

MUMBAI GRAHAK PANCHAYAT

White Paper

on

Safety in Electrical Installations

in

Housing Sector

Presented To

International Copper Association, India

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White Paper on Safety in Electrical Installations in Housing Sector

Executive Summary

Electricity is as important as food, clothing and shelter to the mankind. While constructing a house the Electrical installations need to be planned and installed in accordance with the provisions of the Electricity Act, 2003, the Rules and Regulations framed thereunder taking into consideration the applicable Codes and Standards. The rising number of Electrical fire accidents reported in the National Crime Report of 2018 in the residential sector and the major fire incidents occurring recently are signalling the necessity to look into the Electrical safety aspects in the planning and execution of the residential projects. After the fire it is difficult to identify as to who is responsible for the fire accident. Whether it is due to insufficient provision in civil design by the Developer/Architect, faulty Electrical design by the MEP Consultant, improper execution or unskilled/ faulty workmanship by the Electrical Contractor. Each one shirks away the liability and the home buyers are left to suffer.

This is an exercise to study the adequacy of the existing laws, codes, standards and practices and to recommend solution to fix the gaps, if any, in the applicable law in force and the practices followed by the various professionals associated with the construction. We gathered inputs from professionals like Developers Architects, Electrical Consultants, Electrical Contractors and the industry bodies by way of survey, discussion and personal interviews. We considered the applicable laws and the practices followed by the above to identify the gaps and suggest some means to plug those.

Section 53 of the Electricity Act, 2003 provides for the Safety requirements to be implemented inter alia provides that CEA may in consultation of the State Government provide safety measure to “eliminating or reducing the risks of personal injury to any person, or damage to property of any person or interference with use of such property”. Central Electricity Authority (Measures of Safety and Electricity Supply) Regulations 2010 (as amended) provide for the various safety measure to be adopted for electrical installations. These Regulations emphasise on following the relevant codes and standards.

The Preamble to the Electricity Act, 2003 provides for the protection of consumers amongst many other objectives. Section 175 of the Electricity Act, 2003 provides that “the provisions of this Act are in addition to and not in derogation to any other law for the time being in force”. Here reference may be made to then Consumer Protection Act, 1986 (CPA) now in its new avatar CPA 2019 which provides various rights and provides protection in terms of compensation for the deficiency in service in case the work of the Electrical Contractor is not in accordance with the committed standards and/or quality. However, it is pertinent to note that such recourse is only curative and not preventive. It is necessary that the electrical installations are inspected thoroughly at the time of completion of building (before occupation) which will act as a preventive course of action and will ensure that the relevant acts, regulations, standards and good practices are adhered to by the Electrical Contractors to ensure quality.

During the study it was observed that though the provisions of present EA 2003 and CEA Regulations 2010 with subsequent amendments have sufficient provisions for Electricity safety there is lack in the systems and procedures followed presently to ensure compliance to the same. As RERA is now supposed to ensure protection to consumers we looked at provisions of the same to see whether invoking some of the provisions of the same can achieve our requirement. Some of the provisions of RERA are as follows.

Real Estate (Regulation and Development) Act, 2016 (RERA) became the game changer aiming to achieve transparency by removing the information asymmetry between the Promoter and the Allottees and online disclosures in the public domain has infused transparency instrumental in ensuring fair-play and reduce frauds and delays. It is instrumental in bridging the trust deficit between the buyers and Developers. Its objective is to ensure accountability towards allottees and protecting their interest while focussing on the timely completion of projects. Another objective of RERA is to provide effective and fast track grievance redressal mechanism. The Developers, Architects, Structural Engineers, Chartered Accountants and other professionals have been made accountable for their acts and follies. It endeavours to introduce professionalism and pan India Standardisation as such the Forum of RERA has come out with a “Compendium of Best Practices” followed by all the State RERAs in India in 2019.

Section 34 provides for the functions of the Authority for promotion of real estate sector. RERA has been entrusted with the function to protect the interest of the allottees, promoters and real estate agents. It also provides that the Authority shall facilitate the measures to encourage the construction of environmentally sustainable and affordable housing, promoting standardisation and use of appropriate construction material, fixtures, fittings, and construction techniques. Further, the Authority has to facilitate the measure to encourage the grading of projects on various parameters of development including grading of developers. Here Safety measures and standards adopted by the developer in the electrical installation can be considered as one the parameters for grading. This will assist in achieving the protection of interest of allottees and also the developers. Authority can also render advice to the appropriate Government in matters relating to the development of real estate sector. The recommendations made herein merit a serious consideration by the Authority.

Section 3 of RERA provides for Registration of on-going and new Projects with the exception mentioned therein. While Chapter III (Section 11 to 18) of the RERA provides for functions and duties/obligations of Promoters Section 19 provides for the Rights and Duties of Allottees. Section 4 (2) (k) of the RERA stipulates to specify the details of the professionals associated with the project in the specified format, it is observed that the Promoters are giving details of the Architect and/or Engineers and/or Chartered Accountants. However, details of other Professionals associated in the construction business like MEP Consultants, Electrical Consultants, and Electrical Contractors do not find place on the registered project of the developers on the State RERA website. It may be noted that Electrical Consultants do not have any accreditation as such there is no standard requirement as to who can become a Consultant. Thus, it is necessary that a Self-Regulatory Organisation be formed for the purpose of standardisation and best practices. Further, Electrical Consultants and Electrical Contractors shall be brought under the ambit of RERA by casting certain obligations on them with respect

to the crucial role in the building construction and making them accountable. We recommend that the RERA Act and/or the Rules /Regulations framed thereunder be amended to this effect by making it mandatory for the Developers submit the information pertaining to the Electrical Consultants, Electrical Contractors on the website of the RERA at the time of project registration and the Electrical Contractor shall submit self-declaration/submit Certificate for compliance with applicable provisions of law relating to safety, quality, Standards and Codes and other information as detailed herein. A standard format of Declaration/ Self-Certificate may be designed to be submitted to RERA authorities.

RERA requires Fire Safety measures to be taken by the Developers. Approval from Fire Authority is mandatory for obtaining the Occupation Certificate. Short circuit is the common cause (without giving a detailed report) quoted in the fire reports after the incident. Short Circuit could be due to various reasons, like use of sub-standard material or faulty design or workmanship, lack of supervision, etc., but its impact is loss of life and loss of property, both are precious. At present the inspection for Fire Safety before granting the Occupation certificate to the building, periodical Fire Audits and actual Fire Fighting is done by the same people. The Fire Brigade does not have sufficient manpower to carry out all these functions simultaneously which leads lapses in ensuring fire safety. The Fire Brigade also does not have necessary expertise to conduct Electrical Safety audit. Experts have expressed the need to have two wings of the Fire Brigade one to look after the fire Safety compliance while the other does the regular firefighting operations. Fire brigade should appoint independent accredited fire safety inspection audit agencies which should include Chartered Electrical Safety Engineer who can perform the Electrical Safety Audit.

