoC (substation /transformers in the building)	Electricity Distribution Authority	During construction	15	5	Following K
M	Damp Proof Certificate (On Site)	Development Authority	During construction	7	3	Following K
N	Pollution Clearance	State Pollution control Board	During construction	30-60	5	Following L
Ø	**Construction Complete**	**Construction time depends on the project scale and size**				
O	Building completion Certificate	Development Authority/ Municipality	Post-construction	30-60	5	Following Ø
P	Service Plan Clearance and Service Connections	Service Departments / Parastatals	Post-construction	30	10	Following O
Q	Occupancy Certificate	Development Authority/ Municipality	Post-construction	15	2	Following P
	Sub-Total				**17 (Max)**	

Building plans approval includes approval from different bodies in charge for clearance of building plans before construction such as Urban Art Commission (UAC), National Monuments Authority (NMA), Airports Authority of India (AAI), Metro Rail Corporation (MRC), Heritage Conservation Committee (HCC), etc. to grant No Objection Certificate (NOC)/ approvals on the proposed building plans to the local bodies. Moreover, the clearance of the master plan from different bodies is required.

MBBL also defines the term "*Authority*"- The Authority which has been created by a statute and which, for the purpose of administering the Code/Part, may authorize a committee or an official or an agency to act on its behalf; hereinafter called the 'Authority'. Authority can be any Urban Local Body/Urban Development Authority/Industrial Development Authority or any other authority as notified by the State Government as the case may be.

MBBL also refers to the National Building Code (NBC) of India published by the Bureau of Indian Standards. The Planning, design and installation of electrical installations, air conditioning installation of lifts and escalators are to be carried out in accordance with the Part-VIII Building Services. However, deviations from National Building Code may be done as per good Engineering practices. All material and workmanship have to be of good quality conforming generally to be accepted standards of Public Works Department and Indian standard specification and codes as included in Part-V Building Materials and Part-VII Construction practices and safety of NBC.

The revised Model Building Bye Laws 2016 have envisaged '*Streamlining the Building Plan Approvals*' including all clearances within a month of application through online building plan approval system in order to ensure ease of doing business.

DCI related Provisions in MBBL

As far as DCI related requirements are concerned, MBBL-2016 in Part 5 (5.5.2) under Chapter "Provision of Electrical services" requires that there should be a mandatory provision of ducts for conveyance of telecommunication infrastructure networks. *"…provision of dedicated telecommunication ducts for all new building proposals is mandatory for conveyance of telecommunication and other data cables."*

Further, in Part 6 of the Bye-laws, which provides for "Provisions for structural safety", there are guidelines relating to "telecommunication infrastructure" including cellphone towers and telephone towers. The Bye-laws also provide for the type of structure to be located, where it should be located and the necessary permissions it requires to operate, i.e. SACFA permission from the WPC/ DoT and Part 6.1.9 deals with the Control of signage & outdoor display structures, cellphone towers and telephone towers.

3.4 National Building Code (NBC) of India

3.4.1 Introduction to various parts of the NBC

The National Building Code of India (NBC), a comprehensive building Code, is a national instrument providing guidelines for regulating the building construction activities across the country. It serves as a Model Code for adoption by all agencies involved in building construction works be they Public Works Departments, other government construction departments, local bodies or private construction agencies. The Code mainly contains administrative regulations, development control rules and general building requirements; fire safety requirements; stipulations regarding materials, structural design and construction (including safety); building and plumbing services; approach to sustainability; and asset and facility management. Provisions of National Building Code (NBC) are intended to serve as a Model for adoption. It lays down a set of minimum provisions (Safety, Accessibility, Environment friendly). Choice of

materials and methods is left to the ingenuity of the building professionals. NBC also recognized "Industrialized systems of building" for speed of construction and "Architectural control" to maintain the surroundings and premises at an acceptable level. NBC describes an integrated approach in its introduction. Its Part I to Part II focus on specific aspects, while the last part is supplemented with focus on sustainability. Telecom/ICT related requirements were introduced in 2016 and are included in Volume II Part 8 on "Building Services".

3.4.2   Administration Part of the NBC

NBC has played a key role in providing good practices and acceptable standards for a variety of utility services and defining requirements at the time of construction of building and also at subsequent stages such as operation and maintenance of the buildings. The administration part of the Code deals with aspects such as the applicability of the Code, organization of the Building Department for enforcement of the Code, procedure for obtaining development and building permits, and responsibility of the owner and all professionals involved in the planning, design, and construction of the building. Code also defines the "authority" that administers its Codes/Parts. It also defines the structure that is called a "Building" and also provides a definition for the owner of the building. The authority to administer can be given to a committee or an official or an agency to act on its behalf. Annexures A to P of the Code have details about the guide for the qualifications and competence of professionals, certificate for supervision of work, certificate for completed work, Completion Certificate, Occupancy Permit, etc.

3.4.3   ICT related Requirements in the NBC

Vol. 2 Part 8 Section 6 of the NBC provides requirements related to Information and Communication Enabled Installations mainly focuses on the essential requirements for ICT-enabled installations, technology systems and related cabling installations in a building. This section also covers basic design and integration requirements for telecommunication

with earmarking of spaces within the building/buildings and their cabling infrastructure including their components and passive connectivity hardware. It also mentions that buildings meant for data centers and those for housing telecom exchange or facilities for offering public services in such buildings may have to look into various other considerations suited to their requirements. The provisions given herein are basic requirements applicable to all residential and other buildings.

Further, the Code in Part 5, while setting out the guidelines for "Planning, Designing and Development", also mentions "intelligent designing" by utilizing voice and data communications.

3.5 Real Estate (Regulations and Development) Act 2016

It is an Act to establish the Real Estate Regulatory Authority for regulation and promotion of the real estate sector and to ensure sale of plot, apartment or building, as the case may be, or sale of real estate project, in an efficient and transparent manner and to protect the interest of consumers in the real estate sector and to establish an adjudicating mechanism for speedy dispute redressal and also to establish the Appellate Tribunal to hear appeals from the decisions, directions or orders of the Real Estate Regulatory Authority and the adjudicating officer and for matters connected therewith or incidental thereto.

The provisions of this Act advocate for protection of the interests of the consumers of real estate sector and for speedy disposal of their disputes. It mainly focusses on the implementation of the builder-buyer agreement and ensures provision of services as promised at the time of sale offer. Clause (zb) of the RERA defines internal development works which presently does not include DCI. Clause (zb) is reproduced below:

"*internal development works*" *means roads, footpaths, water supply, sewers, drains, parks, tree planting, street lighting, provision for community buildings and for treatment and disposal of sewage and sullage water, solid waste management and disposal, water conservation, energy management,*

fire protection and fire safety requirements, social infrastructure such as educational health and other public amenities or any other work in a project for its benefit, as per sanctioned plans;

Similar provisions for mandating digital connectivity inside the buildings may be incorporated in the builder-buyer agreement for covering it under the jurisdiction of this Act and its enforceability by the RERA.

The Ministry has notified the specific Sections of the Act for implementation with effect from 01st May, 2016, towards making of rules and establishment of regulatory authorities and appellate tribunals. Also, being the 'Appropriate Government' for Union Territories (UTs) without legislature, the Ministry notified the Real Estate (Regulation and Development) (General) Rules, 2016 and the Real Estate (Regulation and Development) (Agreement for Sale) Rules, 2016 on 31st October 2016.

34 States/UTs have notified rules under RERA; One North Eastern States (Nagaland) is under process to notify the rules.

3.6 Indian Telegraph Act

Right of way is the right in the nature of easement which provides for limited right of use of property belonging to another for specific purpose. Right of way can be over both public property i.e. property belonging to State, and private property. Legal provision relating to right of way for telecom sector are part of the Indian Telegraph Act 1885.

The Section 10 of Indian Telegraph Act 1885, provides *power of telegraph authority to place and maintain telegraph lines and posts*, Section 11 confers *power to enter on property in order to repair or remove telegraph lines or posts*, and Section 16 of the Act provides for *Exercise of powers conferred by section 10, and disputes as to compensation, in case of property other than that of a local authority.* The Section 19B of the Act provides for, *Power to confer upon licensee the powers of Telegraph Authority.*

3.6.1   Indian Telegraph Right of Way Rules 2016

These rules are applicable only for the property vested in Central Government, State Governments, local authority or other authority, body, company, or institution incorporated or established by the Central Government or the State Government (i.e. in relation to public property). These rules are not applicable to private property.

Further, Rule 14 of these rules provides that dispute under these rules shall be referred to the officer designated by the Central Government. However, it may be noted that vide Notification dated 22nd July 2017, DoT has designated officers of state governments/union territories only for the purpose of resolution of dispute under the rules. Therefore, in effect, power of dispute resolution under the rules lies with the state governments.

Further, rules/policy of many States provides for/give substantial reference to right of way for telecommunication services.

3.6.2   Infrastructure Provider Registration

In 2000, DoT invited application for Infrastructure Providers (IP-I) registrations. Prior to that only TSPs were installing tower and other passive infrastructure. Indian companies registered under Companies Act 1956/2013 are eligible to apply for IP-I registration. With introduction of IP-I, independent tower companies evolved and paved the way for sharing of infrastructure. IP-I create towers and passive infrastructure which they connect with TSP's infrastructure.

Earlier, there were two kinds of Infrastructure Providers namely IP-I and IP-II. Issuance of IP-II License has been discontinued w.e.f. 14th December 2005. An IP-II license could lease or rent out or sell end to end bandwidth i.e., digital transmission capacity capable to carry a message.

The **Infrastructure Providers Category-I (IP-I)** are those Infrastructure Providers who provide assets such as *Dark Fibre, Right of Way, Duct space and Tower*. There is no restriction on foreign equity and number of

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entrants. There is no entry fee and no bank guarantee. The applicant company is required to pay some processing fee only along with the application. The IP-I can establish and maintain the assets such as Dark Fibres, Right of Way, Duct Space and Tower for the purpose to grant on lease/rent/sale basis to the licensees of Telecom Services licensed under Section 4 of Indian Telegraph Act, 1885 on mutually agreed terms and conditions. In no case the company shall work and operate or provide telegraph service including end to end bandwidth as defined in Indian Telegraph Act, 1885 either to any service provider or any other customer.

3.7 Summary

For construction of building and development of area, various laws recognize roles of persons such as architects and engineers. Laws also prescribe minimum qualification requirements for such persons, and they are also required to be registered. Building bye laws require approvals and clearance from relevant agencies at different stages of the construction of building. "Building Services" under Building bye laws prescribe practices for planning, design and installation of lifts, air conditioning etc.

There is a need to create an ecosystem for planning, designing and installation of DCI on the similar lines as it is being done in case of civil and electrical engineering works. This ecosystem may also be required to be backed by the law. For example, there may be requirement to register persons who architect the solution for digital connectivity and persons who deploy designed solutions. There may be need to specify training and certification courses for persons responsible to design and deploy DCI. Building bye laws may need to incorporate requirements of DCI specific clearances or approvals. Next chapter deals these aspects in the detail.

CHAPTER 4

Developing New Ecosystem - *Entities, Tools, Processes and Market*

4.1 Key requirements to develop a new ecosystem

4.1.1 As already discussed in previous chapter, there is a need to create an ecosystem which will help property managers to design and deploy and evaluate Digital Connectivity Infrastructure (DCI) in such a manner that the deployed infrastructure, if integrated with TSPs' network, is ready for service delivery on non-discriminatory basis, and it also meets the expectations of the end users. Further, the ecosystem so created shall have digital infrastructure, which is designed based on scientific analysis with support from tools analyzing multiple inputs and simulating the same to provide best suited model for the given building.

4.1.2 In order to provide a good digital connectivity network inside the building in a timely manner, with active participation of the end users, influencing the decisions making processes, there is a need to introduce new entities, who would enable the stakeholders to come out with best suited solution. In addition, there would also be requirement of creating platforms and processes so that entities including those from sectors other than telecom, can get digital connectivity solution implemented easily. In short, such an ecosystem would require introduction of new entities, marketplace, processes, along with certified products and certified professionals.

4.2 Typical entities of new ecosystem

4.2.1 Typical entities in a new ecosystem may be:

a) *Property Manager* who may own the DCI for the building they are responsible for. They may also run it themselves or get services of

other agencies to run it on their behalf. Owning of the assets by property managers may give control in their hands, not only in the initial stages of the network roll out but during its entire life cycle.

b) *DCI Designers* are certified professionals who have competence and possess desired qualifications to design networks for in-building solutions. Such professionals may directly take up the work or there may be firms who hire such professionals to carry out the work.

c) *DCI Engineers* are certified professionals who have competence and possess desired qualifications to implement the solutions designed for in-buildings. Such professionals may provide services directly or there may be firms who can hire such professionals to carry out the work.

d) *DCI Evaluators* are empaneled agencies to measure and evaluate quality of network inside buildings. These agencies may have their own platforms, or they may be required to take services of a designated platform built for the purpose.

4.2.2 These entities would be required to be identified and recognized as part of new regulatory framework. Their role and responsibilities may also be required to be defined and described under Right of Way (RoW) Rules, the National Building Code (NBC) of India, Model Building Bye Laws (MBBL) and various other guidelines issued on the subject by Town and Country Planning Organisation under Ministry of Housing and Urban Affairs (MoHUA), for example Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines etc.

4.2.3 In addition to new entities, digital tools and platforms offering solutions to non-telecom professionals to get network designed may play important role in de-coupling activities related to realization of digital connectivity inside the buildings. It would enable property managers to get network designed as per the requirements of the users of the buildings. There are tools which help in deciding take-off quantity of the material and equipment that would be required to build the solution. Such tools may

also provide estimated cost for various options.

4.2.4 Establishing digital platforms which may enable collaborative working among stakeholders would help in faster roll out of digital connectivity. Collaborative tools may help in co-designing of the network by telecom professionals and real estate together. There may be entailing processes required to be defined and developed for the purpose.

Issues for Consultation

Q.1. How can an ecosystem be created to design, deploy and evaluate DCI with good connectivity in a cohesive and timely manner? What would be the typical role and responsibilities of actors of the ecosystem? Please justify your response with rationale and suitable examples, if any.

Q.2. How would the ecosystem proposed in response to Question no.1 ensure that created infrastructure does not get monopolized? Please justify your response with rationale and suitable examples, if any.

Q.3. How would the ecosystem proposed in response to Question no.1 enable DCI Designers to factor in the digital connectivity requirements of the existing and/or prospective users of the network? How can such requirements be gathered at the stage of construction of a new building or at the time of upgradation or expansion in case of pre-existing DCI? Please justify your response with rationale and suitable examples, if any.

Q.4. How would the ecosystem proposed in response to Question no.1 enable DCI Evaluators to get requisite information to evaluate and ensure that the designed or deployed network would meet the requirements of end users? Please justify your response with rationale and suitable examples, if any.

Q.5. How would the ecosystem proposed in response to Question no.1 ensure that upgrades and expansion of the DCI are done from time to time and

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continue to meet rising demands? Please justify your response with rationale and suitable examples, if any.

Q.6. How would the ecosystem proposed in response to Question no.1 ensure that the TSPs' networks are planned, designed, deployed, and upgraded to serve the DCI requirements in a timely manner? Please justify your response with rationale and suitable examples, if any.

4.2.5 Ecosystem and digital platforms so created may also work as a marketplace to various stake holders. Property managers would require services of professionals like DCI designers, DCI engineers and DCI evaluators to get solutions designed, deployed and evaluated in accordance with benchmarks defined for the purpose. Such certified professionals may be required to be recognized in designing, deployment and certification of quality of the work executed. A similar approach of recognizing the registration of professional being followed for Architects under the Architects Act, 1972 is described in **Annexure-IV**. The Architects Act, 1972 also lays down minimum qualifications for an Architect and Council of Architecture has the responsibility to regulate the education and practice of profession throughout India besides maintaining the register of architects.

In telecom domain, there are various training and certification courses to plan, design and deploy DCI. List of some of such courses are offered by various organizations such as BICSI, iNARTE, CTNS etc.is provided in **Annexure V**. However, there may be need to examine content of such courses and their suitability in India specific environment. These courses might be accredited in present form or may be required to be customized for India specific requirements. Availability of such courses in the country and affordability may also be required to be seen. The present training infrastructure available in the telecom sector may be utilized to offer such courses.

4.2.6 The platforms so created for hiring services of certified professionals

shall facilitate property managers and other stakeholders, as per their convenience. These platforms may also be used to gather feedback about the quality of the work carried out by the professionals.

4.2.7 To ensure that property managers use standard products to build the solutions, the certification of products related to the in-building solutions is also required. Currently, Telecom Engineering Centre (TEC), DoT is entrusted with the task of mandatory testing requirements in case of telecom products. TEC may also take up certification of products related to inbuilding solutions. List of certified products may be made available in public domain so that network designers consider the same while designing solutions and procurement of the same.

Issues for Consultation

Q.7. How can an ecosystem be created to build capacity requirements of skilled professionals such as DCI Designers, DCI Engineers, DCI Evaluators? What would be the typical role and responsibilities of actors of the ecosystem? Please justify your response with rationale and suitable examples, if any.

Q.8. How would the ecosystem proposed in response to Question no.7 ensure that relevant training courses are available in the country? Please justify your response with rationale and suitable examples, if any.

Q.9. Whether the training courses proposed in response to Question no. 8 are already being offered by any organisation or institution that can be recognized for the purpose? If yes, please provide a list of organisations offering such courses. If not, how specialized courses can be designed to meet the requirements? Please justify your response with rationale and suitable examples, if any.

Q.10.   Is there a need to establish a council on the lines of "Council of Architecture" (CoA) to regulate minimum qualifications, additional

specialized courses and practice of DCI profession in the country? Please justify your response with rationale and suitable examples, if any.

Q.11.   Whether the requirements of additional specialized courses and practices of profession would vary depending upon the size of work or kind of work involved in a particular DCI project? Please justify your response with rationale and suitable examples, if any.

Q.12.   Whether creation of a digital platform to hire services of professionals would help Property Managers in creation of DCI? Should there be a feedback mechanism to assess quality of services delivered by professionals? Please justify your response with rationale and suitable examples, if any.

Q.13.   Whether creation of a digital platform for procurement of certified products would help Property Managers in creation of DCI? How would the certified products for the purpose of DCI be identified and updated on the platform? Please justify your response with rationale and suitable examples, if any.

4.3   Key issues in empowering property managers to build and own the network

4.3.1 In such new ecosystem, if property managers are allowed to play a role to build the infrastructure for the building, then some new issues may emerge which may be required to be addressed. For example, there may be need to create new category of Infrastructure Providers defined for a specific purpose.

4.3.2 Co-ownership of the assets may be helpful in addressing issues where agency engaged to build, operate and manage digital infrastructure is required to be changed due to non-performance or breach of the contract by the property managers. In such a scenario, key issues like transferring ownership or foreclosing contract etc. are required to be handled.

Currently, award of contracts and ownership of inbuilding networks do not take care of such situations creating problems for the users when the service provider fails. One possible solution is to have ownership mandatorily in the hands of end users in a similar way as it is done when a realtor hands over the completed housing project to Resident Welfare Association, which acts as a registered society of the purchasers of units in the project.

4.3.3 Further, there may also be a requirement to define accounting practices for operating and maintaining the networks and, if required, to define performance requirements at a building level. Such measures may be important to bring transparency to the end users who have stakes in building, operating and managing such an infrastructure.