We studied the Regulation and Standards followed in countries like Dubai, Singapore, Hongkong, etc. It is pertinent to note that the Dubai Electricity and Water Authority (DEWA) requires all Electric Consultants and Electrical Contractors to enrol with DEWA to undertake the electrical design and/or installation works in any project or premises in the Emirate of Dubai. The requirement may also include specific training & certification by DEWA for specialised categories of work, if found essential for ensuring the safety, reliability and quality of the installation. Each electrical contractor should mention the details of the engineers and technicians who have adequate knowledge of the DEWA Regulation and applicable standards and safety requirement. They shall be responsible for correct installation and shall also supervise and test the entire electrical works prior to connecting power supply. Electrical installation of any scale requires prior approvals from the DEWA. Electrical Contractor is required to carry out the testing before the DEWA conduct the final inspection and testing of the Electrical Installations hence there is double check in inspection and testing. Similarly the consumer is not allowed to make any extensions or alterations to his electrical installation without obtaining prior approval from DEWA.

Hongkong Regulation for Electrical Installations, 2017 requires all Electrical Contractors to comply with the Construction Site Safety Regulations and the Construction Site Safety Manual. Further, Electrical Contractor has to submit to the Supervising Officer as-built drawings, including the draft prints and revised draft prints for checking and the final approved drawings for record in accordance with the requirements set out in the contract documents. Such

regulations and practises are not seen in India. Some of the best practices followed abroad are included in our recommendations.

CEA Regulations 2015 provides for Chartered Electrical Safety Engineers to assist the owner or supplier or consumer of electrical installations for the purpose of self-certification under regulation 30 and regulation 43. Currently the various State Governments are in the process of notifying and/or conducting exams for the post. Electrical Contractor should appoint a Chartered Electrical Safety Engineer to get the installation inspected for Electrical safety and his certificate should be submitted the Electrical Inspector for approval. It is recommended that the State Governments should expedite the process of accreditation of Chartered Electrical Safety Engineers.

Developers generally provide a very small percentage of the project cost towards the Internal and external electrical works which may result in compromising on the quality of the material and workmen. It is recommended that the Developers should provide sufficient allocation considering the safety of the home buyers. This will enable the Electrical Contractor to use good quality material like the wires for internal wiring to be of copper, fire resistant cables (FRLS and above) to prevent fire incidents, trained certified wiremen under the skilling initiative RERA

There appears to be a lack of coordination between the Architects, Electrical Consultants and Electrical Contractors which hamper the safety of the Electrical Installations. This coordination needs to be enhanced to avoid gaps.

There are certain other points included in the recommendations, which require action from the appropriate authorities so that the entire process is ironed out. It is necessary that the safety precautions are taken at every level and stagewise inspection, periodic and all the test reports be made available to the home buyer. Ultimately Electrical hazards can be averted, if safety requirements are asserted.

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1. Introduction

1.1. Electricity is a boon to the mankind. Life revolves around various gadgets not only in the business but also in the residential segments. The dependency on the electrical gadgets has increased to a greater extent resulting in substantial increase in the electrical load per square meter of the residential building. It is important that utmost care is taken at the planning and designing stage, proper cables and other material is used and workmanship is done skilfully and appropriately supervised to ensure a safe environment for the residents, failing which there is an open invitation to disaster and fire accidents as is evident from the data of the National Crime Records. It is alarming to know that 40% of the fire accidents are in residential buildings. Fire statistics for Mumbai for last 4 years is given below:

Sr. No.	Year	Total	Electrical	Percentage (%)
1.	2015-2016	5239	3335	64%
2.	2016-2017	4808	3278	68%
3.	2017-2018	4869	3337	69%
4.	2018-2019 (April to July)	1091	736	67%
	Daily Average	14	9	

Table 1. Fire Statics for the last 4 years as per the National Crime Records.

1.2. The Home buyer is unaware of any of these technical aspects and safety measures to be adopted in electrical installation. National Crime Records 2017 shows that 13.5% fires are due to electrical faults which could be due to the faulty design, improper material, unskilled workmanship, supervision or casual attitude toward the safety norms.

1.3. The recent fires e.g. Bhandara Hospital which resulted in deaths of 10 infants, the fire at Sunrise Hospital at Dream Mall, Bhandup on 26th March 2021 which claimed 11 lives, fire at Apex Hospital, Mulund on 12th October, 2020 which claimed 2 lives and the fire which took place in Prabhadevi High rise Beau Monde about a year back have brought out the need for looking at Electrical safety more seriously and taking actions to prevent them.

2. Purpose and Scope of Study

2.1. Considering the high number of fire accidents due to Electrical faults, it is necessary to identify the reasons and to do a gap analysis. This study is conducted to understand the following with respect to various aspects of Electrical safety in Residential Sector and make recommendations/suggestions for improvements in the same to reduce accidents and resultant damage and fatalities/injuries due to Electrical fires/shocks:

2.1.1. Prevailing Laws, Rules and Regulations and their adequacy.

2.1.2. Various standards available presently and Adequacy of the same.

2.1.3. Present systems and procedures of government authorities involved.

2.1.4. Practices followed by the professionals involved in residential/commercial Construction including Architects, Developers, Civil Contractors, Electrical Consultants, and Electrical Contractors vis-a-vis the applicable law and standards, Rules and Regulations.

2.1.5. Applicable International standards and best practices

2.1.6. Present level of awareness amongst the home buyers and consumers.

2.2. The methodology adopted is consultative and inputs are gathered by way of conducting surveys and personal discussions with the industry experts, Consumer Activists, Practitioners and Professionals in the areas of Electricity and Real Estate.

3. Applicable Electricity and Housing Laws

3.1. The Electrical Safety in the residential, sector is governed under following:

3.1.1. The Electricity Act, 2003 and the Rules framed thereunder by each State.

3.1.2. Central Electricity Authority Regulations 2010, Amendments 2015, 2018, 2019 (EV) (Section 53 of Electricity Act, 2003 read with Regulation 177 of CEA (Measures of Safety and Electric Supply) Regulations, 2010 hereinafter referred to as CEA Regulations)

3.1.3. Real Estate (Regulation and Development) Act 2016 (RERA) and Rules and Regulations framed thereunder by the State Governments.

3.1.4. Bureau of Indian Standards Act as amended from time to time shall be applicable as it is responsible for making the Standards and mandatory Certifications.

3.1.5. Fire Safety Act for seeking approval from Fire Officer. RERA provides for Fire Safety if not electrical safety. As Short circuit is one of the major cause of fire in buildings it gains significance.

3.1.6. Other Local Laws for granting approvals and permissions for residential construction and providing electricity connections. Presently Local laws do not cover Electrical Safety.