Issue for Consultation

Q.14. **What may be the possible models of DCI ownership and its upkeep? Whether co-ownership models would help in aligning incentives in realising connectivity that would meet expectations of the end users from time to time? Should there be a need to specify terms and conditions for entities owning and responsible for upkeep of DCI to function in a fair, transparent and non-discriminatory manner? Please justify your response with rationale and suitable examples, if any.**

4.4 Key changes required in the NBC to enable new ecosystem

4.4.1 Provisions of National Building Code of India 2016 (NBC) are intended to serve as a guiding principle to be followed by all stakeholders for adoption. NBC has played a key role in providing good practices and acceptable standards for a variety of utility services and defining requirements at the time of construction of building and at subsequent stages also such as operation and maintenance of the buildings.

The Telecom/ICT related requirements were included in "Volume II Part 8:

Section 6" of NBC in 2016. These requirements mainly focus on the essential requirements for ICT enabled installations, technology systems and related cabling installations in a building. This section also covers basic design and integration requirements for telecommunication with earmarking of spaces within the building/ buildings and their cabling infrastructure including their components and passive connectivity hardware. The various aspects of the NBC 2016 are already dealt in detail in Chapter 3.

4.4.2 Though the requirements for telecom and ICT have been introduced in NBC for project management, design and supervision, however no separate concept of preparation of plan and designs, approval thereof and certification is prescribed. Rather general practices which are applicable for civil and electrical work are followed. Telecom and ICT i.e. digital connectivity infrastructure requires a separate classification on the line of classification of buildings for "Fire and Safety" as mentioned in **Annexure-VI.** Also, design of telecom and ICT is evolutionary and requires property manager's participation in the process of creation of DCI.

4.4.3 As such there is requirement of incorporating necessary provisions in NBC for creating a system for defining qualifications of professionals for provision of digital connectivity infrastructure and their registration processes etc. NBC can assign some specialized agency for this purpose. NBC provisions can be further incorporated in various Building Bye Laws and Guidelines published by Ministry of Housing and Urban Affairs and/or State/UT Governments.

4.4.4 To design and deploy a digital connectivity infrastructure involving wireline or wireless systems which can meet the desired coverage and capacity it might be critical to refer to the specific standards of telecom and ICT and Best Current Practices (BCPs), and then NBC may be required to develop more detailed guidelines on the subject. Planning and designing of digital connectivity infrastructure, apart from technical parameters, will need consideration of other parameters such as aesthetics, safety, value

engineering etc. Such parameters can vary according to the types and size of the buildings, and service requirements of occupants. This may also impact the design and deployment of the systems. Buildings can be specifically classified for digital connectivity infrastructure on the basis of various factors like area, height, density, type of construction and type of use. As mentioned in table 2 of **Annexure-VI**, it will be very useful to define general parameters for different classes of buildings for digital connectivity infrastructure. The monograph discusses in detail the varied requirements depending upon class or type of the building.

Issues for Consultation

Q.15. **As one solution might not be suitable for all types of buildings, whether current requirements stipulated in the National Building Code of India, 2016 would be required to be evolved and prescribed ab initio to make it more appropriate for DCI requirements? Please justify your response with rationale and suitable examples, if any.**

Q.16. **Whether NBC needs to prescribe a separate classification of buildings for the purpose of DCI? If yes, which factors should be considered to make such a classification? If not, how to accommodate DCI specific requirements in the existing classification of buildings by the NBC? Please justify your response with rationale and suitable examples, if any.**

4.5 Need to recognise and register professionals for digital connectivity infrastructure and specify qualifications and other aspects for such professionals

Volume II Part 8 of NBC 2016 on Building Services specifies qualifications and competence of the architects, various engineers, designers and the contractors for utility services but does not specify any qualifications for professional experts for telecom and ICT i.e. DCI. Telecom and IT infrastructure in the buildings is becoming critical in the light of Industry 4.0 and new technologies like artificial intelligence (AI), augmented reality

(AR)/ virtual reality (VR), robotics, machine to machine (M2M) communication etc. being increasingly used at the workplace and even at home in light of increasing work from home. Hence, there is a need to recognise certified professionals for digital connectivity infrastructure without any delay. NBC enables government to stipulate eligible requirements for registering professionals for building works and services under Building Services part of the Code.

The Authority may take into account practices being followed by national professional bodies dealing with specialist engineering services for arriving at the conclusion to recommend such professionals for digital connectivity infrastructure, if required by a law as had been done in case of other technical professionals connected with construction. The responsibilities of Individual Persons on Record (PoR) for professionals of Architect, Engineer, Structural Engineer, etc. are mentioned in The Comprehensive General Development Control Regulations -2017 notified by Urban Development and Urban Housing Department, Government of Gujarat.

For a good DCI within the building or area, it is important to engage qualified professionals for the entire period of the DCI project for an integrated approach. However, professionals referred in NBC for telecom or ICT planning and installations are only Electrical Engineers, with the competency in LV (Low Voltage) systems. They are not experts in telecom or ICT and more specifically, they may not be qualified to handle radio networks covering 2G, 3G, 4G and upcoming 5G mobile network systems.

Further, in wireless systems, installing antennas at buildings or boundary walls or street poles might be required, and such requirements need engagement of telecom or ICT design professionals. Designing wireless systems requires in depth knowledge of radio propagation models, capacity calculation on air interface, and hands-on experience on coverage prediction tools, drive or walk test tools, etc. Hence, it is absolutely necessary to create a new category of professionals to handle increasingly complex subject of digital connectivity infrastructure.

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4.6 Appropriate provisions of requirements in NBC, Building Bye Laws and other associated guidelines and laws for digital connectivity infrastructure

a) Keeping in view the complexity of the subject, handling of varieties of building types and rapid changes on supply and demand side, it would be better to have standards which are open and ready to accommodate futuristic standards evolving from time to time. Accordingly, standardisation body created either under broad ambit of NBC or through any other agency, as deemed fit, should keep enough provisions in standards to take care of innovative solutions offered by the network designers. However, it may be useful to give legal backing to such requirements by appropriately amending various related laws, bye-laws and regulations. Amendments may also be required in the state and central laws and related regulations.

b) Such separate standards for DCI may not only help in dealing with rapid changes in digital communication but also would be helpful in allowing participation of relevant stakeholders in the design and implementation of digital connectivity infrastructure. Such standards will be required to be made applicable to special areas and organisations like Railways, Defence estates, Cantonment areas etc.

c) In such ecosystem, NBC and Building Bye Laws may be required to amended so as to recognise the DCI professionals and standardisation body so as to provide legal backing which is entrusted with formulation

of standards including specifications, guidelines and processes.

Issue for Consultation

Q.18. **How can the clearances or approvals required for DCI at various stages of construction of building may be incorporated in building bye laws? In typical building bye laws, there are provisions for getting clearances from central government e.g., in case of civil aviation, defense and telecom being a central subject, what role can be played by the central government in giving such clearances or granting such approvals? Please justify your response with rationale and suitable examples, if any.**

4.7 Empowerment and Accountability of Property Managers to create, own and run DCI

4.7.1 Need to have legal obligations on property managers for creating digital infrastructure

Currently property managers do not have any legal obligations to ensure a good digital connectivity inside a building or in an area which they are controlling or managing. At the same time, they do have obligations in terms of ensuring proper supply and management of appropriate infrastructure for utility services such as water supplies, electricity, sewage, drainage, fire safety systems etc. As mentioned earlier, telecommunications services, are becoming increasingly critical and essential not only for enterprises but also for common users. Therefore, it is essentially required that all stakeholders should create digital connectivity infrastructure in line to other essential services infrastructures.

4.7.2 Need to deal with monopolistic situations

a) Further, Infrastructure Providers (IPs) in telecom and ICT do not have

any direct regulatory obligations, as far as quality of service is concerned. It is expected to be governed via Service Level Agreements (SLAs) that if TSPs enter into with IPs. However, normally as only one IP is selected for a building or area, TSPs may not have much say in influencing the residents and users in enforcing such SLA agreements between TSPs and IPs.

b) Property managers are supposed to work as facilitator for providing good quality digital connectivity to the users in their respective areas. They rather see requests by the TSPs for access to the building or areas for laying telecom infrastructure as a business opportunity and try to maximize their revenues. They give exclusive rights to a particular entity to operate DCI in their buildings or area, many times by way of bidding. The selected bidder gets monopolistic rights to operate DCI either through leasing to one of the TSPs purely on commercial terms or operates as an ISP by leasing bandwidth from TSPs. In both the cases, options available to the end users are very limited and users, most of the times, are denied good quality digital connectivity.

4.7.3   Need to develop a mechanism that ensures sustained good digital connectivity

Further, many times, infrastructure created by Infrastructure providers is not adequately equipped or upgraded to meet challenges posed by changing technologies. As a result, the exercise of building a sustained good digital connectivity network fails if existing infrastructure is not adequately upgraded. Here, the prime motive of the infrastructure provider is maximization of the monetization.

4.8   Need to have a new regulatory framework that assigns bigger role to property managers

a) If new responsibilities are to be given to the property managers, then there is a need to make necessary changes in the legal, licensing and regulatory requirements to recognize them as one of the responsible

stakeholders in the eco-system. For example, if we want to create DCI in accordance with the regulatory framework developed, property managers may be required to be recognized as an entity under the Indian Telegraph Act, 1885 and the Indian Wireless Act, 1933.

b) In new ecosystem, as per the discussions in above paragraphs, the ownership and the management of the solution in case of buildings may be shifted towards property managers. They may be responsible for all financial, regulatory, legal and technical aspects of designing, deploying, installing and maintaining the system.

c) Property managers with onus of ensuring good quality network inside the building or area, can get tailored solutions for their buildings and provide the same to the end users. The property managers will have liberty to build DCI designed and deployed by the certified firms or professionals by using certified products.

d) The network solutions so developed can be evaluated by DCI evaluators.

Issue for Consultation

Q.19. **Is there a need to introduce a special class of Infrastructure Providers to create, operate and maintain DCI for a building or cluster of buildings in ownership models suggested in response to Question No. 14? What should be the terms and conditions for such special Infrastructure Providers? Should such terms and conditions vary depending upon type, size and usage of buildings? Please justify your response with rationale and suitable examples, if any.**

CHAPTER 5

Nudging Property Managers - *Rating System for Digital Connectivity Infrastructure*

5.1 New ecosystem may enable market forces to drive QoS requirements for a building

5.1.1 Some may tend to think that defining baseline requirements of quality of service for IPs may address the issue. However, in this case following points are to be kept in mind:

a) IPs are governed purely by their business interest and hence they may not provide services in buildings and areas where it is not economically viable.

b) All buildings are not of the same type and it is almost impossible to define general requirements that serve the purpose in all circumstances.

c) In wireless, there are multiple solutions including those for connecting a building from outside to achieve the same result of intended DCI.

5.1.2 As discussed in previous chapter, if an ecosystem is developed, then an in-building solution would get deployed that would meet general requirements of the users. Such ecosystem may also offer options to consumers to get customized premium quality network built. However, just having regulatory framework that defines new entities, lists out processes and creates a marketplace, may not be adequate to meet the desired objectives. To reach a level of delightful experience, a mechanism may be required to be introduced that would nudge property managers to come forward and implement the solutions accordingly.

5.2 Need to rate digital connectivity experience in the building

5.2.1 All issues mentioned above are addressable, if we start looking from end user's perspective and empower them to control and manage the issues that are affecting them. A building can be categorized based on assessment of quality of digital connectivity and suitable rating can be awarded to the buildings. Such rating can bring value addition to the concerned building. This will also draw attention of all stakeholders especially end users. If ratings are poor, then property managers and other stakeholders will be required to improve such ratings for the benefit of the users. For example, cleanliness rating of the cities by the government has drawn attention of all stakeholders towards improving rating of their cities. Some of existing framework for rating system used in other fields like hotels and green buildings are described in **Annexure-VIII**.

5.2.2 Rating of digital connectivity experience of the buildings would create an environment that can cause competition among property managers to achieve best quality in their buildings. This is quite likely to happen as positive externalities of rating of digital connectivity will impact the commercial decision of buyers and prospective tenants.

5.2.3 If end users and property managers are enabled and empowered to design, deploy and operate DCI under an ecosystem of designers, engineers and evaluators on one hand and property managers and rating agencies on the other hand, then market forces may start working in a manner that might address the issues and concerns of the end users.

5.3 International practices regarding rating of buildings

Internationally, in a few countries, rating of buildings has already started or on advanced stages of being introduced. However, these initiatives are taken by private organizations or by consortium of telecom industry or by

building councils. Some of such initiatives are given below:

5.3.1 WiredScore Score Certification Programs

a) WiredScore[11] a global organization that owns and operates WiredScore Certification provides digital connectivity certification. It rates quality and resilience of digital infrastructure in the buildings. It is operating in multiple countries and regions including USA, Canada, Australia, UK, and Europe.

b) WiredScore certification acts as an independent digital connectivity benchmark and provides landlords/ managers with insights to enhance their building's digital infrastructure. WiredScore certifies buildings including commercial, residential properties and mixed-use neighborhoods. It rates them on a scale of five, based on points earned through credit scores. WiredScore certifies buildings at four different levels, including WiredScore Certified, WiredScore Silver, WiredScore Gold, and WiredScore Platinum.

c) WiredScore certification measures the quality and resilience of the digital infrastructure of a building, mobile coverage, the choice of internet service providers and whether the buildings' critical digital infrastructure is safe and secure from any physical damage. The certification ensures that the building has the infrastructure in place to adapt to future technological advancements. It measures resilience, future readiness, mobile coverage, choice of providers and user experience. It also provides a digital map to search WiredScore Certified Buildings. It also enables a concierge service by the landlord to tenants to help them connect to the internet and enable more seamless move-in experience.

d) It has developed a system offering for interested ones to become WiredScore Accredited Professionals and also a platform for hiring such professionals. The WiredScore D&R AP (Development and

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[11] https://wiredscore.com/

Redevelopment Accredited Professional) program has been designed for professionals such as Engineers, Building Consultants, Technology Consultants, Sustainability Professionals, Architects, Project Managers, and Certification Consultants who work with developers and landlords in the commercial real estate sector.

5.3.2   SPIRE program by UL and TIA for assessing smart buildings

a) In the USA, Underwriters Laboratory (UL)[12] and the Telecommunications Industry Association (TIA) recently announced that they would provide a joint program for assessing smart buildings. The SPIRE Smart Building Program will offer both self-certification programs as well as Verified Assessment Ratings completed jointly by UL and TIA that measures the effectiveness and security of smart buildings based on six primary criteria of life and property safety, health and well-being, connectivity, power and energy, cybersecurity and sustainability. The SPIRE Self-Assessment online tool can evaluate building intelligence and performance based on an expertly curated, objective and holistic framework across these six criteria.

b) The SPIRE Verified Assessment and Rating offers a complete smart building evaluation with the opportunity to earn a Smart Building Verified Mark and a plaque to proudly display the Verified Mark. They also have a plan to offer benchmarking that draws upon anonymized building performance data. Comparisons would be available by assessment criteria and building type, giving users a point-of-reference for review and analysis.

5.3.3   Other programs of certification of buildings

There are similar efforts to certify certain aspects of the built environment, by the US Green Building Council's LEED Certification but

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[12] https://ul.org/

its focus is on sustainability. Arc Skoru helps power the LEED certification and has a relationship with Green Business Certification Inc. The WELL building certification standard focuses on the human health and well-being aspect of smart buildings.

5.4 Expected benefits of introducing rating system to various Stakeholders

Introduction of rating systems for digital connectivity experience is expected to bring benefits to various stakeholders and some of these are presented in the following paragraphs.

5.4.1 Expected benefits to the property managers

Digital transformation will make reliable mobile connectivity even more essential. Ongoing COVID-19 pandemic has made work from remote locations a norm. Good connectivity would most likely result in increasing the value of the property including rental value as it increases productivity, improves satisfaction, and boosts commercial activity making the property more attractive.

5.4.2 Expected benefits to the end-users

a) Introduction of rating systems for digital connectivity would result in the principal-agent system to work in the interest of end users. Real estate buyers and tenants looking for high quality digital infrastructure would be able to make informed choices and thereby put pressure on builders and property managers to build and maintain good quality digital infrastructure. End users who are visitors to the building would also get benefitted. Rating known to the public and especially to current or prospective users, buyers or tenants would empower them to demand a good quality network.

b) Good and reliable digital connectivity infrastructure would improve quality of life, social inclusion, increased use of new services and applications, and overall better user experience.

c) Areas such as the subway and tunnels, railway track, highway which often suffer from lack of coverage and poor quality, are more likely to receive attention of the community and concerned authorities once the rating of digital connectivity is published.

5.4.3 Expected benefits to TSPs

a) Flexible business models are likely to improve business case for the mobile operators. Macro base stations alone might not be good enough to tackle growing connectivity needs, they also need to densify their networks inside the buildings. Collaborative models and approach of co-design, co-create, and co-build would help TSPs to get good quality digital infrastructure built inside buildings.

b) Public authorities or the authorities who are currently responsible for grant of permissions for deploying digital connectivity infrastructure would also now be eager to improve the rating of the area/city/state and work in collaboration with TSPs to build digital connectivity infrastructure.

c) Similarly, property managers would offer support to TSPs to put infrastructure or get it deployed to ensure good quality digital connectivity and make the property attractive.

d) TSPs would also be benefitted as they may get better understanding of total cost of owning the DCI project, associated liabilities and rights which would facilitate selection from various options available in CapEx or OpEx models.

5.4.4 Expected benefits to new entities that may emerge

A system of building ratings may create an environment and eco-systems where multiple skilled agencies will get new opportunities offering services like designing and implementation of inbuilding solutions. New entities may emerge that can play an important role in survey, assessment, and evaluation of areas for award of ratings. This will also create opportunities for many startups, and small & medium

entrepreneurs to create necessary infrastructure and support systems providing good quality of services through outsourced models.

5.5 Rating mechanism would nudge property managers to improve connectivity

Rating would provide information transparency about quality of DCI in the buildings. As property managers will also be benefitted with better ratings, it is expected that rating would nudge the property managers to build good DCI. In case of new buildings where infrastructure is to be built and property managers can clearly see business model of providing good connectivity, they would be willing to invest.

Even property managers of existing buildings and areas used for business related activities such as enterprise workplaces, shopping malls, industrial estates, restaurants, cafeterias etc., would be willing to invest and build good connectivity. Even in case of existing residential buildings, residents may push to get better rating when they will realize that they are empowered to influence the property managers.

It is also expected that likely commercial benefits of good connectivity would automatically push property managers to get their buildings rated. A good awareness campaign may push property managers of existing buildings to get their buildings rated.

If concept of rating of building is extended to rate cities, towns and even villages, then it may push local government authorities to mobilize local resources to create awareness about rating. The local authorities and states may also take steps to improve rating of their cities, towns, villages which may include facilitating roll out of networks in collaboration with TSPs, augmentation of outdoor digital infrastructure, overhauling approval mechanism, and helping stakeholders to upgrade digital connectivity infrastructure to match new technologies. Criteria like number of buildings rated, ratings awarded to such buildings, outdoor quality of network, easy approval mechanism for DCI etc. may be used

for rating of a city.

Issues for Consultation

Q.20.   What are the initiatives or practices being taken in other jurisdictions outside India with regard to rating of buildings from a DCI perspective? Please share details and suggest how similar processes can be created in India?