3.2. The provisions of some of the above related to Electrical Safety are given in **Annexure 1.**

4. Regulatory requirements in Housing Sector

4.1. RERA was implemented to regulate and develop the Real Estate Sector in India. Promoters are required to register the on-going projects with the State Real Estate Regulatory Authority to ensure the timely completion of the project and protection of interest of the home buyers. The local authority i.e. Municipal Corporation/Planning Authority/Gram Panchayat, as the case may be, is involved in granting approvals to the constructions and ensuring the norms are complied with. The Developers have to obtain the Intimation of Disapproval (IOD), Commencement Certificate (CC), Completion Certificate (CC), and Occupation Certificate (OC) from such local Authorities. In addition, the Developer has to obtain a number of clearances like Highway clearance, Airport Authority Clearance, Lift Certificate, Fire NOC, Electrical Supply Certificate, water supply, etc., to name a few from other concerned appropriate authorities. There are various government bodies involved depending on the construction segment in housing like the Gram Panchayats, Zilla Parishad, Tehsildar, Local Municipal Authorities, State Housing Departments, City Survey Department, Town Planning Departments, State Housing Development Corporations/Authorities, Slum Rehabilitation Authority, City and Industrial Development Corporation (CIDCO), State Real Estate Regulatory Authority etc., to name a few. Each Authority is having a distinct role to play like granting approvals and registering such residential projects in the segments like rural and urban housing, redevelopment, slum rehabilitation, housing under the Pradhan Mantri Awaas Yojana, etc. Presently the government is trying to simplify the approvals process by making applications on-line and for seeking all permissions under one roof.

5. Role of Regulators in Electricity Sector

- 5.1. As stated earlier the State Electricity Regulatory Commissions are regulating the generation, transmission and distribution of electricity in each State. The Regulatory Commissions also regulate the tariff and are involved in setting up Consumers Grievance Redressal Forum and the Electricity Ombudsman to redress consumer complaints.
- 5.2. It is necessary to get approval from The Electrical Inspector (EI) for the electrical installation in the building in case of buildings above 15 metres high. For buildings with height less than 15 metres no approval from EI is required. The Electrical Contractor has to only submit Test Report to EI to ensure compliance with various standards and rules and regulations. However, there is no such requirement for buildings below 15 meters high.
- 5.3. The Electrical Inspector also deals with the complaints of unauthorised use of Electricity.
- 5.4. The Chartered Electrical Safety Engineer is accredited by State Government. The Electrical Inspector of Energy Department of State Government is the licencing Authority to grant licenses to the Electrical Contractors and Chartered Electrical Safety Engineers.

6. Role of Regulators in Housing Sector

- 6.1. The Real Estate (Regulation and Development) Act (RERA) was passed in 2016 and was fully operational from 1st May, 2017, Maharashtra being the first mover. The objective of RERA was to protect the interest of the home buyers and provide a speedy mechanism for dispute resolution apart from regulating and developing the real estate sector and providing transparency. Every State (barring West Bengal) and Union Territory has established or is in the process establishing a Real
- 6.2. Estate Regulatory Authority and has provided an online platform for registration of the on-going real estate projects, Real Estate Agents and Promoters of the Real Estate Projects. A compilation of the provisions relevant in the RERA and State Rules is enclosed as **Annexure 2**.

7. Significance of standards

7.1. Standardisation is a process to create a set form of creating goods and services considering the best practices in the industry which is agreeable to all the stakeholders. The Standards ensure that the goods and services are of minimum acceptable level of quality and are comparable and compatible with the other goods available in the industry. Standards are significant to ensure the uniformity of certain practices while manufacturing the goods. Standardisation is help for consumers to ensure the interoperability and compatibility of the products.

7.2. In case of conflict between what is mentioned in relevant Indian Standard and the Regulations the Regulations shall prevail.

7.2.1. Indian Standards

7.2.1.1. In India, Bureau of Indian Standards (BIS) is responsible for standardisation of goods or services. One of the aspects of Standardisation is reliability and safety of consumers. Safety is ensured by BIS by specifying compulsory ISI Mark for certain electrical appliances, requiring compulsory registration and compliance with the Specified Standards. There is a prohibition to manufacture, store for sale, sell or distribute Electrical goods such as electrical wires, cables, appliances, protection devices, accessories without ISI mark. Apart from the ISI Mark there is a scheme of Compulsory registration of Electronic and IT products to be in conformity with the standards specified by BIS. It is essential that all Electrical equipment used in the building conform to relevant Indian Standard. The CEA Regulations framed under the Electricity Act prescribe the Standards to be followed and make some registration process mandatory. Regulation 12 of the CEA Regulations specify that the relevant provisions of BIS and NEC may be followed. The material shall conform to the relevant Indian Standard or IEC / International Standard when Indian Standards are not available. In the event of any inconsistencies between the provision of the CEA Regulations and Standards, the CEA Regulation shall prevail.

7.2.1.2. **IS 732** - Code of Practice for Electrical Wiring Installations shall be referred for design and wiring installation in the residential premises.

7.2.2. International Standards

7.2.2.1. India is a founder member of the International Standards Organisation which is a voluntary body to develop standards in consensus with its 165 members. ISO takes efforts to strengthen the link between standardization and public policies by disseminating knowledge, promoting awareness and supporting the application of good practices in referencing standards in national legal frameworks. BIS specifies International Standards in the absence of Indian Standards in certain goods. As regards International Standards in Electrical Installations in Housing Sector, following standards are adopted by most countries:

7.2.2.1.1. British Standard: BS 7671 as amended from time to time.

7.2.2.1.2. International Electro-technical Committee: IEC 60364

7.2.2.2. Worldwide, in countries, standards are based on BS 7671 except in US. CEA Regulations take reference of Indian Standards. We have studied Regulations of some countries from Asia and Middle East mainly Singapore, Hongkong, Malaysia, Kuwait and UAE. USA adopts different standards due to different supply conditions (110 V ac, 60 Hz). The relevant extracts from regulations of Dubai Electricity and Water Authority (DEWA) and Hongkong Government Buildings Authority are given in **Annexure 3**.

8. Stakeholders point of view with regard to electrical Safety

8.1. We discussed with the various stakeholders involved in the construction business like the Architects, Developers, Electrical (MEP) Consultants, Electrical Contractors, Housing Societies and the home owners/buyers (Consumers) about their level of awareness and understanding on the subject. It may be noted that the Electrical Consultants are neither accredited bodies nor do they have any specific registration. However MEP Consultants are recognised which include Mechanical, Electrical and Plumbing Consultants. A Short survey was also conducted with a limited target to gather their views. The survey questionnaire for each of the stakeholders is annexed as **Annexure 4** while the response received from each of them is discussed hereunder.

9. Developers Point of view:

9.1. Developers initiate the project and appoint various agencies involved in the construction of a residential/commercial complex. Architects and Structural Engineers are appointed to make the plans and structural drawings and Electrical Contractors are appointed to carry out the Electrical Installation who either design the installation themselves or get the design and plan for the electrical installations in the building from Electrical (MEP) Consultants. Large Developers have either in-house capability of Electrical design or have regular tie ups with MEP Consultants. The Developer also appoints a civil contractor to undertake the construction work. Electrical installation takes a low priority in the list of preferences in the construction sector which hampers the safety of the home buyers. We have taken inputs from Developers who have constructed minimum 200 to more than 1000 buildings and have professional experience ranging from 10 to 20 years. Developers claimed that they take into consideration the following factors while appointing an electrical contractor:

9.1.1. Whether he is a Licensed Contractor

9.1.2. Track Record for fire Accidents

9.1.3. Whether he has Trained and Skilled Staff

9.1.4. Cost quoted by the Electrical Contractor

9.1.5. Though this may be true for large developers we are not sure whether small developers follow these criteria. Normally only around 4-6% of the cost of the project is apportioned by the Developers for Electrical Installations. In very rare case it goes above 10-15% of the project cost. Hence, the safety of the homebuyers is likely to be compromised.

9.2. It is evident that the budget is barely sufficient to cover the cost of the electrical installation. It appears that the important aspect of safety in electrical installations is taking a back seat. This is one of the major reasons for increasing number of fire accidents in residential buildings.

9.3. The Developers have claimed that they are aware about the sizes and types of wires to be used for different circuits i.e. Lighting, Geyser, Air Conditioner, Fire Pumps, etc., and insist on installation of standard ISI Mark material for electrical installations. They rely on the expertise and advice of the Electrical (MEP) Consultants or Contractor for the same purpose.

- 9.4. Majority of Developers have stated that before handing over possession of the premises to the flat buyer they do show him/her the meter room and wiring to his/her premises. Some Developers responded that they do not take such pains as the home buyers also do not ask for the same. However, majority of **the Home buyers have stated in their survey that they are not aware and have not visited the meter room**. Awareness in this regard needs to be created amongst the home buyers.
- 9.5. 66% Developers have stated that at the time of handing over possession of the premises to buyers the wiring and electrical installation is inspected by the Accredited Electrical Engineer. Some Developers have stated that they take approvals from Chartered Electrical Safety Engineer while some approach the Government Electrical Inspector.
- 9.6. Developers have stated that the wiring plans are handed over to the Society at the time of Conveyance. Normally only external wiring plans are handed over to the Society. Some Developers are handing over the internal wiring plans to the home buyers on request. While most of the Developers do not handover the flat internal wiring plans to home buyers the building wiring plans are available with the Electrical Contractor of the Project.
- 9.7. Developers have claimed that they are mostly aware of the stage-wise maintenance of electrical systems during the construction and Periodic Maintenance during Defect Liability Period (DLP). Though Periodic Inspection and maintenance is mandatory as per CEA Regulation 30 at least once in 5 years **it** is not implemented. Breach is punishable by law but still not implemented, No action has been taken so far by the authorities in this respect. As on today there is no authority which conducts periodic inspection of Electrical installation in buildings. In the newly constructed buildings also there are no check points with regard to electrical installations.
- 9.8. Developers claim that Warranties and guarantees for the electrical installations are generally handed over to the home buyers. However, in many cases the warranties and guarantees are retained by the Electrical Contractors or Developers.
- 9.9. Majority of the Developers are aware of the mandatory requirement of free, direct accessibility to emergency staircase from all parts of the floor without crossing the fire zone.

9.10. Many Developers have stated that they conduct fire drill during the construction period including head count & evacuation.

9.11. Developers are aware that it is necessary to demonstrate provisions for safety and evacuation during fire and conduct fire drill to home buyers/society office bearers during handover as per Fire Protection Act. After handover, it is responsibility of the owner/society to get a fire drill done by the fire prevention contractors and get his building inspected twice a year and submit relevant form to the fire authority.

10. Architects Point of view

10.1. 28.6% always ensure that requirements of National Building Code and National Electrical Code related to Electrical installation and safety are met with during design/execution. Another 28.6% mostly ensure that requirements. 14.3 % participants stated that this is not applicable. Another 14.3/% said that the same is the responsibility of the Electrical Contractor or MEP consultants while 14.3% participants have stated that it is done during the designing stage by the Electrical Consultants. It is, however, doubtful whether compliance is done at the execution stage.

10.2. 71.4% of the participants claimed that they ensure that the drawings for electrical systems are prepared and certified by Chartered Electrical Safety Engineer whereas 14.3% participants have said this is not applicable for them and 14.3% participants have stated that it is the Client who decides the same.

10.3. 71.4% ensure that project electrical intake and meter room details are approved by Electricity Distribution Company. 14.3% participants have said this is not applicable for them and another 14,3% participants have stated that it is the Client who decides the same.

10.4. 57.1% participants always ensure that adequate space for project electrical intake and meter room is provided during design whereas 28.6% participants sometimes ensure the same. 14.3% participants have said this is not applicable for them and another 14,3% participants have stated that it is the Client who decides the same.

10.5. 85.7% participants always provide dedicated shafts for electrical distribution cables as against 14.3% of the Participants which has stated this provision is not applicable to them.

- 10.6. 57.4% participants always check maps of existing underground/overhead distribution cables while designing a project. 14.3 % have confirmed that the maps are available.14.3% have stated not applicable and 14.3% have stated that Electrical Contractors are appointed for the said purpose.
- 10.7. 71.4% always insist on obtaining clearance by Electricity distribution authority prior to commencement of the project while 14.3% have stated that this is not applicable and 14.3% have stated that Electrical Contractors are appointed for the said purpose.
- 10.8. 85.7% participants always ensure provisions for specific elements, equipment like façade lighting, swimming pool/garden, lifts/escalators, CCTV cameras etc. are made in design by the MEP consultant/electrical contractor while 14.3% participants have stated that the provision is not applicable to Architects.
- 10.9. 42.9% participants always and 28.6% mostly make provision for special needs of diesel generator like exhaust, oil storage, fresh air intake etc. while 14.3% have stated that this provision is not applicable for them and 14.3% have stated that this is the responsibility of the MEP Consultant.
- 10.10. 71.4% participants are aware of electrical safety requirements of geyser/cooking range/stove, dry/wet risers/ hydrants, hose reels about sizes, locations, and clearances. 14.3% have stated that this provision is not applicable for them and 14.3% have stated that this is the responsibility of MEP Consultants appointed by them.
- 10.11. 71.4% participants insist on using ISI marked wiring accessories and wires for installation. While 14.3% have stated that this provision is not applicable for them and 14.3% have stated that this is the responsibility of Consultants appointed by them.
- 10.12. 42.9% participants always check and convince themselves that the MEP consultant has taken enough steps to ensure electrical safety. 28.6% mostly check and convince themselves While 14.3% have stated that they do check the safety measure if the Client insists so and 14.3% have stated that this is the responsibility of the Consultants appointed by them.
- 10.13. 42.9% ensure that requirements given by MEP consultant regarding provision of electrical equipment are built into civil design. 28.6% mostly verify the same. 14.3% participants have stated they do so if the Client insists and 14.3% participants stated that the same is not applicable to them.