Q.21.   Is there a need to introduce Rating of buildings from the perspective of DCI that may help in nudging the Property Managers to strive for collaboration with other stakeholders to meet the digital connectivity expectations of the users of the building? Please justify your response with rationale and suitable examples, if any.

Q.22.   In case, rating is introduced as a voluntary scheme, is there a need to monitor the progress? If progress is not satisfactory, would there be a need to launch campaigns and awareness drive to encourage Property Managers to come forward for rating? Please justify your response with rationale and suitable examples, if any.

Q.23.   Should the voluntary scheme of rating be extended to cover cities, towns and villages and even states? Would such a scheme help in encouraging local and state authorities to facilitate TSPs in creation or in improving outdoor as well as indoor DCI? Please justify your response with rationale and suitable examples, if any.

Q.24.   If in response to the Question No. 23 answer is yes then what framework should be introduced to rate cities, towns, villages and states, and how weightages can be assigned to different aspects of indoor and outdoor connectivity? Please justify your response with rationale and suitable examples, if any.

CHAPTER 6

New Regulatory Framework to Institutionalize New Ecosystem

6.1 Need to make necessary provisions in the law to introduce a system of rating

6.1.1 It would be pertinent to note that rating in general would nudge property managers to get their buildings evaluated on quality of DCI available in the building. Rating may not be made mandatory for all buildings. The market forces may push property managers to act in the direction of improving quality inside buildings and add values to their properties, to make same as business case. It is expected that once a successful model emerges, various stakeholders would start adopting it.

6.1.2 However, in some cases, it may be required to make it mandatory, especially in the cases in which end-users don't have any ownership or have not rented any space. In such cases, many users of the buildings might be prospective owners or tenants or daily visitors as working employees/citizens availing facilities created in the building. Examples of such buildings can be airports, ports, railway stations, public transport stations, bus stands, major rail routes and highways, large shopping complexes, industrial estates, major market areas, office or workplaces, government buildings, government residential colonies and any other building of public importance. In such cases it may be required to make rating mandatory. Rating may also be made mandatory for large or high-rise residential buildings.

6.1.3 In case of important buildings where rating is made mandatory, designating a nodal official may help other stakeholders involved in quality assessment of DCI. Such an official may play a significant role in reaching out to the concerned stakeholders, coordinating activities, and getting digital connectivity rated.

6.2   Changes required in law

a) It may be required to create a legal framework to enforce voluntary and mandatory requirements of ratings. The relevant laws including the Indian Telegraph Act, the Indian Wireless Act and other relevant acts are to be aligned to recognize property managers as legal stakeholders in providing DCI in the buildings.

b) For buildings where option to get rated is mandatory, a clear road map is to be developed to rate such buildings which may be in large numbers. New ecosystem would also require TSPs, property managers and other stakeholders to participate in co-design, co-creation and co-deployment. In order to ensure that end-users are empowered to influence the decisions and force property managers to act in their interest, it is required to introduce appropriate legal provisions. Legal provisions are also required to support the stakeholders in getting necessary permissions from the concerned authorities in a time bound manner. These legal provisions may be either in the Indian Telegraph Act, Indian Wireless Act or other relevant laws related to Building Bye Laws, National Building Code, Real Estate Acts, Urban and Regional Development Plans Formulations and Guidelines and also in other relevant acts related to development activities taken up in Railways, Cantonment Boards and Forest etc. The details of such legal framework for construction of building and roll out of DCI are mentioned in detail in Chapter 3.

c) The laws and guidelines are required to be reviewed periodically so as to facilitate market growth continually in smooth manner.

6.3   Regulator may play important role in introduction of rating

The initiatives for building ratings have been introduced mainly in advanced countries and are mostly led by industry. In country like India where in past one and half decades, communication network expansion has seen exponential growth with introduction of new technologies specially in wireless segment serving more than 116 million customers and its

readiness to launch of 5G soon, it is essential to create a well-defined system to ensure availability of reliable and robust digital connectivity infrastructure in every building. As such, any delay in establishment of a regulatory framework duly supported by all stakeholders may be detrimental to digital inclusion and effective launch and utilization of the potentials of 5G technologies.

Further, even if such ecosystem of rating gets introduced, it will require adoption at an accelerated rate and therefore to extend the benefits of such ecosystem of rating, regulator may be required to play an important role. To make such system acceptable to all stakeholders, a wider consultation is required to be done before it gets introduced. It is well acknowledged that private players and industry may play very important role in creation of ecosystem and run it. However, establishment of an institutional mechanism backed by regulations may help in implementation as well as protecting the interests of all stakeholders including end-users.

6.4 Regulator support to stakeholders in implementing innovative solutions

a) Sometimes, it is observed that the present regulations are not fully aligned to promote innovative solutions. The regulations are general in nature specially when it comes to technical aspects. However, new innovations and new technologies allow a problem to be handled in a different manner which also reduce cost and improve quality. We may need to take a relook at existing regulatory provisions and make them flexible to allow innovations in in-building solutions.

b) **Regulatory Sandbox** approach may help in demonstrating capabilities of innovative solutions before relevant stakeholders. Based on feedback, necessary changes in the laws or regulations may be required. Changes may be related to variety of aspects covering technical specifications/standards such as limits of maximum output power in case of smart antennas, changes in approval processes, new business models introducing new entities and assigning role and

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responsibilities in new context and any out of box solutions.

c) Regulatory Sandbox may also bring different types of stakeholders together to demonstrate their capabilities in the fields of planning, designing, procurement, deployment, and evaluation in the new ecosystem. New concepts with necessary proven-ness of the product and features may help in bringing acceptance of the solution by the property managers. For example, better way of camouflaging and aesthetic blending of digital infrastructure. Such solutions may also be demonstrated as a part of Regulatory Sandbox.

Issues for Consultation

Q.25. **Is there a need to make rating a mandatory requirement for specific classes of buildings such as public transport hubs, government buildings or any building of public importance etc.? If yes, which type of buildings should be covered under this category? Please justify your response with rationale and suitable examples, if any.**

Q.26. **What should be the time plan to rate buildings falling under the mandatory category and is there a need to prioritize some buildings within the mandatory category to make it more effective? Whether existing buildings falling under such classes are required to be dealt differently? Please justify your response with rationale and suitable examples, if any.**

Q.27. **Is there a need to designate a nodal official for building(s) falling under the mandatory category to comply with the rating related requirements? What actions are proposed to be taken in case of non-compliance? Please justify your response with rationale and suitable examples, if any.**

Q.28. **Is there a need to amend legal provisions under various laws, bye laws dealing with development of land and buildings or areas including forest areas, cantonment areas, port areas, panchayat areas, municipal areas etc. to facilitate creation of DCI and ratings of the buildings or**

> **areas? Please justify your response with rationale and suitable examples, if any.**
>
> **Q.29. In case a voluntary scheme for rating is to be introduced or rating is notified as mandatory for specific classes of buildings then what should be the role of TRAI or DoT? Please justify your response with rationale and suitable examples, if any.**
>
> **Q.30. Whether creation of "Regulatory Sandbox" to carry out experiments or demonstrate capabilities of innovative solutions to improve digital connectivity would be helpful to make changes in existing policies, laws or regulations? What should be the terms and conditions to establish a regulatory sandbox? Please justify your response with rationale and suitable examples, if any.**

6.5 Authorities or agencies to evaluate and rate buildings

6.5.1 Use reports of DCI evaluators

a) As large number of buildings may be required to be rated or there may be voluntarily options for rating, the volume of work may be huge and will require considerable amount of time and resources. In addition, these buildings would be spread across the country. It may not be possible to carry out this work unless an elaborate ecosystem is created which allows, promotes and encourages participation of private sector and active role of state governments and local bodies.

b) Identification of agencies who can carry out such work of rating and create an institutional mechanism that assigns role and responsibilities of such agencies is crucial. These agencies may be hired by property managers for evaluation to be done by using objective and other methods. These agencies will also be required to follow certain well-defined guidelines so that their evaluation remain reliable and trustworthy. DCI evaluators may carry out such functions and their reports may be used to rate the buildings.

c) DCI evaluators may operate in a particular region and may also

develop expertise in particular type of buildings. There may be a need to maintain a data base of such evaluators and the works performed. Such readily available pool of information will help property manager in selecting and hiring of an appropriate DCI evaluator for rating his building.

d) It may be appropriate to develop a platform, service of which can be used by the DCI evaluators. Advantage of having such a platform is that it allows standards to be established based on learning of such evaluators and improve same from time to time to take care of futuristic requirements.

e) It is also required to be examined whether there may be a single platform or multiple platforms. In case of multiple platforms, there may be requirements to establish a synergy between platforms for common types of evaluations. Ownership of these platform may be with the regulator and or any agency authorized for the purpose. Or it may also be run by private entities with detailed terms and conditions defined by an appropriate regulation in this regard.

6.5.2   Introduce certification and certificate issuing authority

a) On the basis of the measurements and evaluation details provided by the DCI evaluators, a certificate of rating will be required to be issued to the property manager for his building being rated. For discussion and deliberations, such entities issuing such certificates may be called as *Certificate Issuing Authorities*. Ratings may be awarded in terms of numerical values and there may be a standard form to present it in form of stars as illustrated in following figure 6.1. This certificate should be usable for all legal purposes and may allow rating of digital connectivity to be used for various marketing purposes. Due provisions may be required in regulations to deal with any misuse of methods of rating. When rating awarded earlier is withdrawn or becomes time barred, provisions may be required so that old rating is not used again.

Figure 6.1: Rating Presented in Form of Stars

b) Such certificate can have associated terms and conditions for its use with a validity period. It may also provide conditions under which it may be required to be renewed or may also describe conditions under which it may be withdrawn. For example, performance quality of same DCI may degrade because of change in average traffic demand or expectations may get changed because of availability of new technology networks, spectrum bands. In case, additional capabilities are introduced in DCI and renewal of rating is requested, only incremental assessment might be required to be done.

c) There may be requirement of identifying and delegating power to issue certificates and reviewing the same periodically for continued compliances. Also, there is need to maintain a data base of such awards on a platform accessible to the relevant authorities for verifications and further auditing, as the case may be.

6.5.3 Appellate Authority

There may be instances of disagreement of the Property Manager with the rating assigned to his building based on the measurement and the evaluation done. There is need for the provisions in the new framework for revaluation of the rating assigned, where the property manager can prefer appeal against the decision of the Certificate Issuing authority, for review and reconsideration, within certain time frame of receiving the communication of rating assigned. The appeal so preferred is also required to be disposed in timely manner for maintaining fairness and transparency in the system.

Issues for Consultation

Q.31. Is there a need to establish a Certificate Issuing Authority to award ratings to buildings from DCI perspective? If yes, what should be the structure of such an authority? If not, who can be assigned the role to perform this function? Please justify your response with rationale and suitable examples, if any.

Q.32. Whether the authority suggested in response to Question no. 31 may use reports from DCI evaluators to award ratings? To ensure reliability of reports from DCI Evaluators, should Certificate Issuing Authority need to conduct periodic audits of DCI evaluators? Please justify your response with rationale and suitable examples, if any.

Q.33. What should be the terms and conditions for using ratings awarded to a building(s) from a DCI perspective? What should be the validity period of awarded ratings? Do you envisage any situations under which an awardee of ratings might be required to get the ratings renewed before the validity period? Please justify your response with rationale and suitable examples, if any.

Q.34. Whether in the initial stages of introduction of the rating system, validity should be for a shorter time period, and later it may be increased over time as evaluation system matures? Should the validity period be dependent on the type of buildings? Please justify your response with rationale and suitable examples, if any.

Q.35. Whether the process of renewal of rating should be the same as the process defined to get rated first time or it may be incremental? Or renewal process may be dependent upon the grounds on which it is being renewed e.g. expiry of validity period, introduction of new technology, introduction of new spectrum band(s), introduction of new services(s) etc.? Please justify your response with rationale and suitable examples, if any.

Q.36. Whether the provisions to make an appeal should be introduced to give an opportunity to the applicant to make representation against the decisions of the Certificate Issuing Authority? What should be the time frame for preferring the appeal in case of disagreement with the rating assigned and its disposal? Please justify your response with rationale and suitable examples, if any.

Q.37. If somebody is found to be using ratings in an unauthorized manner, what legal actions are proposed to be taken against such entities? Please justify your response with rationale and suitable examples, if any.

CHAPTER 7

Rating Framework - *Detailed Methodology*

7.1 Rating is a complex task

Rating at first instance seems to be a simple concept and easy to implement but, in reality, it may be a complex task. Rating involves assessment of quality which can be done using objective methods and subjective methods. Objective methods may involve measurement of parameters related to Key Performance Indicators (KPIs). These KPIs may be for network performances and service performances. Subjective methods may involve surveying about the quality perceived by end users. For a good assessment, outcome of both types of methods, objective as well as subjective methods, would be required to be combined.

7.1.1 Complexities involved in the assessment via objective methods

a) Assessment of quality by measuring network and service related KPIs involves complexities on two counts, measurement as well as evaluation. On measurement part, it requires

   i.   measurement of numerous parameters of network and service KPIs,

   ii. collection of samples for huge number of spots, and

   iii. collection of samples for each spot during different time bands and on different types of days.

b) On evaluation part it is complex, as it is not a simple addition of measured values. Also, it requires discovery of value of weights to be assigned to

   • values observed for various network KPIs

   • values observed for various service KPIs

   • values measured at different locations

   • values measured during different time bands or days

c) Multi-dimensionality of parameter measurements and evaluation gets further complicated because of dynamic nature of performance of wireless network. In practice, measurements done earlier may not remain valid for a long period as quality also gets impacted due to various network related activities such as network optimization, expansion and upgradation. Variations in traffic demand also impacts quality of service.

7.1.2 Complexity involved in combining information from multiple sources

a) There may be various ways to make measurements of network KPIs. Typical ways are as follows:

i. **Network performance monitoring reports**: Statistical counters available with operation and maintenance sub-system can be used to make performance assessments. Granularity of such details is usually at cell level. However, with the advancement of technologies, more granular information may be available. Features in LTE networks of radio measurement collection for Minimization of Drive Test (MDT) has enabled such information.

ii. **Crowd source Apps**: Network performance details can also be directly collected from end-users via Mobile Apps. Mobile Apps developed for this specific purpose may either collect quality experienced by the users through feedback mechanism or conducting test measurements with support from end users and submit reports.

iii. **Field measurements:** Network performance can also be measured by conducting measurements in the field. These measurements can be done using special tools, and with the help of experts.

iv. **Prediction tools:** Network performance can also be reasonably predicted with the help of digital tools. Precision of such predictions may depend upon the kind of data available to make predictions

and algorithm that are developed to use radio propagation characteristics and make predictions. Latest tools based on advanced technology can make predictions in a very precise manner. However, it would depend upon the quality of information available about the clutter[13] in which these predictions are to be made.

b) Complexity in measurement of wireless data speed is presented in the white paper published by TRAI on "Wireless Data Speed Measurement" released in February 2018. Similar type of observations for quality assessment via network performance reports and field measurements were presented in the Monograph published by TRAI in September 2020 which is based on case studies carried out by TRAI.

c) Overall assessment using information available from all types of sources can be done by combining them algorithmically. This process would involve aggregation of information for geographical bins and time bins and assigning different weightages to different sources. These weightages may vary based on the context.

7.1.3 Complexities involved in the assessment via subjective methods

a) Assessment of quality via subjective methods may typically involve online surveys, face-to-face interactions, and feedbacks. Even when quality is almost same, people may rate quality differently. Sometimes difference in ratings may be very significant. In case of mobile services, people rate their overall experience which may be on different locations and may be for different kinds of services. Complexity in case of subjective methods is of same type as in case of objective methods. Only difference is that collection of more detailed information translates into burdensome exercise for the end user. Also, it may lead

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[13] As per ITU-T recommendations P.2108, Clutter refers to objects, such as buildings or vegetation, which are on the surface of the Earth but not actual terrain. Clutter around a radio transmission/ receiver terminal can have a significant effect on the overall propagation.

to lesser participation in survey conducted for the purpose.

b) For overall assessment of quality, information obtained via objective methods needs to be compared with information provided via subjective methods. In fact, subjective methods may help in determining weightages applied in case of objective methods. For rating purposes, information obtained via both methods may be required to be combined algorithmically. Similar type of complexities in case of subjective methods would be faced as mentioned in case of objective methods if more and more granular information is sought from the individuals.

c) With the advancement in user interfaces and more and more penetration of smart phones, it has become possible to improve survey methodologies, especially for quality assessment purposes. For example, availability of 3D maps of the buildings and possibility of presenting it to the person participating in the survey as walk through can change the way survey is done currently. It may provide good insights to the TSPs and help in identifying actionable items. It may also be good from a property manager's perspective as he can offer solutions which improve quality. With good end user interface and intuitive applications, process of capturing minute details during the survey may not be burdensome or cumbersome.

d) Minute details captured via subjective methods would be of great help in combining this information with other information collected via objective methods. Such details would also be helpful in tuning the models developed for evaluation.

7.2 Micro details do matter and need to be factored in for evaluation

7.2.1 Rating in case of digital connectivity would require consideration of individual's experience in a more nuanced manner. For example, poor connectivity even for a few numbers of apartment in a residential building cannot be compensated by excellent quality in other apartments of the same building. For real assessment, subjective methods such as survey and face-to-face interactions with the end users would also be required. However,

conventional way of subjective methods of assessment of quality may require a relook to make it more insightful so that it can provide actionable items to improve quality.

7.2.2 Current assessment methodologies usually give equal weightage to all parameters like importance of location, time spent by the end user at such locations etc. As observed in the report on "Mobile Network QoS at Delhi Airport and Dhaula Kuan", quality experience varies with the changes in traffic on roads and time spent at a particular location during times of heavy traffic.

7.2.3 Similar observations were also made in case of quality assessment inside buildings during the case studies by TRAI. These issues were presented in the Monograph released by TRAI in September 2020.

7.2.4 Any general assessment of quality inside building by making prediction of quality inside the apartment on the basis of fixed amount of loss of signal in penetration of walls will not give true picture of quality. Even if quality is assessed inside premises of a residential multi-storey building, it varies significantly across floors, side of the tower on which apartment is located, basement, lawn area, etc. The experience of different users staying in the same residential society may not be the same or even close to each other.

7.2.5 It may require more detailed understanding of the building structure, layouts and properties of material from which it is made. Such details can be captured and may be factored in with the introduction of advanced tools on both sides, real estate as well as telecom side.

7.2.6 In addition to this, usage contexts are also important part of evaluation and may be building specific. Wide variations combined by using any statistical methodology may give a number that might be agreed by some but not by others. One might consider such variations as insignificant, if quality is representative of quality perceived by the majority of residents. However, such a consideration might not be acceptable to all

stakeholders. Users' contexts and type of methodology of collection of samples need to be appropriately factored in while combining all the data. All these micro details are important to make evaluation that is relevant and closer to the perceived quality.

7.3 Use advanced tools and technologies to make rating task easier and powerful

Rating may be a complex task but not something that cannot be achieved. With the advancements in digital tools and availability of advanced techniques such as Artificial Intelligence (AI) and Machine Learning (ML), rating can be achieved in a more reliable and authentic manner. With these techniques and tools, contexts may be understood in a better way and may also be considered at the stage of evaluation.

7.3.1 Digital tools to predict network quality

Digital tools may help in providing data points by precisely predicting through simulations. Precision may come via better algorithms and availability of detailed information related to building. This may be crucial for making predictions about wireless signals inside building. Availability of building related information in digital form makes it easier to share and factor-in while making evaluation.