- 10.14. 42.9% participants always ensure handover of copies of 'As Built' structural, architectural, plumbing, electrical drawings to the society/home buyers/owner. 28.6% handover the drawings if the client so insists. 14.3% participants have commented that it is doubtful whether such drawings are handed over while 14.3% participants have said that it is not applicable to them.
- 10.15. 42.9% always ensure that the originals of warranties/guarantees related to electrical system are handed over to the society/home buyers/association at the time of possession. 28.6% participants do so if the Clients insist while 14.3% participants have stated that it is the responsibility of the Developers and Architects are not involved. 14.3 % participants stated that the said question is not applicable to them.
- 10.16. 71.4% participants always ensure free, direct accessibility to emergency staircase from all parts of floor without crossing fire zone. 14.3% have stated that the users at times block the emergency exits. 14.3 % have responded as not applicable.
- 10.17. It is necessary to cast an obligation as to who owns the responsibility of electrical accidents as the homebuyer is the ultimate sufferer. Is it due to faulty design by the Architect or the Electrical Consultants or deficiency in workmanship by the Electrical Contractor etc,

Electrical (MEP) Consultants' Point of view

- 10.18. Electrical (MEP) consultants are mainly involved in planning and designing of electrical installations and to make the electrical drawings like Single Line Diagrams, Equipment Location Drawings and as such are responsible for building of safety in the design itself. We have discussed with Electrical (MEP) Consultants having more than 20 years of experience in this area. Following are the responses received:
- 10.19. 66% of the participants always ensure adherence to requirements of National Building Code and National Electrical Code related to Electrical installation and safety during Electrical design/Installation while 33% adhere to the requirements sometimes.
- 10.20. 66% participants always ensure right sizing of wires & cables are used in line with National Building Code or National Electrical Code of India and 33% ensure

it sometimes. 100% participants are aware that the drawings for electrical systems must be prepared and certified by a MEP Consultant.

10.21. 66% MEP Consultants always ensure that project electrical intake and meter room details are approved by Electricity Distribution Company.

10.22. MEP Consultants always provide adequate space for project electrical intake and meter room, but in case of any specific constraints about available space, they try to accommodate the equipment without compromising electrical safety.

10.23. 33% of the MEP Consultants claimed that they mostly provide for dedicated shafts for electrical distribution cables. Many stated that it depends upon the Architects. In case shafts are not provided in the design by Architect, then at least dedicated cableways or troughs are provided.

11. Electrical Contractors' Point of view

11.1. 70.6% of the participants had more than 20 years of Experience. 70% of the Participants stated that they always follow and 17% stated that they mostly follow the NEC and NBC while 12% stated that as per them the NEC and NBC are not mandatory.

11.2. 82.3% participants stated that they are ensuring right size of wires and cables are used as prescribed while 17.2% mostly follow the right sizes of wires and cables.

11.3. 76.5% participants responded that the drawings for electrical systems must be prepared and certified by a MEP Consultant or licensed qualified electrical engineer. Rest have stated that there is no such provision as there is no authority presently to certify the drawings for electrical systems. CEEMA has proposed this to the Government but they have not received any response so far.

11.4. 17.6% participants mostly ensure, 11.8% participants sometimes ensure, 58% participants always ensure that the Architect has provided adequate space for project electrical intake and meter room.

11.5. 88% participants always and 6% sometimes take into consideration the existing underground/overhead distribution cables while designing/constructing a project.

11.6. 82.4% of participants always insist, 17.6% sometimes insist on obtaining site clearance by Electricity Distribution Company prior to planning of the project. It is important to know as to how the location which catches fire is required to be

handled. The kind of equipment including generators required to be provided for the safety of the homebuyers needs to be prescribed.

- 11.7. 64.7% always ensure and 23.5% mostly ensure provisions for specific elements, equipment like façade lighting, swimming pool/garden, window cleaning equipment, lifts/escalators, CCTV cameras etc. are made in design and followed during execution of electrical work.
- 11.8. 82.4% are aware and follow the special requirements of diesel generator like exhaust, oil storage, fresh air intake etc., while 17.6% mostly follow the said requirements. If not, then their role ends once the drawings are handed over to the client. Even if the Electrical Contractors insists, **the final call taken by the Client i.e. the Developer/Architect.**
- 11.9. 94% participants are aware of safety requirements of geyser/cooking range/stove, wet area clearances while 6% were not aware of the same. 88% participants get the wiring done thru certified wiremen.
- 11.10. 35% participants always get their electrical installations inspected and certified by the Chief Electrical Inspectorate Department. Electrical Consultants do not do it personally but insist on the Electrical Contractor to get it approved. They also recommend this to their Clients. This is the responsibility cast on the Electrical Contractors to get it approved. However, it is their observation that this is rarely done (read it never). At times the Electrical Consultants certifies the as built drawings prepared by the Electrical Contractors.
- 11.11. 53% always and 29.4 % mostly handover copies of As-built Electrical drawings for Fire detection/suppression system to the Society/home buyers/ Owners. We are given to understand that this is done only if the Client insists.
- 11.12. 94% participants are aware of Annual /Period Maintenance of the Systems and during the construction work in the development.
- 11.13. Lightning protection during construction activities is missed at many sites. (Electrical Contractors bring this to the attention of the Architect/Client, However rarely this is done in India. Electrical Contractors have been doing this in projects abroad.)
- 11.14. 76% of the participants check originals of warranties/guarantees of all equipment used in the project before claiming completion. Others have responded that this is done if the client involves Architects as PMC during the execution phase. Further Electrical Contractors do this if it is in their scope of work. Many

times Clients (Developer or Architect) do not want to increase the fees of Electrical Contractors and hence they say their Administration Department will verify the same.

11.15. 84.4% participants always provide earthing of all external façade elements viz. curtain wall whereas the rest do it on most occasions. 100% of the participants have responded that they are aware of special provisions for smoke/fire detection systems in atriums, auditoriums, banquet halls.

11.16. 94% participants are aware of provisions for smoke exhaust system in atriums, lobbies, staircases, auditoriums, halls etc.

12. Survey for Housing Societies

12.1. 69% of the participants were officer bearers of the Housing Societies. 58% were from smaller Housing Societies having less than 5 buildings, 11% up to 10 buildings and 22% up to 20 buildings.

12.2. 46% of the participants have up to 50 flats in their buildings, 46% have 50 to 100 flats in each building and 7% have more than 100 flats in the building.

12.3. There are up to 5 shops in 69% of Housing Societies, up to 10 shops in 8% of Housing Societies and more than 10 shops in 23% of Housing Societies.

12.4. 54% of the Housing Societies have less than 7 floors and as such have no refuge area. 31% of the Housing Societies have informed that the Refuge Area is on every 7th Floor and in the rest of the housing societies the Refuge Area is on the 8th or 10th or 12th or 13th floor.

12.5. **Only 27% of the Housing Societies are aware about the frequency of inspection of Electrical Installation as per Electricity rules. 73% are not aware.**

12.6. 38% Housing Societies are not aware about Electrical safety regulations related to outdoor installations like swimming pools, gym, gardens etc. whereas 48% responded that this requirement is not applicable to their Society. **Only 15% of the Office bearers who responded are aware of Electrical safety regulations.**

12.7. 42% of the participants are aware about Electrical safety regulations related to fire safety equipment like Fire pumps etc., **while 48% are not aware of the same.**

12.8. 35% of the participants conduct Fire safety drills once in 3 years while **50% of the participants have never conducted fire drills in their Societies.** 3% participants each conduct fire drills every 6 months and once in 5 years.

- 12.9. **65% of the participants have not conducted any awareness programs for their society members regarding Electrical Safety** while only 11% of the Participants have conducted awareness programs in their Societies for the benefit of the members and residents. 24% of the participants have shown willingness to conduct an awareness programme on electrical safety.
- 12.10. Participants have pointed out that in some Societies the Managing Committee is not following the Bye-laws. Participants have informed that the Builders have not handed over any drawing pertaining to the electrical installations including the MHADA buildings. At times the builder is non-cooperative in the handing over process. Participants have requested for awareness programmes on electrical safety.
- 12.11. 23% participants are members of MGP whereas 77% are non-members.

Analysis of Survey on Home Buyers/Consumers awareness on safety in electrical installations

- 12.12. 593 consumers participated in the Survey from Pan India out of which 297 (50%) were members of Mumbai Grahak Panchayat (MGP). 296 (50%) were non-members.
- 12.13. Following is the data pertaining to the Survey participants staying in the present address.

Sr. No.	Range of No. of years	Responses	Percentage
1.	Up to 5 years	92	15.5%
2.	5 to 10 Years	74	12.5%
3.	10 to 20 Years	162	27.3%
4.	Above 20 Years	265	44.7%

- 12.14. 507 (85%) participants claimed that they are aware that the building wiring is required to be done by a licensed Electrician. Whereas 22 participants are not aware and 64 participants have never verified as to whether the electrician is having a practicing license. (It is, however, not clear how many really check whether the contractor or wireman is a Licensed one)
- 12.15. While 373 (62.9%) participants claimed that they are aware about the sizes of wires to be used for different circuits i.e. geyser, lighting, air conditioners, etc. 220

participants are unaware of this fact. (It is, however, not clear how many really know this as it is a technical matter)

- 12.16. 505 (85.2%) participants claimed that they insist upon provision of ISI marked wiring from meter to their premises and inside the premises as against 88 (14.2%) participants who never insisted so. (It is, however, not confirmed how many have really checked this in their residence).
- 12.17. 306 (51.6%) participants always insisted upon providing specific brand of electrical switches, sockets, Miniature Circuit Breakers. 187 (31.5%) participants mostly prefer to specify the brands as against 76 who sometimes prefer to specify the brand. However, a small number of participants (only 24) have never specified the brand for their electrical installations. (It is, however, not possible for a common man to check whether the product used is a spurious one).
- 12.18. 369 (62.2%) participants have got their house pre-wired from the developer while 224 (31.8%) got the wiring done on their own.
- 12.19. 433 (73%) participants have done their internal wiring /subsequent modifications done through a licensed Electrical Contractor while 160 (27%) participants have not got it done through the licensed Electrical Contractor.
- 12.20. 207 (35%) participants have faced a fuse blow out/ MCB tripping due to short circuit in the last 1 year. 77 participants each have faced it in 3 years and 5 years whereas 232 (39%) of participants have never faced any such situation.
- 12.21. Alarmingly 495 (83.5%) participants have not been handed over a copy of the concealed wiring plan of their house by the Developer at the time of purchase. 98 (14.5%) participants were fortunate to receive such a copy from their Developer.
- 12.22. The Developers provide switch points in each house as decided by the Architect. However, 207 (35.9%) participants have asked up to 5 additional points and 173 (29.2%) have asked for more than 5 points in addition to those provided by the Developer resulting in increase in the load calculation made by the Electrical (MEP) Consultant.
- 12.23. 295 (49.7%) participants have visited the meter room and checked the wiring of the premises before taking possession while 298 (50.2%) participants never checked the meter room and wiring of their premises. Only 112 (18.9%) participants have verified that the wiring and electrical installation has been certified by a Chartered Electrical Safety Engineer as against 481 (81.1%) participants who have not done any such verification.

13. Observations made by MGP

13.1. Adequacy of standards:

13.1.1. Relevant BIS Standards relating to Electrical equipment used in Housing projects mainly Transformers, Generators, Cables, Wires, MCCB, MCB, accessories like Switches, plugs and sockets are being updated regularly by the concerned Electro-technical Committees (ETD) to keep in pace with advancement of technologies and also to take care of any feedback received from users time to time. The Rules framed under the Electricity Act and the CEA Regulations should specify the implementation of the Standards which will help in making it mandatory.

13.2. Adequacy of Acts, Rules and Regulations and codes:

13.2.1. RERA hardly makes any mention about Electrical Safety It is, however, observed that most states have either not mentioned anything about this aspect or reproduced some of the CEA Regulations which normally relate to outdoor H.T. installation.

13.2.2. CEA Regulations 2010 have been updated in 2015, 2018 and 2019 and adequately cover aspects of Electrical Safety. The 2015 revision has made provision for “Electrical Safety Engineer” and “Chartered Electrical Safety Engineer” for inspection and certification of installation but these are in the process of being implemented in the States. The 2019 amendment pertains to the Electrical Vehicles. As the EVs are being given a push by the government from the angle of clean environment sooner or later the housing societies will have to make provisions for the Electrical Vehicle Charging station in their campus.

13.2.3. Electricity Act 2003 covers aspects of Electrical Safety at policy level but leaves it mainly to the CEA regulations which cover this subject in exhaustive manner.

13.2.4. National Electrical Code covers the Electrical Safety aspect to some extent. However, it is not being considered by anyone in the field as it is more of recommendatory nature. It has, however, several good practices which, if followed, can lead to improvement in the field.

13.2.5. National Building Code, though recommendatory in nature, is generally followed by all agencies working in the field of Housing.

14. Present Systems and Procedures of government authorities involved:

14.1. Real Estate Regulatory Authorities (RERA)

14.1.1. Protection of Consumers i.e. the home buyers is one of the prime objectives of RERA. Information with regard to the registered Projects is available on the web portal of the RERAs as such buyers are taking an informed decision. Various State RERAs are presently only concentrating on ensuring timely completion of registered projects and looking into grievances of consumers pertaining to delays to grant compensation for the same. Section 14(3) of RERA provides reference to the quality and workmanship with regard to defect liability. The promoter shall be obliged to rectify without further charge, within thirty days, any structural defect or any other defect in workmanship, quality or provision of services. Though there are some provision and laid down procedures in RERA to ensure workmanship and quality of civil construction there is no such provision to ensure design, workmanship and quality of Electrical Installation, especially the internal wiring network. For Electrical installation the entire dependence is upon test report submitted by Electrical contractors to Government Electrical Inspectors. (Maharashtra RERA has initiated Skill Development Programs through Skill India Mission to facilitate Train the trainer training to unskilled site workers. The Developers can take benefit of this program to provide formal training to unskilled site workers. The first batch of the Electrical workers has completed the “Train the Trainer” training program recently conducted by Rustomjee Academy. (source MahaRERA website)

14.1.2. It is highly necessary that Electrical Safety being an important aspect state RERA should have proper system of ensuring that adequate care has been taken by the Electrical contractor and supporting agencies like Architect and Civil Contractor and there is related supportive documentation to ensure/ record that the same is adhered to.