7.3.2 Digital tools to conduct survey that captures precise information

a) Digital tools may also help in engaging end-users to participate in the surveys and provide more precise information about the quality of experience. User interfaces developed considering capabilities of new devices and using building related information may make it much easier for an end-user to participate in the surveys. User interfaces may be much more interactive and intuitive and may help in capturing relevant information and avoiding unnecessary details.

b) AI/ML may help in combining information from multiple sources such as network reports, field measurement reports, crowd source apps, prediction tools, survey reports etc. Creating picture of quality inside

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building after considering multiple sources and both objective as well as subjective assessments, may be much more reliable and closer to the perceived quality. However, process of combining of data may be context specific and there may be large number of variants, each one developed or evolved suiting to the context in which it is to be applied. Classification of buildings from digital connectivity perspective would help in this process. Digital tools, AI/ML may help in dealing with such large number of variants. Digital platforms created for this specific purpose may help in learning of this model from the data collected from different parts of city or state or country.

c) Prediction tools which may predict quality of service considering network configurations and building and other clutter related information are very useful for evaluation of the quality. These digital tools with simulation mechanisms can predict network performance in a reliable and granular manner.

7.3.3 Digital tools used by the real estate sector

a) Technological advancement is continually happening in digital tools used in the real estate sector. Earlier building information was generated via AutoCAD which was a drafting tool and provided information as 2D geometry. Subsequently, Building Information Modelling (BIM) software was developed for Architects, Structural Engineers, Contractors (AEC) and Mechanical, Electrical and Plumbing (MEP) Engineers and Designers. The software allows users to design a building, its structure and components in 3D, annotate the model with 2D drafting elements and access building information from the building's model database. 3D visualizations allow consumers to see historic preservation and site context with respect to the new project.

b) New dimensions are being added and 4D designs have added time dimension i.e., project phasing and construction sequencing to the model. Other dimensions in this model are cost and maintenance. It

can be automated for quantity take-offs[14] and cost estimating, including relationships between quantities, costs and locations.

c) Construction Operations Building Information Exchange (COBIE) is an information exchange format to capture the information created during design, construction and commissioning and it allows this information to be passed directly to the building operator into the owner's facility management program.

d) Some of the examples of BIM software include AutoDesk Revit, ArchiCAD, Allplan, CYPE and ACCA software. Similar types of capabilities in BIM tools, as in the case of AEC or MEP to plan, design, build and manage, are evolving to take care of telecom requirements in the buildings. For example, these tools or add-on software applications may figure out quantities and coordinate locations of telecommunication outlets with the Electrical Engineer for rough-ins[15] and ensure that there is power adjacent to the outlet.

e) Most platforms, for the development of BIM projects in the cloud, have a mobile application giving real-time notifications of modifications made to the project. Advancements in technologies such as Augmented Reality (AR) are also being used to work with a virtual model in order to know the exact position of the elements.

f) There may be applications or software which are specially designed for planning, designing, building, and managing digital connectivity inside the buildings. Even for the existing buildings which might not be having building information in BIM format, there are some tools which carry out surveys of the building with use of special software and generate BIM required for the purpose of digital connectivity.

7.3.4 Digital Twin

Latest innovation related to building information is creation of Digital Twin

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[14] Quantity take-offs are a detailed measurement of materials and labor needed to complete a construction project.
[15] To make a rough or unfinished version of something, such as a design, as the first step in creating the finished version.

of the building. BIM focuses on design and construction whereas a Digital Twin models how people interact with the built environment. They create robust data models about all the aspects of the building. It may capture more context about the built environment and behavior pattern of the people including space design to achieve better outcomes through enhanced analytical and predictive capabilities.

7.3.5 3D models of clutter environment

a) Advanced Unmanned Aerial Vehicles (UAVs) with tilt photography and computing technologies to analyze images, facilitates generation of 3D models of reliefs, terrain textures, clutter etc. through much faster processes and at a lower cost. These are required to predict radio propagation in a more precise manner. Such models may be used not only to improve accuracy but also to save time.

b) With more detailed and accurate information about building and clutter environment, and that too in a digital format that is interoperable, would be of great help for tools predicting quality of services inside the building. However, acquiring such information or getting it generated for single purpose like digital connectivity infrastructure may be a costly proposition. But such information may be useful for variety of purposes and if digital repository of such information is maintained by city or state or concerned authorities and made available to design and evaluate digital connectivity infrastructure, then it might be a feasible option.

7.4 Rating methodology requires terminologies to be defined

To define rating methodology, there would be need to define typical terms that may form elements of assessment process. For the purpose of deliberation and to develop a methodology, a few terminologies, as envisaged at this stage, are being introduced. In actual practice, these terms might be defined same as described here or may also differ. Or, there may be many more terms which may be required to be introduced. Such methodology may be decided after due consultation and

consideration of any other relevant inputs. In the following para, a few such terminologies are discussed.

7.4.1 Area to be Rated for digital Connectivity (ARC)

As discussed earlier, assessment of quality needs to be done for a small geographical area for which context is same or similar and network set-up is also same. Such an area, in general, should have similar type of clutter environment, user density, usage profile etc.

As shown in illustration (refer figure 7.1), the area may be of any polygon shapes, but it should be contiguous. In some cases, contiguous large area may be required to be divided into smaller areas for ARC purpose so that each ARC represents an area that is having similar characteristics and similar context.

For example, such areas may be -
- a society of residential apartments
- a gated colony
- a public building
- a village
- a small town
- a cantonment area
- a transport hub such as airport, bus and rail terminals
- a campus such as college campus, hospital, a government building
- a segment of corridor of a highway or railway track or a metro line
- a group of independent houses (not part of any residential complex)
- a group of independent shops (not part of any shopping complex)

Figure 7.1: Illustration of typical types of ARCs

7.4.2 Services To be Considered

For assessment of quality, various types of services are to be considered. Services which are required to be assessed may vary even within the same ARC. For example, video conferencing may be a very important service to be used from an apartment but may not be that important in the basement area for a residential apartment society. Internet of Things (IoT) or M2M (Machine to Machine) may be of high importance in parking and basement area.

Services that may be required to be evaluated may include

- Conversational services such as voice/ video calls,
- Streaming services such as audio/ video podcasts,
- Interactive services such as chat, text/ multi-media messaging, audio clips or video clips,
- Background services such as file transfer, web browsing, and email etc.
- Services when using collaborative tools such as working on a shared document, presentation typically used for office working
- Services when doing group tasks such as group singing when

persons are located at different places

- Certain scenarios to capture digital connectivity experience.

A list of services out of consolidated list of services that would be more appropriate to be evaluated in a particular part of area, may be required to be prepared.

Table 7.1: List of typical services that may be considered for assessment (illustrative but not exhaustive)

Services	Apartment	Club	Basement
Video Streaming	Yes	Yes	Yes
Audio Streaming	Yes	Yes	Yes
Video Conferencing	Yes	Yes	No
Gaming	Yes	Yes	No
Web Browsing	Yes	Yes	No
Email	Yes	Yes	No
Navigation	Yes	Yes	Yes
IoT/M2M	Yes	Yes	Yes

7.4.3 Consumption Profile

To assess quality, consumption patterns of various services may be important for deciding and applying weightages for evaluation of various services. Consumption of services may vary at aggregated level and at individual level from apartment to apartment and from individual to individual as shown in figure 7.2. Depending upon an individual, for someone, quality of entertainment services may be more important than quality of web browsing. For another person, requirement might be opposite of this. Importance of various services can be assessed from the consumption patterns.

Figure 7.2: Different profiles may require different weights for evaluation
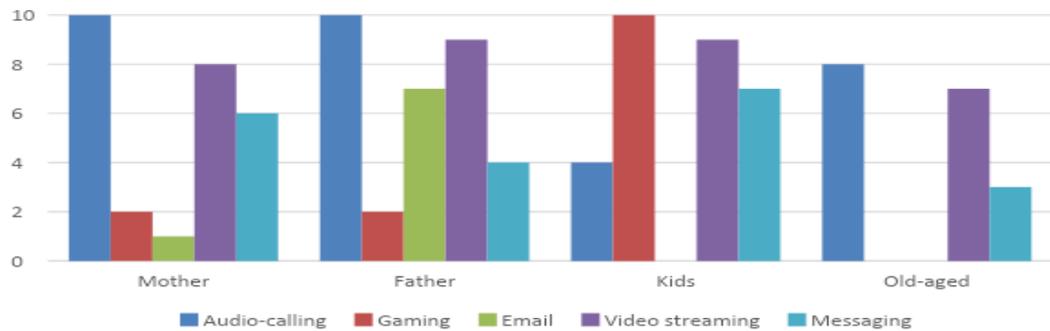
Weightage assignment may be related to variations in consumption pattern and variation in location. For example, in case of apartments, consumption pattern changes significantly in different parts of the apartment such as drawing room, balcony, kitchen etc. Evaluation methodologies will require to evolve to reduce the gap between the measured quality and quality perceived by the users. Desired accuracy in the quality evaluation would decide requirement of level of granularity in measurements and assessments.

7.4.4 Building Profile

For assessment of quality, context in which digital connectivity would be used is very important. Context may significantly change from one type of building to another type of building. Models of evaluation of quality would evolve over a period with better understanding of the context. In practice, there may be variants or sub-modules of the models which may be best suited for evaluation for a particular type of building.

It would be important to classify buildings from the point of view of digital connectivity experience. As discussed earlier, National Building Code of India and Development Regulations may introduce classifications of the buildings from a digital connectivity perspective. Wherever required, sub-classification may also be done to focus on specifics.

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7.4.5 Applications To be Considered

Similar to the list of services to be considered, a list of applications with a popularity index in an ARC would also be required to predict the experience. Similarly, the profile of ARC in terms of typical devices along with their models etc., would also be required to be generated for better assessment of the experience. Predicted experience needs to be derived from network performance parameters, application performance in an ARC, Services to be Considered, Consumption Profile, Device Profile, etc.

7.5   Rating of Digital Connectivity Experience

7.5.1 In view of the various aspects mentioned in previous paragraphs, overall assessment of quality would be required to be done. Overall assessment may be required to be presented in a manner which is simple to understand and easy to compare. Usually, ratings in terms of numeric values or presentation in terms of stars awarded are considered as simple one. However, at the individual level, people may agree or disagree with such rated values. A customized view i.e. rating in the context of a person would require to capture information in granular manner with better understanding of individual's requirements in more nuanced manner

7.5.2 For the purpose of deliberation, evaluation of an ARC may be called Rating of Digital Connectivity Experience (REx). REx may require composite assessment of all values measured and evaluated after assigning due weightages to the measured values as discussed in previous paras.

7.5.3 Sources of inputs from which data and information may be required to be combined are network performance reports, field measurement reports, crowd source data and data provided by prediction tools. Prediction tools may play an important role in assessment even when building has not come up or network has not been put in place and users are not present. However, accuracy and reliability of prediction tools, as discussed earlier, would depend upon quality and quantity of data and

would also depend upon algorithms used to make predictions.

7.5.4 Typical stages that might be involved in such an evaluation are illustrated in following diagram 7.3.

Figure 7.3: Typical steps for evaluation of quality of experience
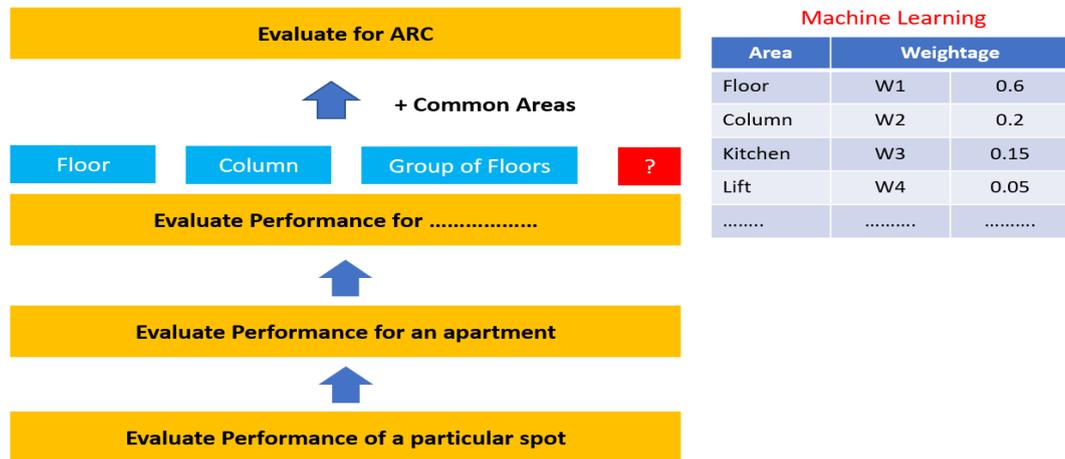
7.5.5 Combining all kinds of inputs for overall assessment

Digital connectivity quality assessment may start from a particular spot for a variety of services to be measured at that spot. Assessment of quality in an apartment may be composed of a number of such spots. Further assessment at building level may or may not be aggregation at floor level depending upon closeness of the variations across apartments on the same floor or across floor on the same side of the tower.

Issues for consultation

Q.38. **Whether creation of a digital platform that allows stakeholders to co-design and co-create DCI would be helpful to realise better, faster and cheaper solutions? Whether technologies and tools such as AI, ML would be helpful in achieving this objective? Please justify your response with rationale and suitable examples, if any.**

Q.39. **What should be the typical process to rate a building? Whether terminologies and steps involved in the rating process need to be standardized? Please justify your response with rationale and suitable**

examples, if any.

Q.40. Whether the process of rating would vary based on the types of buildings? If yes, then what factors or aspects of a building would matter or impact the outcome of rating? Please justify your response with rationale and suitable examples, if any.

Q.41. Which objective methods should be used to evaluate the DCI? How can various aspects of performance to evaluate the quality can be combined together? Please justify your response with rationale and suitable examples, if any.

Q.42. Which subjective methods should be used to evaluate perceived quality of DCI? Whether survey techniques can be improved considering penetration of smartphones? Whether improved techniques can help in providing insights and actionable items to improve DCI? Please justify your response with rationale and suitable examples, if any.

Q.43. Would combining the parametric values or results of objective and subjective methods be helpful in assessing digital connectivity that is closer to the perceived quality of experience? Please justify your response with rationale and suitable examples, if any.

Q.44. How advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML) etc. might be useful to make the evaluation process more nuanced and suitable for the purpose? How can AI/ML models evolve from the inputs of measurement and evaluation being carried out in other parts of the city, state or Country? Please justify your response with rationale and suitable examples, if any.

CHAPTER 8

Issues for Consultation - *Summary of Questions*

Please justify your reply to the following questions with reasons and citing best practices, wherever possible:

New ecosystem to create DCI

Q.1. **How can an ecosystem be created to design, deploy and evaluate DCI with good connectivity in a cohesive and timely manner? What would be the typical role and responsibilities of actors of the ecosystem? Please justify your response with rationale and suitable examples, if any.**

Q.2. **How would the ecosystem proposed in response to Question no.1 ensure that created infrastructure does not get monopolized? Please justify your response with rationale and suitable examples, if any.**

Q.3. **How would the ecosystem proposed in response to Question no.1 enable DCI Designers to factor in the digital connectivity requirements of the existing and/or prospective users of the network? How can such requirements be gathered at the stage of construction of a new building or at the time of upgradation or expansion in case of pre-existing DCI? Please justify your response with rationale and suitable examples, if any.**

Q.4. **How would the ecosystem proposed in response to Question no.1 enable DCI Evaluators to get requisite information to evaluate and ensure that the designed or deployed network would meet the requirements of end users? Please justify your response with rationale and suitable examples, if any.**

Q.5. **How would the ecosystem proposed in response to Question no.1 ensure that upgrades and expansion of the DCI are done from time to time and continue to meet rising demands? Please justify your**

response with rationale and suitable examples, if any.

Q.6. How would the ecosystem proposed in response to Question no.1 ensure that the TSPs' networks are planned, designed, deployed, and upgraded to serve the DCI requirements in a timely manner? Please justify your response with rationale and suitable examples, if any.

Capacity Building of skilled Professionals

Q.7. How can an ecosystem be created to build capacity requirements of skilled professionals such as DCI Designers, DCI Engineers, DCI Evaluators? What would be the typical role and responsibilities of actors of the ecosystem? Please justify your response with rationale and suitable examples, if any.

Q.8. How would the ecosystem proposed in response to Question no.7 ensure that relevant training courses are available in the country? Please justify your response with rationale and suitable examples, if any.

Q.9. Whether the training courses proposed in response to Question no. 8 are already being offered by any organisation or institution that can be recognized for the purpose? If yes, please provide a list of organisations offering such courses. If not, how specialized courses can be designed to meet the requirements? Please justify your response with rationale and suitable examples, if any.

Q.10. Is there a need to establish a council on the lines of "Council of Architecture" (CoA) to regulate minimum qualifications, additional specialized courses and practice of DCI profession in the country? Please justify your response with rationale and suitable examples, if any.

Q.11. Whether the requirements of additional specialized courses and practices of profession would vary depending upon the size of work or

kind of work involved in a particular DCI project? Please justify your response with rationale and suitable examples, if any.

Creation of Digital Platform to hire services of professionals and procure products

Q.12. **Whether creation of a digital platform to hire services of professionals would help Property Managers in creation of DCI? Should there be a feedback mechanism to assess quality of services delivered by professionals? Please justify your response with rationale and suitable examples, if any.**

Q.13. **Whether creation of a digital platform for procurement of certified products would help Property Managers in creation of DCI? How would the certified products for the purpose of DCI be identified and updated on the platform? Please justify your response with rationale and suitable examples, if any.**

DCI ownership and upkeep models

Q.14. **What may be the possible models of DCI ownership and its upkeep? Whether co-ownership models would help in aligning incentives in realising connectivity that would meet expectations of the end users from time to time? Should there be a need to specify terms and conditions for entities owning and responsible for upkeep of DCI to function in a fair, transparent and non-discriminatory manner? Please justify your response with rationale and suitable examples, if any.**

Enabling new Ecosystem by Technical requirement specifications for DCI in Building Codes (NBC)

Q.15. **As one solution might not be suitable for all types of buildings, whether current requirements stipulated in the National Building Code of India, 2016 would be required to be evolved and prescribed ab initio to make it more appropriate for DCI requirements? Please justify your**

response with rationale and suitable examples, if any.

Q.16.   Whether NBC needs to prescribe a separate classification of buildings for the purpose of DCI? If yes, which factors should be considered to make such a classification? If not, how to accommodate DCI specific requirements in the existing classification of buildings by the NBC? Please justify your response with rationale and suitable examples, if any.

Q.17.   Whether there is a need to include DCI Professionals as Persons on Record as typically done in building bye laws or development regulations? Or registration with the Council proposed in Question no. 10 would suffice to practice profession across the country as followed in the case of Architects? Please justify your response with rationale and suitable examples, if any.

Q.18.   How can the clearances or approvals required for DCI at various stages of construction of building may be incorporated in building bye laws? In typical building bye laws, there are provisions for getting clearances from central government e.g., in case of civil aviation, defense and telecom being a central subject, what role can be played by the central government in giving such clearances or granting such approvals? Please justify your response with rationale and suitable examples, if any.

Need to introduce a special class of Infrastructure Providers

Q.19.   Is there a need to introduce a special class of Infrastructure Providers to create, operate and maintain DCI for a building or cluster of buildings in ownership models suggested in response to Question No. 14? What should be the terms and conditions for such special Infrastructure Providers? Should such terms and conditions vary depending upon type, size and usage of buildings? Please justify your response with rationale and suitable examples, if any.