14.2. Government Electrical Inspector

14.2.1. As per Electricity Act, 2003 the Government Electrical Inspector is the authority to grant approval to charge high tension installation. Low tension installation does not require approval prior to charging. Section 53 (f) provides that the CEA may in consultation of State Governments specify suitable measures for “inspection of maps, plans and sections by any person authorised by it or by Electrical Inspector or by any person on payment of specified fee”. However, under

Regulation 36 of the CEA Regulations their scope is limited. Internal electrical installation within the individual owner's premises does not get inspected.

- 14.2.2. There is insufficient number of Inspectors to check all installations rigorously. Hence, approvals are issued generally on the basis of the documents submitted by the contractor. For buildings up to 15 metres high there is no inspection. Only Test Reports are submitted by Electrical Contractors.
- 14.2.3. In many cases the actual work is carried out by an unlicensed Electrical contractor who appoints a licensed contractor as a "Liaison Contractor" who submits the documents with his signature for approval.
- 14.2.4. The Electrical Contractor does not employ certified wiremen to do the work.
- 14.2.5. For low tension installation works, Electrical drawings prepared by the Electrical Consultant do not require prior approval of Government Electrical Inspector or any other Authority. Thus, deviations, if any, from CEA Regulations are not detected early and are allowed to go through to the final stage.
- 14.2.6. In respect of low tension installations, there is no system of periodic inspection of buildings for Electrical Safety by Electrical Inspector or by the Distribution licensee. As a result, any unauthorized additions to the sanctioned loads remain undetected causing overheating of cables resulting in short circuits and resultant fires. Also as the Distribution company does not carry out periodic checking of connected loads to find out additions made by residents it results in overloading of feeder cable to the building. There is no periodic inspection of Meter boards of old buildings which are normally situated below the staircase (in many cases wooden) on ground floor. This further causes problems in evacuation of residents in case of fires.
- 14.2.7. In High rise buildings the Fire escape staircases, which are normally not in use, are used for dumping old scrap furniture etc. making evacuation difficult during fire.
- 14.2.8. At present the entire responsibility of ensuring adherence to standards, rules and regulations and maintenance of quality during construction is with the Electrical Contractor only. He is not only supposed to do the work but also do self-certification. There is no third party inspection by a qualified agency. Government Electrical Inspectors normally go based on Test Reports submitted by the Electrical contractor and conduct only cursory checks.

14.2.9. The system of checking of installation by Chartered Electrical Safety Engineer mandated by CEA Rules 2015 is still in the early stages of implementation.

14.2.10. It is felt that role of Electrical Inspector needs to be enhanced similar to those abroad to increase their involvement in approving the drawings at the initial stage before start of work and also the inspection and approval of the installation before charging and periodic inspection thereafter. (Ref. DEWA and Hongkong Regulations -**Annexure 3**)

15. Practices followed by Developers during design and construction

15.1. Generally developers appoint Civil Contractors to perform the civil constructions and they concentrate more in the planning and selling aspect. Though experienced developers are aware of Rules, Regulations and Standards, they do not involve themselves into ensuring proper design of Electrical system and leave it to the Electrical (MEP) Consultant appointed by them to design the system and the contractor to carry out the work according to the drawings prepared by the consultant. Smaller developers are not even aware of the applicable standards, rules and regulations and codes and totally depend upon the Electrical contractor. The contractor either prepares the drawings himself or gets the drawings prepared by his own consultant and carries out work accordingly.

15.2. Developers allocate around 4-6% of the project cost to Electrical installation and ask the MEP consultants to prepare designs within that cost. This results in cutting corners by consultants and contractors in many cases. The major item costs e.g. transformers, generators, main cables from transformer to main switchboard, main switchboard etc. are included either based on tentative quotations or past data but minor costs like that of internal wiring and accessories are taken on thumb rules. (As per a study “A Need for Expansion: Mechanical and Electrical Courses” by Daryl L. North, Ph.D. and Christian Mains, Northern Kentucky University, Highland Heights, KY, USA the average cost of Electrical installation in construction cost in USA is about 8% for Apartments, 10% for Hotels, 9% for Nursing Homes and 10% for schools.)

15.3. In large projects independent Electrical (MEP) consultants are directly appointed by the developers whereas for smaller projects like individual building developers give the whole contract to the Electrical contractor who appoints his own consultant and gets the designs from him.

16. Practices followed by Electrical Consultants during design and construction

16.1. Electrical (MEP) consultants, appointed either by Developer or Electrical contractor calculate the loads and prepare the Electrical drawings like equipment layouts, Single Line Diagrams, cable and wire routing based on provisions made in civil drawings by architect, decide cable and wire sizes and number of points to be provided. MEP Consultants are generally aware of requirements of all relevant provisions of Electricity Act 2003, Rules framed thereunder and CEA Regulations 2010, 2015 and 2019 and relevant IS Standards and incorporate these while preparing the drawings. They also prepare Bill of Materials and give to the contractors. They sometimes coordinate with Architects to ensure proper provisions for Electrical installations. Otherwise the coordination is done by the Electrical Contractor. They also prepare cost estimates and handover to developer or Electrical Contractor.

16.2. It is, however, noted that MEP Consultants do not have any further role and are not involved in either supervision of works or in work in progress inspection or final inspection or coordination with Government Electrical Inspector for getting the certification for completed installation.

16.3. It is observed that Electrical Consultant's role in the present changed scenario needs to be recognised by the authorities and they should be allowed to deal directly with the Electrical Inspector for submission of drawings for approval and should be involved in stage and final inspection/testing of the installation as being done abroad. (Refer DEWA, Hongkong Regulations – Annex 3)

17. Practices followed by Architects during design and construction

17.1. Architects are appointed by the developer at the time of conceiving the project. His job is to prepare a feasibility study based on location and size of plot, prepare plans considering the development potential and prepare estimated cost of the project considering various factors such as cost of land, premiums and duties to be made to local authorities, fees to be paid to various consultants etc. After the feasibility is established and it is decided to go ahead with the project, Architects along with Structural Consultants prepare the final plans and civil and structural drawings to be submitted to the local authorities for approval. Experienced Architects are generally well versed with requirements of National Building Code, Electricity Act 2003, Rules framed thereunder and CEA Regulations. However, inexperienced Architects depend upon the Electrical Consultant/Contractor to give

inputs. While preparing final drawings the Architect is supposed to take inputs from Electrical (MEP) Consultant and make provisions for various equipment like transformer, Diesel generator, main switchboard, Meter room, Distribution boards on different floors, shafts for running of cables to various floors and wires to individual flats on each floor, Distribution boxes in each flat, concealed wiring in each flat and power points for switches and plugs and sockets in each room.