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Introduce rating of building from a DCI perspective- Voluntary scheme

Q.20.   **What are the initiatives or practices being taken in other jurisdictions outside India with regard to rating of buildings from a DCI perspective? Please share details and suggest how similar processes can be created in India?**

Q.21.   **Is there a need to introduce Rating of buildings from the perspective of DCI that may help in nudging the Property Managers to strive for collaboration with other stakeholders to meet the digital connectivity expectations of the users of the building? Please justify your response with rationale and suitable examples, if any.**

Q.22.   **In case, rating is introduced as a voluntary scheme, is there a need to monitor the progress? If progress is not satisfactory, would there be a need to launch campaigns and awareness drive to encourage Property Managers to come forward for rating? Please justify your response with rationale and suitable examples, if any.**

Q.23.   **Should the voluntary scheme of rating be extended to cover cities, towns and villages and even states? Would such a scheme help in encouraging local and state authorities to facilitate TSPs in creation or in improving outdoor as well as indoor DCI? Please justify your response with rationale and suitable examples, if any.**

Q.24.   **If in response to the Question No. 23 answer is yes then what framework should be introduced to rate cities, towns, villages and states, and how weightages can be assigned to different aspects of indoor and outdoor connectivity? Please justify your response with rationale and suitable examples, if any.**

Rating as a mandatory requirement for specific classes of buildings

Q.25.   **Is there a need to make rating a mandatory requirement for specific classes of buildings such as public transport hubs, government**

buildings or any building of public importance etc.? If yes, which type of buildings should be covered under this category? Please justify your response with rationale and suitable examples, if any.

Q.26. What should be the time plan to rate buildings falling under the mandatory category and is there a need to prioritize some buildings within the mandatory category to make it more effective? Whether existing buildings falling under such classes are required to be dealt differently? Please justify your response with rationale and suitable examples, if any.

Q.27. Is there a need to designate a nodal official for building(s) falling under the mandatory category to comply with the rating related requirements? What actions are proposed to be taken in case of non-compliance? Please justify your response with rationale and suitable examples, if any.

Changes required in laws dealing with the development of areas or construction of buildings

Q.28. Is there a need to amend legal provisions under various laws, bye laws dealing with development of land and buildings or areas including forest areas, cantonment areas, port areas, panchayat areas, municipal areas etc. to facilitate creation of DCI and ratings of the buildings or areas? Please justify your response with rationale and suitable examples, if any.

Role of Regulator in New ecosystem

Q.29. In case a voluntary scheme for rating is to be introduced or rating is notified as mandatory for specific classes of buildings then what should be the role of TRAI or DoT? Please justify your response with rationale and suitable examples, if any.

Q.30. Whether creation of "Regulatory Sandbox" to carry out

experiments or demonstrate capabilities of innovative solutions to improve digital connectivity would be helpful to make changes in existing policies, laws or regulations? What should be the terms and conditions to establish a regulatory sandbox? Please justify your response with rationale and suitable examples, if any.

Operationalization of rating framework

Q.31. **Is there a need to establish a Certificate Issuing Authority to award ratings to buildings from DCI perspective? If yes, what should be the structure of such an authority? If not, who can be assigned the role to perform this function? Please justify your response with rationale and suitable examples, if any.**

Q.32. **Whether the authority suggested in response to Question no. 31 may use reports from DCI evaluators to award ratings? To ensure reliability of reports from DCI Evaluators, should Certificate Issuing Authority need to conduct periodic audits of DCI evaluators? Please justify your response with rationale and suitable examples, if any.**

Terms and conditions for using awarded ratings including provisions for its renewal, revocation & penal provisions in case of misuse

Q.33. **What should be the terms and conditions for using ratings awarded to a building(s) from a DCI perspective? What should be the validity period of awarded ratings? Do you envisage any situations under which an awardee of ratings might be required to get the ratings renewed before the validity period? Please justify your response with rationale and suitable examples, if any.**

Q.34. **Whether in the initial stages of introduction of the rating system, validity should be for a shorter time period, and later it may be increased as evaluation system matures? Should the validity period be dependent on the type of buildings? Please justify your response with rationale and suitable examples, if any.**

Q.35. Whether the process of renewal of rating should be the same as the process defined to get rated first time or it may be incremental? Or renewal process may be dependent upon the grounds on which it is being renewed e.g. expiry of validity period, introduction of new technology, introduction of new spectrum band(s), introduction of new services(s) etc.? Please justify your response with rationale and suitable examples, if any.

Q.36. Whether the provisions to make an appeal should be introduced to give an opportunity to the applicant to make representation against the decisions of the Certificate Issuing Authority? What should be the time frame for preferring the appeal in case of disagreement with the rating assigned and its disposal? Please justify your response with rationale and suitable examples, if any.

Q.37. If somebody is found to be using ratings in an unauthorized manner, what legal actions are proposed to be taken against such entities? Please justify your response with rationale and suitable examples, if any.

Adoption of Digital Tools & Platforms, AI/ML Models to co-design and co-create DCI

Q.38. Whether creation of a digital platform that allows stakeholders to co-design and co-create DCI would be helpful to realise better, faster and cheaper solutions? Whether technologies and tools such as AI, ML would be helpful in achieving this objective? Please justify your response with rationale and suitable examples, if any.

Typical processes involved in rating of a building

Q.39. What should be the typical process to rate a building? Whether terminologies and steps involved in the rating process need to be standardized? Please justify your response with rationale and suitable examples, if any.

Q.40. Whether the process of rating would vary based on the types of buildings? If yes, then what factors or aspects of a building would matter or impact the outcome of rating? Please justify your response with rationale and suitable examples, if any.

Q.41. Which objective methods should be used to evaluate the DCI? How can various aspects of performance to evaluate the quality can be combined together? Please justify your response with rationale and suitable examples, if any.

Q.42. Which subjective methods should be used to evaluate perceived quality of DCI? Whether survey techniques can be improved considering penetration of smartphones? Whether improved techniques can help in providing insights and actionable items to improve DCI? Please justify your response with rationale and suitable examples, if any.

Q.43. Would combining the parametric values or results of objective and subjective methods be helpful in assessing digital connectivity that is closer to the perceived quality of experience? Please justify your response with rationale and suitable examples, if any.

Q.44. How advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML) etc. might be useful to make the evaluation process more nuanced and suitable for the purpose? How can AI/ML models evolve from the inputs of measurement and evaluation being carried out in other parts of the city, state or Country? Please justify your response with rationale and suitable examples, if any.

Q.45. Any other issue which is relevant to this subject? Please justify your response with rationale and suitable examples, if any.

ANNEXURE-I

Definition of Property Manager

For the sake of brevity, in this consultation paper, the term "Property Manager" is used to refer to the person who is responsible to oversee and manage the operation and maintenance affairs of a particular property, building, premises or an area and he has the authority on behalf of the owner of the property to carry out the functions requisite for upkeep or upgradation of the systems deployed inside the building or property or an area. The term "Property Manager" would also include and refer to any of the following entities depending upon the context:

- A person, who is heading Resident Welfare Association (RWA) in case of residential societies.

- A person, who is heading the maintenance agency that has entered into an agreement with the property owner or with the RWA to carry out operation and maintenance of the facilities.

- A person, who is heading the concerned unit of an organisation that has entered into concession agreements for use and operation of land or commercial premise such as in case of Airport terminals.

- A person, who is venue manager i.e. person-in-charge of a venue or an event and his main duty is to oversee activities and use of the facilities like Sport Stadiums, Cinema Halls, Theatres, Conferences, Hotels.

- A person who has been designated by the Government for operating and maintaining facilities for a particular government building or premises, area or residential colony such as in case of Cantonment Area, Government Office Buildings, Government Residential Colonies etc.

- A person, who is a builder or a developer of a real estate project and is responsible to plan, design and build facilities like Multi-storey residential buildings, Commercial buildings or complexes.

- A person, who is designated by the Government to build or develop a real estate project for its own purposes and is responsible to plan, design and

build facilities as in cases of buildings constructed by CPWD, Indian Railways, Housing Boards.

- Any other person or entity as notified by the Government.

ANNEXURE-II

Summary of the TRAI's Key Recommendations to Improve the Connectivity

1. **On Infrastructure Sharing dated 11th April 2007**

    (i)   Infrastructure Providers (IP) Category-I may also be allowed to seek SACFA clearance if they have at least one agreement with existing wireless service providers for leasing infrastructure. (Rec. 5.1.1(2))

    (ii)   In order to identify and notify critical infrastructure sites, it is recommended that a Joint Working Groups (JWG) should be constituted with District Magistrate of that district as the Chairman and having representatives from all mobile service providers present in that service area, representatives of municipal corporation/ Body, and a representative of Military land and Cantonment wing if area under consideration also covers cantonment areas. (Rec. 5.1.2.1(i))

    (iii)   Municipal bodies/ Corporations/ Cantonment authorities shall grant permission to any service provider/ Infrastructure provider category I (IP I) to set up tower in such notified sites only when the service provider gives a commitment that the site would be shared by at least three service providers. (Rec. 5.1.2.1(ii))

2. **On Growth of Broadband dated 2nd January 2008**

    (i)   DoT should encourage through state governments that all Municipal committees include a clause for making Multiple Dwelling Units/buildings broadband ready by internal wiring while giving clearance for the construction of all such buildings in future. This will help to create infrastructure to provide broadband in future and will be very convenient to users. (Rec. 7.1.6)

3. **On Telecommunications Infrastructure Policy dated 12th April 2011**

    (i)   IP-I and telecom service providers may be mandated to share IBS/DAS system deployed in the buildings, complexes, or

streets.(Rec. 4.11)

(ii)   DoT should advise all ministries to provide, within next one year, IBS/DAS solutions in all Central Government buildings including central PSU buildings, Airports and buildings falling under their jurisdiction & control. (Rec. 4.12)

(iii)   All State Governments should be similarly advised to provide/ mandate, within next one year, IBS/DAS solutions in all buildings including hospitals having more than 100 beds and shopping malls of more than 25000 square feet super built area. (Rec. 4.13)

(iv)   Infrastructure providers should be permitted to install and share active network limited to antenna, feeder cable, Node B, Radio Access Network (RAN) and transmission system, subject to the condition that they are brought under the Unified Licensing regime as recommended by this Authority in May 2010. (Rec. 4.23)

(v)   Such Unified licensee should also be permitted to possess and maintain wireless telegraphy equipment. (Rec. 4.24)

4. **On Delivering Broadband Quickly: What do we need to do? Dated 17th April 2015**

(i)   There is a need to change building by-laws which currently deem only electricity, water and fire safety as necessary infrastructure for the issue of a completion certificate. Including mandatory inclusion of either ducts/optical fibre with well-defined access mechanisms in all upcoming office complexes, commercial spaces and residential complexes would have a significant and measurable net positive impact on BB penetration. (Rec. 3)

(ii)   There is a need to mandate city developers and builders to have properly demarcated sections within buildings and on rooftops for housing BB infrastructure and antenna. These areas should have uninterrupted power supply for reliable, always-on services. (Rec. 6)

5. On In-Building Access by Telecom Service Providers dated 20th January 2017

(i) Considering the requirement of ubiquitous voice and data network inside the large public places/commercial complexes/residential complexes and considering the fact that it is not practical for each TSP to put its IBS and other telecom infrastructure inside such complexes, the requirement of sharing the In-building telecom infrastructure including IBS has become inevitable. Therefore, TSPs/IP-Is should be mandated to share the in-building infrastructure (IBS, OFC and other cables, ducts etc) with other TSPs, in large public places like Airports, hotels, multiplexes, etc., commercial complexes and residential complexes. (Rec. 1(i))

(ii) The TSPs/IP-Is may be categorically disallowed to enter into any kind of agreement or contract, which results in exclusive access or lessening of competition. Indulgence into such a practice, through either formal or informal arrangement, may be treated as violation of the license agreement/registration. (Rec. 1(ii))

(iii) A system (time bound) may be developed, which may, inter-alia, include (Rec. 1(iii)):

a) The seeker-TSP i.e. who wish to access the Cables/IBS installed by an existing TSP/IP-I (provider-TSP), should place its requirement in writing to such provider-TSP.

b) The provider-TSP shall respond in writing within 30 days' time. In case of denial of request to access the infrastructure, the provider-TSP shall give reasons and justification for denial.

(iv) Commercial terms for sharing of the in-building telecom infrastructure system, may be decided by the provider-TSP. However, the same shall be done in transparent, fair and non-discriminatory manner. (Rec. 1(iv))

(v) DoT should take up the matter with the Ministry of Housing and

Urban Affairs to ensure that Suitable provision for the creation of Common Telecom Infrastructure (CTI) inside the newly constructed public places like Airports, commercial complexes and residential complexes, should form part of the Model Building Bye-Laws (Rec. 2(i)).

(vi) Government should ensure that the essential requirement for telecom installations and the associated cabling is formed part of National Building Code of India (NBC), being amended by Bureau of Indian Standards (BIS). (Rec. 2(ii))

(vii) The telecom ducts to access the buildings from outside should invariably be part of the CTI, which could be used by TSPs/IP-Is for putting cables, which would ensure unhindered access to TSPs/IP-Is. (Rec. 2(iii))

(viii) No building plan should be approved without having a plan for creation of CTI including the duct to reach to the telecom room inside the building. (Rec. 2(iv))

(ix) Completion certificate to a building to be granted only after ensuring that the CTI as per the prescribed standards is in place. (Rec. 2.(v))

(x) As part of Building Bye-Laws, the builder/RWA should be mandated to ensure that (Rec. 2(vi));
   a) Access to building as well as CTI facilities inside the building should be available on a fair, transparent and non-discriminatory manner and minimum three TSPs/IP-Is should have presence in the building.
   b) Public Sector TSP (BSNL / MTNL) should be given access to Government and commercial buildings.
   c) The TSPs/IP-Is should have unrestricted access for maintenance work.
   d) The permission to in-building access and/or use of CTI facilities inside the building should not be seen as a source of revenue

generation for builder(s)/RWA(s).

e) Charges (rentals/power rates etc.) levied to the TSPs should be fair, transparent and non-discriminatory.

6. On Enhancement of Scope of Infrastructure Providers Category-I (IP-I) Registration dated 13th March 2020

(i) The scope of Infrastructure Providers Category – I (IP-I) Registration should be expanded to satisfy the present need for telegraph in the country. (Rec. 3.1)

(ii) The expanded scope of the IP-I registration should include to own, establish, maintain, and work all such infrastructure items, equipment, and systems which are required for establishing Wireline Access Network, Radio Access Network (RAN), and Transmission Links. However, it shall not include core network elements such as Switch, MSC, HLR, IN etc. The scope of the IP-I Registration should include, but not limited to, Right of Way, Duct Space, Optical Fiber, Tower, Feeder cable, Antenna, Base Station, In-Building Solution (IBS), Distributed Antenna System (DAS), etc. within any part of India. (Rec. 3.3)

(iii) The IP-I registration holder should be authorised (Rec. 3.4)

a) to provide only such infrastructure items, equipment and systems on lease/rent/sale basis to an eligible service provider for which that Service Provider has an authorization from the Government of India, and

b) to provide such infrastructure items, equipment, and systems on mutually agreed terms and conditions to eligible service provider in fair, reasonable and non-discriminatory manner.

(iv) The IP-I registration holder should be eligible to apply for and issue of licence under the Indian Wireless Telegraphy Act, 1933 to possess such wireless telegraphy apparatus that is permitted under the scope of IP-I Registration. However, the IP-I registration holder should not be eligible to apply for and assignment of any kind of licensed

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spectrum. (Rec. 3.6)

(v)   The IP-I registration holder (Rec. 3.7)

    a)   should be permitted to own, establish, maintain, and work infrastructure items, equipment, and systems, so permitted under its scope, using any technology as per the prescribed standards.

    b)   should utilize type of equipment and products that meet TEC standards, wherever made mandatory by the Licensor from time to time. In the absence of mandatory TEC standards, the IP-I registration holder should be permitted to utilize only those equipment and products which meet the relevant standards set by international standardization bodies, such as, ITU, ETSI, IEEE, ISO, IEC etc., or set by International Fora, such as 3GPP, 3GPP-2, IETF, MEF, WiMAX, Wi-Fi, IPTV, IPv6, etc. as recognized by TEC and subject to modifications/adaptation, if any, as may be prescribed by TEC/Licensor from time to time.

    c)   should be bounded by the terms and conditions of IP-I registration as well as instructions issued by the Licensor and by such orders/directions/regulations of TRAI issued as per the provisions of the TRAI Act, 1997, as amended from time to time.

    d)   should, wherever applicable as per the scope of the IP-I registration, with necessary adaptations and modifications, comply with the norms stipulated in the Unified License under the heads of Electromagnetic Field exposure by BTS (Base Stations), Sharing of Infrastructure, Confidentiality of Information, and Security Conditions.

ANNEXURE-III

Draft addendum to Model Building Byelaws (MBBL) – 2016

C-2/3/(3)/2021-QoS

29778(1)/2021/PR_ADV (CA)

No. K-14011/25/2021-AMRUT-IIA
Government of India
Ministry of Housing & Urban Affairs

Nirman Bhawan, New Delhi
Dated: 6th July, 2021

OFFICE MEMORANDUM

Sub: Consultation Paper on "Roadmap to Promote Broadband Connectivity and Enhanced Broadband Speed" issued by TRAI– Inputs of Ministry of Housing & Urban Affairs –reg.

The undersigned is directed to refer to Secretary (I/C), Telecom Regulatory Authority of India (TRAI)'s DO letter No. C-9/9/(1)/2021-NSL-I-Part-(2) dated 04 June, 2021 on the subject cited above. Based on TRAI recommendations on "In-Building Access by Telecom Service Providers" dated 20 January 2017, Ministry has prepared addendum to *Model Building Bye Laws (MBBL),2016 on* **Provisions for in-building solutions for Telecom Infrastructure**. *D*raft addendum to MBBL, 2016 is enclosed for comments of TRAI.

Encl. As above.
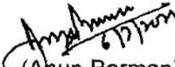
(Anup Barman)
Under Secretary (AMRUT)
011-23062075

Shri Rajender Kumar Singh, Joint Advisor (NSL-1),
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
(next to Zakir Hussain College)
Jawaharlal Nehru Marg (Old Minto Road)
New Delhi: 110 002.

(email: advbbpa@trai.gov.in, ja3-nsl@trai.gov.in)

Draft

ADDENDUM TO MODEL BUILDING BYE-LAWS – 2016

PROVISIONS FOR IN-BUILDING SOLUTIONS FOR TELECOM INFRASTRUCTURE

TOWN AND COUNTRY PLANNING ORGANIZATION

MINISTRY OF HOUSING AND URBAN AFFAIRS

GOVERNMENT OF INDIA

May, 2021

CONTENTS

ABBREVIATION

CCTV	Close Circuit Television
CTI	Common Telecommunication Infrastructure
DoT	Department of Telecommunication
FTTX	Fiber to the X Fiber
	Fiber To The Home (FTTH)
	Fiber To The Premises (FTTP)
	Fiber To The Building (FTTB)
	Fiber To The Node (FTTN)
	Fiber To The Curb/Cabinet (FTTC)
GDP	Gross Domestic Product
IBS	In Building Solutions
IP-1	Infrastructure Provider
ISP	Internet Service Provider
MBIT	Megabit
OFC	Optic Fiber Cable
QoS	Quality of Service
RWA	Residential Welfare Association
TRAI	Telecom Regulatory Authority of India
TSP	Telecommunication Service Provider

Provisions for In-building Solutions for Telecom Infrastructure: Addendum to Model Building Bye Laws, 2016

In-Building Solutions for CTI

1. Introduction: Communication System

Data growth is exploding globally. In India as per Nokia MBiT 2021 Report, the average monthly data usage per user in India has increased almost 17 times over the past 5 years. Covid 19 has further pushed data consumption with people staying indoors. Government has facilitated Work from Home (WFH) guidelines with a Work from Anywhere (within India) permitted. Therefore, home consumption of data has grown exponentially through 2020. According to the Tower and Infrastructure Providers Association, almost 85% data traffic and 70% voice traffic is now generated indoors.

World Bank has clearly demonstrated that every 10% increase in broadband penetration leads to nearly 1.40% increase in GDP growth rate. While that is a global average, even the India specific study by the reputed quasi-Government research agency, ICRIER, has shown that every 10% increase in internet traffic delivers 3.1% increase in GDP per capita and 10% increase in investment in Telecom Infrastructure will increase GDP by 3.3% The consumer pull today is focused on data and broadband with digital services providing free voice services with data services. Video and app-based services are driving the demand for broadband with Apps for e-commerce, e-health care etc. in everyday use. It is very clear that Internet Traffic and Apps are contributing to GDP growth and for this to grow even further, conventional connectivity needs to be replaced with duct-sharing and fibre, which is an essential requirement 'In-Building' as much as it is for FTTx and Tower Fiberization.

{Note - "Service Provider": any organization that provides any type of telecom or IT services in the building complex, as per scope defined by DOT i.e. TSP / ISP / IP1 etc.}

A broad variety of Information Communication Technology (ICT) systems are expected to be installed in buildings. In order to facilitate proper cabling and installation/ up gradation of ICT systems and their cost effectiveness and maintenance, adequate physical infrastructure is required within buildings. This infrastructure will include common ducts, cable riser systems, conduits, cable trays and utility closets etc. among other things. The same can also be retrofitted into existing buildings wherever possible and feasible and must be designed in all new, re-developed and renovated structures. This section describes the general and specific requirements of such an ICT infrastructure in building specially in respect of cabling.

Communication systems are general utility just as water, power, gas, cable TV & CCTV/Security. Unlike traditional communication systems, which are constantly evolving, the recommended digital infrastructure has to be designed to be flexible enough to accommodate a variety of ICT systems and emerging technologies and be future proof for the next 25-30 years. Space, power and earthing is required for installation of common ducts, optical fibre, small cells, antennas, smart sensors etc, for supporting the various digital technologies. Most communication utilities can share the same space since the physical topology and wiring requirements are similar and no significant power is present in the cables. However, in some cases, state-of-the art communication cabling or equipment will involve new or more specific requirements for utility spaces such as:

- Cable routing layout and cable length restrictions between Work-Space and utility closet.

- Bending radius and working clearance requirements for different cable types, e.g., Fiber optic cables, Cat-6 Cables and co-axial cables

- Isolated power circuits for permanent communication equipment,

- Protection, Safety, earthing and environmental requirements of communication equipment.

2.   **Emerging Technologies in Telecommunication Services**

Technologies used for telecommunications have changed greatly and over the past few years. During this time and particularly during the pandemic, India

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has experienced a massive surge in indoor voice and data consumption. According to the Tower and Infrastructure Providers Association, almost 85% data traffic and 70% voice traffic is now generated indoors. Telecommunication network architecture is changing to meet new requirements for a number of services/applications viz. 5G, Internet of Things (IoT), artificial intelligence etc.

Choosing efficient and cost-effective and fast-deployment of wired and wireless networks will improve accessibility. Based on type of building and profile of customers in the buildings, the needs of wired and wireless may vary. Further, the architecture of the information and communication infrastructure is changing to accommodate the requirements of a growing number of ICT-enabled services/applications (broadband, mobile, multimedia, surveillance, IoT etc.)

In line with the changing market needs, the Digital Service Providers i.e. TSPs/ ISPs/ IP-1's have been scaling up the deployment of **IBS and FTTx, covering active and passive infrastructure**. Further, industry stakeholders are putting greater emphasis on sharing in-building infrastructure to save opex and capex, as well as to avoid the duplication of infrastructure deployment.

Moving forward, the humungous growth of data traffic, riding on the use of the digital infrastructure during the pandemic and with the new work-from-home and work-from-anywhere paradigms and with the emergence of 5G, is expected to create huge opportunities for extension of ubiquitous, reliable and high speed digital infrastructure into the homes and residential buildings, leading to huge growth of shared IBS sites.

Theoretically, wireless services can be provided from outside the building. However, there are appreciable losses in signal strength when it penetrates building walls. While all wireless services can suffer from poor in-building coverage, this problem is particularly pronounced for the high-speed services. These services require a much better signal quality than their voice counterpart. Therefore, in order to improve in-building coverage and to offer better-quality high-speed data services, there is a definite need to install IBS for augmenting the wireless-based voice and data services. This is equally true for installing 5G and Wi-Fi hotspots along with Fibre to the x (FTTX) distribution

network of Fiber and Cat-6 Cables for seamless data connectivity.

Inside buildings are not confined to wireless medium only. Provisioning of telecom services and broadcasting services viz Cable TV, DTH and security services e.g. CCTV cameras and futuristic services e.g. IoT based sensors will require suitable wireline connectivity inside the buildings. Wireline services through cables such as copper cables, optical fibre cables (OFC), LAN Cat-6 cables are important for having uninterrupted connectivity. Also, for services such as Cable TV, DTH and smart devices solutions (IoT), suitable cabling within building premises is a pre-requisite. For that purpose, shared duct space across the building riser and floors is critical to achieve the flexibility for the future.

3. Policy Efforts

Provisioning of in-building connectivity has become a key component of government policies. National Digital Communications Policy, 2018 proposes to make the installation of telecom infrastructure and associated cabling and IBS mandatory in all commercial, residential and official buildings (including government buildings) by amending the National Building Code of India with the help of the Bureau of Indian Standards.

In line with TRAI recommendations, Government has been taking a number of steps for promoting the sharing of in-building infrastructure.

a) In October 2019, the Digital Communications Commission (DCC) approved in-building access and sharing of infrastructure among TSPs, thereby allowing them to share infrastructure and, in the process, curbing TSPs' monopoly to install infrastructure through exclusive contracts with the owners/builders.

b) In November 2019, the Department of Telecommunications issued an advisory to encourage all TSPs/IP-1s to share their in-building infrastructure such as systems, optical fibre, other cables, ducts and boosters on government premises and other public places such as airports, railway stations, bus terminals and hospitals.

The government's policy and regulatory push coupled with the ever-expanding data usage has propelled TSPs/IP-1s to scale up the deployment of IBS. There is an urgent requirement to allow TSPs/IP-1s to own and manage active infrastructure in addition to passive infrastructure to help them cater to the ever-increasing data demand.

Bureau of Indian Standards (BIS) has framed National Building Code of India which has the provision of **Common Telecom Infrastructure (CTI)** housed inside the buildings for convenient provision of telecom services.

Making cities smarter: Ministry of Housing and Urban Affairs led Smart Cities Mission is another key driver that is encouraging the adoption of **in-building solutions (IBS) and FTTx/ IP networks covering Fiber and LAN cables**. Since, the success of the mission relies on the underlying digital communications infrastructure, the cities identified under this programme have mandated to install common infrastructure inside buildings to enable seamless connectivity. To this end, certain smart cities have started collaborating with infrastructure providers to scale up the deployment of **IBS and Fiber network**. Moving forward, IBS **and FTTx/Internet Protocol(IP) networks** covering Fiber and LAN cables may be included as one of the key parameters in the selection of smart cities for granting financial assistance.

4.   **In Building and Gated Buildings Solutions**

It is important to ensure quality telecom services inside a building - in residential, multi-story building, commercial complex, hotel or airport. It is also essential for TSPs/IP-1s to work on sharing of telecom infrastructure which may be made mandatory as they extend the services in the buildings.

TSPs/ IP-1s require a non-discriminatory and unhindered access inside the building/ along the premises to install the telecom infrastructure or lay their cables. At present, mobile operators and the building owner or building developer or Resident Welfare Associations (RWA) enter into commercial agreements for in-building deployment. Building owners or building developers delay the negotiations or request exorbitant rents — slowing down the speed of deployment. The Urban Local Body / Urban Development Authority may

intervene in this regard wherein commercial agreements are insisted upon. TSPs/IP-1s should be given legal rights to use the Common Telecom Infrastructure (CTI) within the premises of building / gated society free of charge or for a standardized nominal charge just like other essential services like water electricity and gas. Accordingly, provision of CTI in a building should not be deemed as a revenue source.

The issue is not limited to sharing of IBS/ Distributed Antenna System (DAS) systems only. TSP should get access to all telecom infrastructures including fiber cable and LAN cables for provision of wired and wireless network and other telecom and IoT services.

It is important for telecom service providers to provide mobile coverage / network presence/high speed connectivity inside big residential / commercial complexes to improve QoS of their networks. It may not be practical to install individual in-building infrastructure by TSPs/IP-1s as this will result in not only duplication of network resources but will also entail huge avoidable cost. It may also be not advisable to lay down cables again and again on the same land/ building by several TSPs/IP-1s.

5.   Incorporation in State /UT Building Bye Laws

The buildings are to be constructed in such a way that they are '*Digital Infrastructure deployment*'/ 'Digital Connectivity' ready. There should be provision of telecom ducts / common pathways / runways (digital access paths) to reach to the accessible parts of the buildings. Common ducts /digital access paths to access buildings from outside should invariably be part of the CTI, which could be used by TSPs/IP-1s for laying/deploying digital infrastructure including cables. While approving the building plans, it has to be ensured that plan for creation of CTI including the common duct to access the common space used as telecom room inside the building is also prepared and separate set of drawings showing the inter / intra connectivity access to the building with distribution network need to be furnished.

Occupancy-cum-Completion certificate to a building to be granted only after ensuring that the CTI as per the prescribed standards is in place. An

undertaking from Architect or Engineer to be insisted to certify that building has ensured common access to all digital infrastructure to all service providers in accordance with plan of creation of CTI.

As part of Building Bye-Laws, the builder/RWA should be mandated to ensure that

1. While preparing the building plans, properly demarcated sections within buildings and on rooftops for housing Broadband/ digital connectivity infrastructure / antenna should be mandated. These areas should have access to power supply for reliable, always-on services.
2. Access to building as well as CTI facilities inside the building should be available on a fair, transparent and non- discriminatory manner to all Service Providers /IP-1's.
3. The Service Providers / IP-1's should have unrestricted access for maintenance work.
4. The permission to in-building access and/or CTI facilities inside the building should not be seen as a source of revenue generation for builder(s)/RWA(s) but as a means for facilitating penetration of broadband access and thereby helping in socio-economic growth of all the residents.
5. Charges (rentals/power rates etc.) levied to the TSPs/IP-1s should be fair, transparent and non-discriminatory and should be on residential rates.

Suitable provision for the creation of Common Telecom Infrastructure (CTI) inside the newly constructed public places like Airports, commercial complexes and residential complexes, to be incorporated in State/UT Building Bye Laws.

6.   At Layout Level

While developing Greenfield cities/towns, the layout plans should clearly indicate the telecom as utility infrastructure lines. Standards followed for utility planning shall be published and work may be done by the respective department for bringing in the standardization of the utility coding and sequences. Placement and sequence of above and below ground utilities at the appropriate location in the right-of-way to be ensured for unconstrained

movement as well as easy access for maintenance. Telecommunication cables should be placed in a duct that can be accessed at frequent service points with sufficient spare capacity to enable scaling and future expansion. Empty pipes (large size hume pipes / HDPE pipes) should be laid before planting trees in order to accommodate additional infrastructure.

Digital readiness rating of buildings / society in line to the GREEN ratings to be created where the existing and new buildings to be rated on standardized parameters such as but not limited to digital infrastructure access, provisions for emerging technologies, maintenance and operational ease to TSPs / IP-1s, quality of wireless services, Quality / Interchangeability, ease of wireline services till each unit, security, redundancy and expandability of the digital infrastructure etc. A detailed rating parameters and calculation mechanism of points / stars will be devised and benchmarked for all new/ retrofitted buildings/ societies.

Digital Asset repository which will ensure proper planning and mapping of utilities through GIS is necessary especially when the alignments of telecommunication cables are identified.

<u>Design criteria and standards</u>: Utilities should meet the following criteria:

•	Telecommunication cables should ideally be placed below the parking area or service lane, which may be dug up easily without causing major inconvenience. Where this is not possible, the cables may be placed at the outer edge of the right-of-way.

•	There is a need to reduce conflicts with pedestrian movements. One method is to place telecom boxes in easements just off the right-of-way. Where this is not possible, they should be placed within parking or landscaping areas. If cables have to be located in the pedestrian path, a space of at least 2m should be maintained for the through movement of pedestrians. Telecom boxes should never constrain the width of a cycle track.

•	In order to minimize disruptions, cables should be installed with proper maintenance infrastructure.

7. Other procedures for setting up In-Building Solution (IBS)/Fiber Networks

(1) There is a need to promote installation of In-Building Solution (IBS) / smart connectivity infrastructure. In case of poor connectivity in terms of weak signal strength inside the office, shopping mall, hospitals, multi-story building, education institutions, objective should be to strengthen the quality of service of the voice & data of mobile and fiber broadband network and access to digital services being offered by TSPs/IP-1's.

(2) Mode of deployment of In-Building, FTTx/IP Solution: There may be various modes of deployment of In Building solutions such as deployment by a neutral host infrastructure provider or build and managed by mobile operator and sharing with other service providers on non-discriminatory basis. For In-Build Solutions (IBS), FTTx/IP Solutions can also be deployed by TSPs/ IP-1s. For deploying indoor solutions these companies should have deemed permissions from the premises owners for installation of distribution network within the utility shafts/ common spaces with provisions for common/ shared points of interconnect for connectivity to individual units. Moreover, if the TSP/IP-1 requires to install optical fiber for connecting In-Building Solution (IBS) / Distributed Antenna System (DAS) nodes, FTTx Solutions, RoW/ permissions should be granted by the road owning agency through online mode.

(3) Permissibility: Since the equipment for FTTx/IP are small and can be installed on any type of land/building/utility pole, TSP/IP-1 will be exempted from obtaining the permission for installation of these components from the respective Urban Local Body/Urban Development Authority. However TSP/ IP-1 should get permission from the administrative authority of the concerned premises.

(4) Procedure for submitting application for obtaining clearance: TSP/ IP-1 will apply to the administrative authority of the building/ head of the office with layout diagram for implementing IBS in the building.

(5) Fees: No fee will be charged for IBS / FTTx Network. However, charges

may be levied for power, fixtures, etc. provided by building owners to TSP/IP-1s.

(6) Access and distribution fiber and IP/LAN networks for connectivity for the shopping malls, multi-storey residential buildings, cooperative housing societies, residential welfare association and commercial buildings to be planned and deployed by TSP/IP-1s as per standard requirement of providing high bandwidth and adequate indoor coverage to each unit / apartment in these complexes.

References

1.   Telecom Regulatory Authority of India (2011): *Recommendations on Telecommunications Infrastructure Policy*.

2.   Telecom Regulatory Authority of India (2017): *Recommendations on In-Building Access by Telecom Service Providers*

3.   Uttar Pradesh Expressways Industrial Development Authority (2018): *Guidelines for Applicants for ducting & laying of optical fiber*

F. No. C-2/3/(3)/2021-QoS   Dated: 08-02-2022

To

Mr G S Dhillon
Director, MoHUA
New Delhi

Subject: Regarding input on draft addendum to Model Building Bye Laws-2016.

Reference: Your office OM no. K-14011/25/2021-AMRUT-IIA dated 06.07.2021.

Kindly refer to the communications mentioned above on cited subject. TRAI appreciates initiatives taken by MoHUA to amend Model Building Byelaws-2016 to enable faster roll out and deployment of Digital Connectivity inside buildings. The approach will facilitate access to area/ building premises for creating suitable telecom infra by Infra/ Service Providers.

2.   It is further submitted that in order to create an ecosystem for sustainable good quality of digital connectivity with win-win situations to all stakeholders, TRAI is working on to publish a comprehensive Consultation Paper, which will deliberate on policy interventions and explore possibility of new regulatory framework which may be required for improving digital connectivity inside the buildings, specific areas, covering transport corridors, public transport hubs, Government and commercial complexes etc. Deliberation on probable policy interventions or new regulatory approaches shall also include ecosystems that might be required to design, deploy, operate and maintain, expand and upgrade digital connectivity infrastructure inside such buildings and areas, keeping technical and legal aspects in view.

3.   The eco-system so developed will also have provisions for evaluations and grading of Digital Connectivity Infrastructure which will add to the Value of the property and therefore nudge the owner/developer to opt for.

4.   As regards to TRAI input on the proposed draft as Addendum to Model Building Bye-Laws-2016, following may be noted:

   i. The proposed amendment for creating a Common Telecom Infrastructure (CTI) is based on TRAI earlier recommendations, wherein Telecom Infrastructure in a building were mainly oriented towards provisioning of Optical Fibre Based FTTH connectivity and/or establishment of mobile towers in side campus and connecting its back haul through fibres, with data download throughput upto few tens of Mbps. With trend in evolution of the technology and likely launch of 5G services in the country, it is felt that a comprehensive digital solution needs to be developed as an integrated plan of building outlay and this needs to be evolved through various stages of building constructions including post construction period for maintenance and up-gradation as per need.

ii. TRAI acknowledges for various points captured in draft amendments but observed that processes and methodologies in respect of design, deployment and quality check of the digital connectivity infrastructure proposed to be created are yet to be clearly brought out. This cannot be left to the respective agencies to define themselves. There needs to be some standardization for different categories of the buildings through National Building Codes for reference to various stakeholders in various states.

iii. Some legal frameworks are also to be worked out for recognizing various entities involved/proposed to be involved in creation of digital connectivity infrastructure and their roles and responsibilities are also to be spelt out either in Bye Laws or in NBC or at any appropriate document which should be recognized and referred by all concerned.

iv. Introduction of Digital Readiness Rating of Building / Society in line to GREEN ratings is a forward-looking step and this will nudge building owners/developers to strive for the best rating, which will add to the value of their properties. However, its mechanism, identification for rating agencies and applicability on different kinds of buildings are to be mentioned in document without any ambiguity.

v. With diminishing boundaries of content deliveries to end users of broadcasting and telecommunications services, the name of infrastructure proposed to be created needs a re-look and it is required to be made broader. Accordingly, it is proposed that instead of defining "In Building Solutions for CTI (Common Telecom Infra Structure)" let the name be re-defined as "In Building Solutions for DCI (Digital Connectivity Infrastructure)". This will enable both broadcasting and telecom services as well, without inclination towards any one service.

5.   With broad comments mentioned above, it is proposed that processes for suitable modification in Building Bye Laws and National Building Code may please be initiated with provision that necessary arrangements are to be made to incorporate TRAI new recommendations on "In Building Solutions for Digital Connectivity Infrastructure (DCI)", as and when same are notified after due consultation processes.

Above is issued after approval of competent authority in TRAI.

Signed by Pawan Kumar
Aggarwal
Date: 08-02-2022 12:07:31
(Pawan Kumar Aggarwal)
Jt. Advisor (QoS)

Copy to:
Member (T), DoT, New Delhi for kind information please, with reference to MoHUA's letter no.- K-14011/25/2021-AMRUT-IIA dated 16.09.2021

ANNEXURE-IV

Registration of Professionals

1. Introduction

1.1 Designing DCI for buildings is an interdisciplinary subject and requires involvement of experts from telecom wireless and wireline domains and as well as involvement of architects who design buildings. There is also an interplay between typical requirements considered for a building and the requirements for deploying DCI. This interplay may be related to aspects related to supporting civil and electrical infrastructure requirements for a DCI. Physical infrastructure required to deploy DCI may also need to be blended aesthetically with the design of the building to make it more acceptable. Choice of building materials and lay-out designs may also affect coverage of wireless signals and architects may be required to factor in these aspects while designing the buildings and exercise their choices.

1.2 Many aspects related to DCI might require specialised knowledge in the domain of telecom wireline and wireless which current architects might not be equipped with. Experts designing DCI may require academic qualifications in the telecom domain and they may also be required to have skills to design specialised in-building solutions for digital connectivity.

1.3 It is important to figure out additional capabilities an architect may be required to have to deal with DCI related aspects. It is also required to examine the need of professionals who can design in-building solutions for DCI. Framework for such professionals, if required, may be on similar lines as applicable in case of an architect as requirements would be of similar types. In this context, the section 2 below details the current framework for practising the profession of architects.

2. Current Framework for Practising the Profession of Architects

In 1972, with an aim to provide for a statutory mechanism facilitating the registration of all the practising architects in the Country and for taking care

of all the connected matters, the Architects Act, 1972[16] was promulgated. Objectives of the Act are to prepare a register of qualified Architects and to regulate the profession of Architecture by evolving a "Code of Ethics" and by laying down minimum standards of architectural education in India.

2.1 Council of Architecture

Under the provisions of the Act, the Government of India constituted a Council of Architecture, a body corporate. The Council has the responsibility to regulate the education and practice of profession throughout India besides maintaining the register of architects.

"Council of Architecture" (COA) is headed by its President who is assisted by an Executive Committee and a Council consisting of 52 odd members including 35 architects who are state government/ union territory nominees, five heads of architectural institutions, five representatives of the Indian Institute of Architects, six representatives of other institutions (including Institution of Engineers and Institution of Surveyors) and a nominee of the central government. The Council is assisted by a Registrar - who is a full-time employee of the Council. The Registrar is empowered to carry out certain functions prescribed by the Architects Act.

2.2 Minimum Standards of Architectural Education Regulations 2020

The CoA approves and oversees all institutions in the country that are conducting courses in architecture. The Institutions imparting architectural education such as constituent colleges/departments of universities, deemed universities, affiliated colleges/schools, IITs, NITs and autonomous institutions are governed by Council of Architecture (Minimum Standards of Architectural Education)

The Council may prescribe the minimum standards of architectural education required for granting recognized qualifications by colleges or institutions in India. As a part of reforms introduced by the National Education Policy 2020 (NEP 2020), the Council has recently notified "Minimum Standards of

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[16] https://www.indiacode.nic.in/bitstream/123456789/1690/1/197220.pdf

Architectural Education Regulations, 2020" which supersede its earlier regulations.

An Architect is required to have knowledge in a vast variety of subjects so as to be able to grasp the requirements of any type of Client. Typical subjects covered in the Architectural Course includes Architectural Drawing and Graphics, Surveying and Levelling, Structural Mechanics, Estimation & Costing, Workshop Practice for model making, Building Construction, Building Materials and Specifications, Building Services, Theory of Structures, Town Planning, Landscape Design, Building Bye-laws etc. There is no specific module related to digital connectivity infrastructure as a part of the architecture course.

2.3   Architects (Professional Conduct) Regulations 1989

The Council may by regulations prescribe standards of professional conduct and etiquette and a code of ethics for architects. Council of Architecture has notified Architects (Professional Conduct) Regulations 1989 to promote the standard of professional conduct/ self-discipline required of an Architect. An architect is required to observe professional conduct as stipulated in the Regulations of 1989 and any violation thereof shall constitute a professional misconduct, which will attract disciplinary action as stipulated under section 30 of the Architects Act, 1972.

2.4   Executive and other Committees

The Council may also constitute the Executive Committee and other committees for general and special purposes as it deems necessary to carry out its functions under the act. The Executive Committee may exercise powers and discharge duties as may be prescribed under the regulations. The Executive Committee is the executive authority of the Council and is responsible for giving effect to the resolution and decision of the Council.

Other committees are Disciplinary Committee, Appeal Committee and Committees constituted for a special purpose. Disciplinary Committee investigates and enquires complaints relating to misconduct of architects. The Appeal Committee examines the appeals made by the Applicants against

rejection of the application for registration as an Architect by the Registrar, CoA.

There is a special Committee charged with the responsibility to scrutinise the applications/proposals received from Architectural Institutions for Extension of Approval of B.Arch course, M.Arch course, Introduction of B.Arch course, Additional intake in B.Arch/M.Arch courses. Another committee is charged with the responsibility related to requirements to conduct online test for NATA (National Aptitude Test for Architecture) 2020, to decide time frame of exams, number of centres, to lay down criteria for selection of questions setters, appoint questions setters, moderation of question, supervision of evaluation, moderation of evaluation, Declaration of results etc.

ANNEXURE-V

Examples of Certification Courses in Telecom

1. Certified Telecommunications Network Specialist (CTNS)

The Certified Telecommunications Network Specialist (CTNS) certification is offered by the Telecommunications Certification Organization (TCO) and is aimed at project team members, managers, analysts, planners, and developers who need to understand telecom networking fundamentals, including services and infrastructure requirements. A CTNS usually works for a telecommunications services provider, reseller, or telecom equipment manufacturer.

TCO offers the Certified IP Telecom Network Specialist (CIPTS) the certification, which focuses on IP networking and not on telephony or wireless. The organization also offers the Certified Wireless Analyst (CWA) and Certified Telecommunications Analyst (CTA) certifications.

2. International Association for Radio, Telecommunications, and Electromagnetics (iNARTE)

iNARTE is the International Association for Radio, Telecommunications and Electromagnetics; it is an industry group to develop and implement a certification program for telecommunications' engineers and technicians. iNARTE has certifications for wireless system installers and product safety engineers, and technicians, among others.

The iNARTE Telecommunications certification program includes the Telecommunications Technician and Telecommunications Engineer credentials, geared toward many facets of the industry, including networking (LAN and WAN), cellular, and satellite. Both constitute Junior, Senior, and Master credential levels. Internet Protocol Engineering Professional (IPEP) certification

The Society of Cable Telecommunications Engineers (SCTE) offers several professional certifications for installers, technicians, designers, and engineers who support residential and commercial projects as well as access networks.

The Internet Protocol Engineering Professional (IPEP) certification recognizes a professional's expertise in designing, deploying, testing, integrating, and troubleshooting various Internet Protocol systems. It also covers performance analysis, IP network deployment, operation and testing, and multimedia over IP. It has multiple levels of certifications.

3. NCTI Master Technician Certification

The Master Technician certification is a professional-level, vendor-neutral credential offered by NCTI. NCTI offers College degree programs, College level certificate programs, and NCTI Certifications. NCTI certifies in Master Technician, Master Representative, Master Dispatcher, and Emerging Leader. The Master Technician credential is available in five solution tracks:

- Master Installer (MI): Targets professionals well-versed in broadband cable installation, best practices, and new technologies.
- Master Technician (MT): The Master Technician credential is focused on professionals, who are experts in drop installations, and broadband networks.
- Master Technician, HFC Networks (MTH): This credential focuses on HFC network maintenance, fiber optic systems, and maintenance of two-way analog and digital services.
- Master Technician, Customer Premises (MTC): This credential is geared to professionals who manage all aspects of digital services from distribution to customer devices. Candidates should also possess the ability to perform installations, troubleshoot issues, and maintain systems.
- Senior Master Technician (SMT): is the highest level of master technician certification available. To earn the designation, candidates must be well-versed in HFC networks, drop installation, and complete the Understanding Voice and Data Networks course and possess the MTH and MTC credentials.

4 Registered Communications Distribution Designer (RCDD7) certification offered by BICSI

The Registered Communications Distribution Designer (RCDD) certification offered by Building Industry Consulting Service International (BICSI) is one of several engineering-oriented IT communications credentials from this design and implementation engineering-oriented organization.

Under the Unified Facilities Criteria, the RCDD is required for individuals who work for or with the U.S. Department of Defence (DoD) on telecom related design projects.

The RCDD focuses on the design, integration, and implementation of information and communications technology (ICT) systems and related infrastructure components. Other BISCI credentials include the following:

- Registered Telecommunications Project Manager (RTPM)
- Data Center Design Consultant (DCDC)
- Outside Plant Designer (OSP)
- Installer 1 (INST1)
- Installer 2, Copper (INSTC)
- Installer 2, Optical Fiber (INSTF)
- Technician (TECH)

BICSI is also involved in helping with the development and design for information of transport systems (ITS) such as the ANSI/EIA/TIA 568B structured cabling system standard. A number of Universities in USA are referring to manuals issued by BICSI and professionals certified by BICSI.

Few of the manuals from BICSI are:

- BICSI CO-OSP: BICSI Customer-Owned Outside Plant Design Manual
- BICSI TDMM: BICSI Telecommunications Distribution Methods Manual
- BICSI TCIM: BICSI Telecommunications Cabling Installation Manual

The schematic diagram indicates the role of guidelines and manuals over the basic standards when a specific project is being realised.

The robustness and reliability of the design is an important criterion, and this is a vocational skill that requires it to be properly institutionalised and developed nationwide. The NBC is a first step in this direction. The New Education Policy, 2020, which has been recently announced, gives ample scope for institutionalising such design skills as a vocation and creating new job opportunities.

Last but not the least is the actual deployment of the design. This ranges from right installation practices, proper cable termination, and adherence to fire and safety standards. It is one thing to deliberate and announce well thought out policies and codes, but yet another thing to ensure that the intended results are achieved. This cannot be done unless the following is resorted to:

- Extensive engagement of certified professionals, builders, and TSPs/IPs
- Qualitative and quantitative assessment of implementation
- Continual up-gradation of skill sets required to ensure a comprehensive high-quality network

Cost may be more important than Quality. But Quality is the best way to reduce cost.

Ecosystems, which build in-building networks, operate and manage them, can be country specific. Barriers faced by the stakeholders may be due to the legal framework. If opportunities are seen by real-estate developers in other countries in providing good quality networks, then similar opportunities are required to be made available in India.

ANNEXURE-VI

Classification of Buildings

National Building Code-2016 has included a chapter on Information and Communication Enabled Installations (ICT) in Part 8 under one of the Building Services. The main focus of this part is on activities related to Electrical Engineering such as Lighting, and Natural Ventilation, Electrical and Allied Installations, Air Conditioning, Heating and Mechanical Ventilation, Acoustics, Sound Insulation, and Noise Control, Installation of Lifts, Escalators, and Moving Walks. Section 6 of this part provides the details specific for telecom/ICT enabling requirements.

Part 4 of NBC "Fire and Life safety" classifies Buildings Based on Occupancy. Buildings have been grouped from Group A to J which are further subdivided as mentioned below:

Table 1: Classification of Buildings Based on Occupancy

Group	Sub-division	Types
A-Residential	A-1	Lodging and rooming houses
	A-2	One or two family private dwellings
	A-3	Dormitories
	A-4	Apartment houses
	A-5	Hotels
	A-6	Starred hotels
B- Educational	B-1	Schools up to senior secondary level
	B-2	All others/training institutions
C- Institutional	C-1	Hospitals and sanatoria
	C-2	Custodial institutions
	C-3	Penal and mental institutions
D- Assembly	D-1	Buildings having a theatrical or motion picture or any other stage and fixed seats for over 1,000 persons

	D-2	Buildings having a theatrical or motion picture or any other stage and fixed seats up to 1,000 persons
	D-3	Buildings without a permanent stage having accommodation for 300 or more persons but no permanent seating arrangement
	D-4	Buildings without a permanent stage having accommodation for less than 300 persons with no permanent seating arrangement
	D-5	All other structures including temporary structures designed for assembly of people not covered by Subdivisions D-1 to D-4, at ground level
	D-6	Buildings having mixed occupancies of assembly and mercantile (for example, shopping malls pro- viding facilities such as shopping, cinema theatres, multiplexes and restaurants/food courts)
	D-7	Underground and elevated mass rapid transit system
E- Business	E-1	Offices, banks, professional establishments, like offices of architects, engineers, doctors, lawyers, post offices and police stations
	E-2	Laboratories, outpatient clinics, research establishments, libraries and test houses
	E-3	Electronic data processing centres, computer installations, information technology parks and call centres

	E-4	Telephone exchanges
	E-5	Broadcasting stations, T.V. stations and air traffic control towers
F- Mercantile	F-1	Shops, stores, departmental stores, markets (any with covered area up to 500 sq m)
	F-2	Shops, stores, departmental stores, markets (any with covered area more than 500 sq m)
	F-3	Underground shopping centres
G- Industrial	G-1	Buildings used for low hazard industries
	G-2	Buildings used for moderate hazard industries
	G-3	Buildings used for high hazard industries
I- Storage		These shall include any building or part of a building used primarily for the storage or sheltering (including servicing, processing or repairs incidental to storage) of goods, ware or merchandise (except those that involve highly combustible or explosive products or materials), vehicles or animals, for example, warehouses, cold storages, freight depots, transit sheds, storehouses, truck and marine terminals, garages, hangars, grain elevators, barns and stables.
J- Hazardous		These shall include any building or part thereof which is used for the storage, handling, manufacture or processing of highly combustible or explosive materials or products

2. Model Building Byelaws 2016, issued by Ministry of Housing and Urban Affairs (MoHUA) classify buildings based on use of premises or activity, design or height, features, safety due to maintenance level.

Table 2: Classification of Buildings Based on use of premises or activity, design or height, features, safety due to maintenance level.

Criteria	Sub-division	Types
Use of premises or activity	Residential Building	It includes a building in which sleeping and living accommodation is provided for normal residential purposes, with cooking facilities and includes one or more family dwellings, apartment houses, flats, and private garages of such buildings.
	Educational Building	It includes a building exclusively used for a school or college, recognized by the appropriate Board or University, or any other Competent Authority. It shall also include quarters for essential staff required to reside in the premises.

	Institutional Building	It includes a building constructed by Government, Semi-Government Organizations or Registered Trusts and used for medical or other treatment, penal institutions such as jails, prisons, orphanages etc.
	Assembly Building	A building or part thereof, where groups of people (not ¡ 50) congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes.
	Business Building	It includes any building or part thereof used principally for trans- action of business and/or keeping of accounts and records including offices, banks, professional establishments, court houses etc., if their principal function is trans- action of business and/or keeping of books and records.
	Mercantile Building	It includes a building or part thereof used as shops, stores or markets for display and sale of wholesale and or retail goods or merchandise, including office, storage and service facilities incidental thereto and located in the same building.

	Industrial Building	It includes a building or part thereof wherein products or material are fabricated, assembled or processed, such as assembly plants, laboratories, power plants, refineries, gas plants, mills, dairies and factories etc.,
	Storage Building	A building or part thereof used primarily for storage or shelter of goods, wares, merchandise and includes a building used as a warehouse, cold storage, freight depot, transit shed, store house, public garage, hanger, truck terminal, grain elevator, barn and stables.
	Hazardous Building	It includes a building or part thereof used for Storage, handling, manufacture of processing of radioactive substances or highly combustible or explosive materials highly corrosive, toxic or noxious acids etc.
	Mixed Land Use Building	A building partly used for nonresidential activities and partly for residential purpose.
	Wholesale Establishment	An establishment wholly or partly engaged in wholesale trade and manufacture, whole-sale outlets, including related storage facilities, warehouses

		and establishments engaged in truck transport, including truck transport booking agencies.
Design and Height	Detached Building	It includes a building with walls and roofs independent of any other building and with open spaces on all sides within the same plot.
	Multi-Storied Building or High-Rise Building	A building above 4 stories, and/or a building exceeding 15 meters or more in height (without stilt) and 17.5M (including stilt).
	Semi-detached Building	A building detached on three sides with open space as specified in these regulations.
Based on other features	Special Building	It includes all buildings like assembly, industrial, buildings used for wholesale establishments, hotels, hostels, hazardous, mixed occupancies with any of the afore- said occupancies and centrally air-conditioned buildings having total built up area exceeding 500 sq m.
	Multi-Level Car Parking	A building partly below ground level having two or more basements or above ground level, primarily to be used for parking of cars, scooters or any other type of light motorized vehicle.

Safety due to use/ maintenance level	Slum	Buildings that are in poor condition of maintenance. These are generally declared or notified as slums under relevant legislation by competent authority.
	Unsafe Building	It includes a building which is structurally unsafe, or is insanitary, or is dangerous to human life etc.

ANNEXURE-VII

Comprehensive General Development Control Regulations -2017

1. Introduction

The *Comprehensive General Development Control Regulations -2017*[17] regulations are applicable to the land development and building construction for all development areas in the entire Gujarat State. Different areas are grouped in different categories as given below:

- D1 category- Urban Development Authorities constituted under section 22 of the GTP&UD Act viz. Ahmedabad Urban Development Authority (AUDA).
- D2 category- Urban/ Area Development Authority constituted under section 22 or 5 of the GTP&UD Act.
- D3 category- Area Development Authority constituted under section 5 of the GTP&UD Act and the Municipality declared under the Gujarat Municipality Act, 1963 included in Seismic Zone – V.
- D4 category- Urban/Area Development Authorities constituted under section 22 or 5 of the GTP&UD Act included in other than Seismic Zone-V.
- D5 category- Area Development Authority constituted under section 5 of the GTP&UD Act (special project areas).
- D6 category- Gandhidham Development Authority under The Gandhidham (Development and Control on Erection of Buildings) -1957 Act (Bombay Act no. XIX of 1958).
- D7(A) & D7(B) category- Area Development Authority designated under Section 6 of the GTP&UD Act.
- D8 category- Municipalities declared under the Gujarat Municipalities Act, 1963 and not included in D1 to D6, D7(A), D7(B) and D9.
- D9 category- All Industrial estates or industrial areas under the jurisdictions of Gujarat Industrial Development Corporations included in D1 to D6, D7(A), D7(B) and D8 or otherwise.
- D10 category- All areas other than D1 to D6, D7(A), D7(B), D8 and D9.

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[17] https://townplanning.gujarat.gov.in/act-legislation/common_gdcr.aspx

Any person can carry out any development in any building or in or over any land only after making an application in writing to the Competent Authority provided that an applicant shall have effective Plot Validation Certificate from competent authority.

2. Development Requirements

Urban Local Bodies do carry out urban planning processes which typically are of two tier, first tier is development plan which is macro planning, and second tier is town planning schemes which is micro level planning. The section 3.5 of this regulation states that Development Requirements of the following aspects are mandatory and may be examined by the Competent Authority for ensuring compliance of the development to these Regulations:

a. Permissible Ground Coverage

b. Permissible Floor Space Index

c. Permissible Height and the various floors

d. Permissible Open Spaces enforced under these Regulations - Common Plot, Marginal Open Spaces, Setbacks and other open spaces.

e. Permissible Uses of Land and Buildings

f. Arrangements of stairs, lifts, corridors and parking

g. Minimum requirement of sanitary facility

h. Minimum Common Facility

i. Required light and ventilation

j. Minimum requirement of Fire Prevention and Safety, and Clearance from Chief Fire Officer as applicable.

k. All buildings shall be barrier free accessible to all people.

2.1 Obtaining a development permission

Application for Development Permission shall be made by the Owner of the Building units/land on which the building is proposed. The application shall be accompanied with, drawings, specifications, documents and scrutiny fees. Within thirty days from the date of payment of the scrutiny fees and receipt of an application for Development Permission, Competent Authority shall scrutinize the application for compliance with respect to these regulations. The Competent Authority may utilise the automated building plan approval system for scrutiny of application

In cases of small size of land or buildings, regulations allow the construction to commence without seeking permission. However, the person on record, appointed by the owner, shall ensure that the development commenced is in compliance with these regulations. The plans and documents for the construction are submitted within 30 days from the date of commencement. The licensed Engineer/Architect along with the applicant is required to submit an affidavit in the prescribed format.

2.2 Revising a Development Permission

The developer or the owner shall seek revised development permission for any changes or revisions, in respect of the matters below and with respect to the permission, have occurred during the course of development:

a. Increase in utilised FSI

b. Reduction in Parking area

c. Change in Orientation of the Building

d. Change in size or location of the Common Plot

e. Change in use of Building or part thereof

All provisions with regard to fees, application content, scrutiny and penalty shall apply mutatis mutandis.

3. Grant of Building Use Permission

Grant of a Building Use Permission by the competent authority means an acceptance that the construction of the building has conformed to the sanctioned design requirements as per the regulation and that the owner may use the building in conformity with the Sanctioned Use of the building. Grant of a Building Use Permission does not constitute acceptance of correctness, confirmation, approval or endorsement of and shall not bind or render the Competent Authority liable in any way in regard to workmanship, soundness of material and structural safety of the building.

4. Responsibilities of Persons on Record

a. Registration of Persons on Record (POR)

The Competent Authority registers architects, Developer, engineers, structural engineers, clerk of works and supervisor as Architects on Record (AOR), Developer on record (DOR) Engineers on Record (EOR), Structural Engineers on Record (SEOR) and Clerk of Works on Record (COWOR) and supervisor (SOR). However, Fire Protection Consultant on Record (FPCOR) shall be registered by the Chief Fire Officer/ Regional Fire Officer. Applications for registration are made in the prescribed format.

b. Minimum Qualifications and Competence Requirements

Minimum qualifications and competence requirements for being considered for registration as Persons on Record are specified in the Schedule of the regulations.

5. Responsibilities of the Owner and/ or Developer

The Owner or Developer is responsible to

a. ensure that the building complies with Development Regulations

b. appoint an Architect on Record / Engineer on Record to ensure compliance

c. appoint a Structural Engineer on Record to certify

d. appoint a Clerk of Works on Record irrespective of type of

building/construction in all Building-units having proposed built-up areas more than 1000 sq.mt. for overall constant supervision of construction work on site and such person appointed shall not be allowed to supervise more than ten such sites at a time.

    e.   appoint a supervisor on Record

    f.   certify along with the Clerk of Works on Record that the construction of the building has been undertaken as per detailed design and specifications stipulated by the Architect on Record or Engineer on Record and the Structural Engineer on Record

    g.   certify along with the supervisor on Record that the construction of the building has been undertaken as per detailed design and specifications stipulated by the Architect on Record or Engineer on Record and the Structural Engineer on Record and instruction given by clerk of works from time to time.

    h.   provide adequate safety measures for structural stability and protection against fire hazards likely from installation of services like electrical installation, plumbing, drainage, sanitation, water supply or any other requirements under the regulations.

6. Responsibilities of Individual Persons on Record (PoR)

a. **Architect on Record (AoR)** has to

    i.   Scrutinize and verify the architectural design and specifications of the proposed building.

    ii.   Certify that the architectural design and specification of the proposed building comply with the Regulations using the prescribed format

    iii.   Immediately inform the Competent Authority in writing, if in his/her opinion, the construction of the building is not being undertaken in accordance with the sanctioned design requirement in a format using prescribed Form.

    iv.   On behalf of the owner, submit the progress certificates, completion certificates and obtain the Building Use Permission as required under

the regulations.

b. **Engineer on Record** (abbreviated as EOR) is the Person on Record responsible for ensuring compliance with all procedural requirements specified in the Procedure Regulations.

c. **Structural Engineer on Record** (abbreviated as SEOR) has to scrutinize and verify the structural design and specifications of the proposed building.

d. **Supervisor of Works on Record** (abbreviated as SOR) has to undertake all necessary measures including adequate inspection during construction to ensure that construction of the building is undertaken as per detailed design and specifications stipulated by the AOR and by the SEOR and instruction given by COWOR.

e. **Fire Protection Consultant on Record** (abbreviated as FPCOR) has to

   i.   undertake all necessary measures including adequate inspection during construction to ensure that construction of the building is undertaken as per detailed design and specifications stipulated by the AOR and by the SEOR.

   ii. Certify that the design and specification of the proposed building comply with Fire Prevention and Life Measures Regulations -2016 using the prescribed format.

   iii. Immediately inform the Competent Authority in writing, if in his/her opinion, the construction of the building is not being undertaken in accordance with the sanctioned design requirement in a format using prescribed Form.

   iv. Instruct the relevant agency that adequate provisions are made for fire prevention and safety during construction and development.

7.   Safety requirement for the building height above 45 mts.

For any building height above 45.0 mts., a third party inspection check is mandatory. The third party has to submit a structural safety report to the committee. And the Committee comprises the members from the Authority,

Head of the Fire Services of relevant area, Structural Expert, Officer not below the rank of Superintendent Engineer of design cell of Road and Building Department. The Committee is chaired by the Municipal Commissioner/ Chairman of the Authority. The regulations also define qualifications and experience required in case of "Structural Expert" and "Site Supervisor".

8.   Procedure during construction

For the purpose of inspecting the construction at different stages, the competent authority may hire the services of the architects/engineers who are registered.

The competent authority while hiring architects / engineers, has to see that for different risk levels, the engineer or the architect hired is experienced. For this the competent authority also publishes the fees and invites the applications of architects and engineers who would be willing to work as inspection architect / engineer. On receipt of the applications, the competent authority makes a panel of approved engineers / architects.

The competent authority makes a contract agreement with all the engineers / architects included in the panel. The agreement includes the scope of work, the reporting systems and the protocols (including penalty clauses, mode of payments and reporting systems – both online and in hard copies) for smooth functioning of inspections.

The development has to be carried out as per the uses permissible in the given zone. The general planning and development regulations shall apply to any development in any area, as applicable.

Rating Framework Adopted in Other Areas

1. Framework for rating of hotels[18]

    1.1. Though Hotels or restaurants are not specifically mentioned under any of the lists of the seventh schedule of the constitution, but they are assumed to be covered under entry 26 of state list under Trade and Commerce within the state and comes under the purview of local laws with respect to operation, taxes, registration, licenses etc. However, for the purposes of classification of hotels, guidelines are issued by the Ministry of Tourism under the Central Government.

    1.2. The Ministry of Tourism has a voluntary scheme for approval of Hotel Projects with the aim to provide contemporary standards of facilities and services. Under this voluntary scheme, they classify new projects and operational hotels in the country by awarding one star to five stars. In case of heritage projects, it has provisions for additional classifications.

    1.3. Hotel Projects are approved at implementation stage. Hotels are classified under the defined categories once they become operational, subject to the hotel applying for such classification and being found fit for classification. For the purpose of these classifications, Ministry of Tourism has formed Hotel & Restaurant Approval & Classification Committee (HRACC). The committee is of two levels, one that assesses one-to-three-stars hotels and another that assess three-to-five-stars hotels.

    1.4. The committee is made up of eight members from various sub-sectors in the hospitality industry including one nominee each from the department of tourism in the central government, the state tourism department, tour operators, travel agents, a hotel management

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[18] https://tourism.gov.in/sites/default/files/2020-02/Hotel_Guidelines_From%2019-01-2018.pdf

institute, a nominee from the hotel industry who is considered a specialist in the hospitality industry and one member from the Federation of Hotel & Restaurant Associations of India (FHRAI).

1.5.   Hotels are assessed based on 17 broad parameters, which have a further 108 sub-parameters. Parameters are mainly related to food services, entertainment, view, room variations such as size and additional amenities, spas and fitness facilities, hygiene, ease of access and location.

1.6.   Stages of Classification

1.6.1.   Classification exercise is a two-stage procedure. At the stage I, the presence of facilities and services are evaluated against the checklist of facilities and services required to be available. And at the stage II, the quality of facilities and services are evaluated by the HRACC inspection committee as per the prescribed parameters. Any deficiencies or rectifications pointed out by the HRACC are required to be complied with within the stipulated time.

1.6.2.   The guidelines have been issued for timelines to be adhered to by the HRACC for clearance of application of classification of hotels, including timelines for inspection of hotels, submission of inspection report etc.

1.6.3.   The procedures for approval require recommendations of the inspection Committee to be submitted along with all necessary licenses, No Objection Certificates (NOCs), permissions etc. for the approval of the Chairperson (HRACC) or Joint Secretary (Tourism) or Addl. Director General (Tourism) as the case may be.

1.7.   Process of Classification/ Reclassification of Hotels

1.7.1.   The classification for newly operational hotels is required to be sought within 3 months of commencing of the operations and

it should have been approved by Ministry of Tourism at project stage. Operating hotels may opt for classification at any stage. However, hotels seeking re-classification should apply for the same and complete the process at least six months prior to the expiry of the current period of classification. If a hotel fails to apply for re-classification and complete its documentation free of all deficiencies a clear six months prior to the expiry of the classification period, the application is treated as a fresh case of classification.

1.7.2.   Once a hotel applies for classification or re-classification, it is required to be always ready for inspection by the inspection committee of the HRACC. No request for deferment of inspection is entertained.

1.8.   Validity of rating

Classification will be valid for a period of 5 (Five) years from the date of approval by HRACC, or in the case of re-classification, from the date of expiry of the last classification.

1.9.   Appellate Authority

In case of any dissatisfaction with the decision of the HRACC, there is a provision of Appellate Authority, and the hotel may appeal to Secretary (Tourism), Government of India for review and reconsideration within 30 days of receiving the communication regarding classification or re-classification.

2.   Framework for rating of green buildings[19]

2.1.   India has developed an indigenous National Rating System for Green Buildings known as Green Rating for Integrated Habitat Assessment (GRIHA). It has been developed by the Centre for Research on

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[19] https://www.grihaindia.org/sites/default/files/pdf/Manuals/griha-manual-vol1.pdf
and
https://www.grihaindia.org/sites/default/files/pdf/Manuals/GRIHA_Flyer.pdf

Sustainable Building Science (CRSBS), TERI (The Energy and Resources Institute). It has been endorsed by the MNRE (Ministry of New and Renewable Energy), Government of India.

2.2. GRIHA is designed to evaluate the environmental performance of all habitable spaces which may be air conditioned, non-air conditioned, and hybrid, for their energy and water consumption along with resource utilization and waste management over their entire life cycle. The rating applies to new buildings. It has been formulated in terms of 'appraisals' which while acting as guidelines for the construction of 'green' buildings, also have certain points allocated to them. The project team need to comply with these appraisals to achieve the desired rating and thereby construct sustainable buildings.

2.3. The rating is in alignment with national standards and guidelines such as the National Building Code of India 2016 (NBC) and the Energy Conservation Building Code 2017, together with other relevant regulations pertaining to specific topics such as waste management. Requirements of GRIHA have been last revised in 2019.

2.4. Eligibility w.r.t. built up area, building topology etc.

2.4.1. Under GRIHA version 2019, all new construction projects with built-up area more than 2,500 square meters to 1,50,000 square meters are eligible for certification. All habitable buildings are eligible for GRIHA rating. Buildings which are constructed within a defined site boundary and with same orientation, height, floor plan, plinth level are typically considered for the certification. Buildings are categorized based on their usability such as healthcare facility, hospitality, institutional, office, residential, retail, transit terminals etc.

2.4.2. Projects that have multiple buildings with different uses or a single building with different uses are placed under mixed-use development buildings category. In certain criteria in GRIHA rating, the assessment of spaces is based on the typology and

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in such cases, the evaluation is done considering applicable standards of benchmarks for individual building or space. Unique cases are discussed with GRIHA council for the evaluation of the criteria.

2.4.3. GRIHA rating is designed keeping in consideration the various climate zones in India. The various climate zones as per Energy Conservation Building Code (ECBC) considered in GRIHA are temperate, hot-dry, warm-humid, composite and cold climate.

2.5. Rating Framework

Rating framework has eleven environmental sections which are further split into 29 plus one (innovation) equal to 30 criteria covering all the requisite parameters required to be addressed while making a 'green building'. An additional section on 'innovation' is a part of the rating system that rewards the project team for walking an extra mile to achieve environmental and social sustainability. Different sections have been assigned different weightages. Each criterion consists of intent that would help in achieving the larger goal of sustainability and reducing Green House Gas (GHG) emissions, appraisals specifying guidelines that will help the project proponent create a sustainable built environment and achieve GRIHA rating by demonstrating compliance with them. The appraisals are classified into three categories mandatory, optional and non-applicable. Details of appraisals include the details of concepts, calculations and strategies required to understood to comply with the appraisals. Sample documentation is also provided to exhibit the documents listed in the 'compliance' section.

2.6. Scores and rating

GRIHA has a 100-point percentile-based rating system. On the submission of the required documents and upon final assessment and evaluation, the project is awarded points for all the applicable appraisals. Based on the percentile obtained, star rating is awarded

as one star to five stars. The percentile threshold for one star is 25-40, for two stars it is 41-55, for three stars it is 56-70, for four stars it is 71-85 and five stars are awarded on percentile threshold of 86 and more.

2.7. Rating Process

All buildings in the design stage are eligible for certification under the GRIHA rating system. Industrial buildings that are used as manufacturing units and warehouses are excluded from the rating system; however, office buildings in the industrial complexes, which are essentially habitable spaces, are eligible for certification. Typical steps involved for certification are online registration, orientation workshop by GRIHA officials or field experts, site visits. Site visits are divided into two phases. Site visit I is conducted to validate sustainable measures adopted during the construction phase. The visit is scheduled after the project has reached the plinth level and the structural work is in progress. Site visit II is conducted to validate internal finishes and electrical, plumbing and mechanical components installed in the project. The visit is scheduled after the completion of the structural work while the internal finishing work is in progress. Subsequent to it, final evaluation is done and rating is awarded.

2.8. Reappeal Provision

Any request for re-evaluation is addressed by the GRIHA council. The rating is revised based on the fulfillment of compliance requirements and verification by GRIHA council. The GRIHA council conducts an additional due diligence visit after the award of final rating for green awareness among the project occupants. Such a visit is aimed to impart basic knowledge and understanding on green buildings and their operational mechanism. This awareness programme is organized within 12 months of occupancy of the project.

2.9. Audit Provisions

Project team is required to submit an audit report showing the performance of the project with respect to energy, water, waste management etc. The data is required to be collected for one year after achieving 70% occupancy. Energy audit is done by BEE (Bureau of Energy Efficiency) certified auditors. Rating renewal is done after validity of five years period of rating.

2.10. GRIHA council

2.10.1. GRIHA council (registered under the Societies Registration Act, 1860) is an independent society for the interaction on scientific and administrative issues related to sustainable habitats in the Indian subcontinent. It was founded by TERI with support from MNRE along with experts in sustainability of built environment from across the country. In 2009, GRIHA council was established with the aim to promote the construction of environmentally responsible and resource-efficient buildings through GRIHA. The council works towards streamlining the rating process to facilitate the adoption of activities.

2.10.2. The Council members work towards enabling a smooth rating process for the project proponents and provide them with fair evaluation procedure for awarding certification. The typical tasks undertaken by the council are administerial assistance, handholding and monitoring, evaluation and award of rating, green awareness drive.

2.11. ADaRSH (Association for Development and Research of Sustainable Habitats)

2.11.1. MNRE (Ministry of New and Renewable Energy, Government of India) and TERI (The Energy and Resources Institute, New Delhi) jointly have also founded ADaRSH (Association for Development and Research of Sustainable Habitats), an

independent platform (registered as a society). ADaRSH promotes GRIHA and all activities related to issuance of GRIHA rating are carried out by it.

2.11.2. GRIHA also awards pre-certification to upcoming projects based on their commitment to comply with GRIHA. In accordance with the office memorandum by the Ministry of Environment and Forests (MoEF), GRIHA pre-certified projects are eligible to fast track environmental clearance.

2.11.3. As a variation of GRIHA, ADaRSH has developed SVA (Simple Versatile Affordable) GRIHA for rating of smaller projects. This is applicable to projects with built-up area from 100 square meters to 2500 square meters.

2.11.4. ADaRSH is launching GRIHA LD (Large Developments) rating system for planning green large developments like green campuses, townships and special economic zones. This is applicable to projects with built-up area greater than or equal to 1,50,000 square meters and/ or projects with total site area greater than or equal to 50 hectares.

2.11.5. ADaRSH also conducts awareness workshops on Green Buildings and GRIHA rating system to all the registered project teams. It also trains trainers and evaluators. ADaRSH also conducts need-based in-house awareness or training sessions for government and private organisations.

2.12. National Advisory Council

MNRE has constituted a NAC (National Advisory Council) and it is convened by the Advisor of the Ministry. It comprises eminent architects, senior government officials from the Central Ministry, the BEE, the Central Public Works Department, and select state nodal agencies; representatives from the IT sector, real estate sector and developers; and representatives from ADaRSH (GRIHA secretariat)

and TERI. The NAC is chaired by the Secretary, MNRE, and co-chaired by the Director-General, TERI. The NAC provides advice and direction to the NRS and is the interface between the MNRE and ADaRSH (GRIHA secretariat).

2.13. Technical Advisory Committee

MNRE has also constituted a TAC (Technical Advisory Committee) for providing technical advice to the GRIHA team on modifications and upgradation of the GRIHA framework. The technical advisory team comprises eminent architects and experts well versed with design and construction of green buildings. The Ministry has incentivized the National Rating System (NRS), with a view to promote large-scale design and construction of green buildings in the country.

2.14. Recognition

GRIHA certification has been accepted by many organizations and passed on certain benefits and owners have modified standards according to it:

- GRIHA pre-certification accepted by MoEF for fast track environment clearance.
- Pimpri Chinchwad Municipal Corporation (PCMC), Maharashtra gives financial incentives to developers (upto 50% rebate in premium) and occupants of GRIHA compliant projects (property tax rebate).
- NOIDA Authority has notified FAR incentive for GRIHA 4 and 5 star projects.
- Processing fee waiver from SBI for home loans.
- CPWD Plinth Area Rates have been revised as per GRIHA norms/benchmarks.
- CPWD Centre of Excellence on green buildings and GRIHA established at Ghaziabad.
- DDA, NBCC, BHEL have revised their tender documents to incorporate minimum 3 Star GRIHA compliance.
- PWD, Government of Assam and PWD Kerela have adopted GRIHA
- Cabinet of the Government of Delhi has adopted GRIHA

- Chandigarh Administration has adopted GRIHA

Model Building Byelaws-2016 (MBBL) in Chapter 10, refers to the Provisions with regard to Green Buildings and Sustainability.

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