17.2. Though for large projects there is proper coordination between Architect and Electrical Consultant/Contractor, for smaller projects/individual buildings this is not followed generally. The Electrical Contractor is appointed at a later date when the basic civil and structural plans are already prepared and approved. Hence, the Electrical Consultant has to make arrangements to accommodate the equipment in available space by making compromises regarding safety.

17.3. It is highly essential that Electrical Consultant and Contractor should be appointed right at the start of the project and their requirements are incorporated in the civil design by the Architect and Structural Engineer similar to practice followed abroad. (Refer DEWA, Hongkong Regulations – Annex 3)

18. Practices followed by Electrical Contractor during design and construction

18.1. In the present scenario Electrical contractor is the prime figure in ensuring adherence to requirements of various standards, Electricity Act 2003, Rules framed thereunder, CEA Regulations 2010, 2015, 2018 and 2019, National Building Code, as only he is recognized in the above Act, Rules and Regulations.

18.2. Electrical Contractors get the work done from Electricians under their supervision. As per requirement he has to be a Licensed Contractor. Also he has to get the work done from Certified Wiremen who have to be either ITI trained or having formal training and holding a permit from the Government to operate as a Wireman. But in practice this is observed only in major cities. In smaller towns and villages the work is done by an unlicensed Contractor and using unskilled electricians. These Contractors appoint a Licensed Contractor to submit the Test Reports and get the installation approved by the Government Electrical Inspector. There is no Electrical consultant involved to get the drawings made. In many cases there are no drawings at all. The contractor gets the work done totally based on his knowledge and experience. There is hardly any adherence to Statutory Acts, Rules, Regulations or Standards.

- 18.3. In large projects there is use of ISI marked and branded equipment like cables and wires, MCCB, MCB, Switches and plugs and sockets. The equipment is procured by either the Developer directly or by the Contractor. However, in Tier 2 and 3 cities and rural areas the Contractor buys the locally available non-branded and non ISI marked equipment unless specifically asked by customer. Even in cities like Mumbai and Pune for smaller projects/individual buildings/ SRA, MHADA rehab buildings substandard cables and wires and equipment is used.
- 18.4. As the work is done and inspected by the same person i.e. Electrical Contractor and by using uncertified wiremen there is no check on defective workmanship and checks/certification during execution of work.
- 18.5. At the time of taking possession of the flat by home buyer the Contractor/Developer is supposed to handover the “As Built drawings” and warranties to the flat buyers/Society office bearers. However, this is hardly followed other than large projects or High end projects in Tier 1 cities. It may be noted that many a times such “As Built drawings” are not even prepared by the Contractor or the Consultants hence the question of handing over doesn’t arise.
- 18.6. Regarding concealed wiring when a buyer buys a ready possession flat in an already completed building with Occupation Certificate he has no means of knowing the routing of concealed wiring unless he has the map of concealed wiring route given by Developer. Hence, there is always a chance of damaging the wiring while doing any repairs/modifications in the flat. Also in case of deterioration of insulation of wires there is no means of knowing unless it develops into a short circuit. It is suggested that the as built drawings shall be annexed to the possession letter of the home buyer and also be placed on the website of the State RERAs along with the Completion Certificate and Occupation Certificate.
- 18.7. Earlier the protection for main incoming as well as for main branches used to be only by fuses. This used to give protection only against short circuits. Presently MCBs are used in these places which provide both overload and short circuit protection. However, MCBs do not provide protection against earth leakages due to breakdown of cable insulation or to shocks to humans by accidental touch to live parts. For this purpose an Earth Leakage Circuit Breaker (ELCB/RCD) has become essential.
- 18.8. It is highly essential that preparation and submission of drawings at the initial stage for approval and final As-built drawings need to be considered as an

important step in ensuring proper design and quality of installation and also records for any troubleshooting or investigation as being done abroad. (Refer DEWA, Hongkong Regulations – Annex 3).

19. Home buyers/ Residents of existing buildings

- 19.1. It is noticed that there is very low awareness about Electrical safety among new home buyers/residents of old buildings.
- 19.2. Few people buying new flat ask for branded equipment like switches and plugs and sockets. In case the developer is giving water geysers and AC etc. they insist on having branded products but when it comes to MCCB, MCB and wires from main switchboard to their flat and inside their house they do not insist on having wires conforming to ISI specifications. They are also not aware of various Acts, Rules, Regulations or Standards and totally go by what is provided by the Developer/Contractor. They are not aware about sizes of wires to be used for different circuits based on current rating and go by what is provided by Developer/Contractor.
- 19.3. They do not insist on seeing the meter room and main switchboard and try to ensure whether it conforms to the provisions of the applicable Acts, Rules, Regulations or Standards and Codes.
- 19.4. They claim that they are aware of sizes of wires to be used for different circuits and also that wires should be conforming to BIS Standards but rely on the Contractor to do the needful and have no means to check whether Contractor has adhered to it.
- 19.5. They do not insist upon knowing the routing of the concealed wiring and do not ask for drawings showing route map and sizes of concealed wiring. Only a small percentage confirmed that they have received a copy of a plan of concealed wiring in their house. Most of the home buyers (65%) get the provision done for additional points in their house but do not check whether the incoming wires to their flat and original wiring provided by Developer are of adequate rating or not.
- 19.6. For those home buyers who have got their flat wiring done on their own many do not check whether the Contractor they have appointed is a Licensed one. They also do not check whether the electrician doing the work is a licensed wireman who is skilled /ITI trained.

19.7. There is no awareness about having Earth leakage circuits breakers (ELCB also known as Residual Current Device – RCD) to prevent leakage of current due to breakdown of insulation which can lead to short circuits and to prevent Electrical shocks to humans and do not insist on provision of same.

19.8. Persons staying in existing/old buildings have got their wiring renewed on their own but there also we find the same lack of awareness. They get their main meter/MCB/Switchboard renovated only when they get notice from the Electricity Distribution Company. In such an event, they get it done through a Licensed Contractor as the company insists upon it but when it comes to wiring from main meter board to their flat and inside their flat they do not bother to get it done from a Licensed Contractor. It is normally done through the local Electrician

20. Society Office Bearers.

20.1. Society Office Bearers are generally non-technical persons and depend upon the Developer and Electrical Contractor to ensure that necessary care has been taken for adherence to provisions of the applicable Acts, Rules, Regulations and Standards for Electrical safety. They are also not aware about additional precautions to be taken for outdoor installations like Gardens, Swimming pools etc. (Points merged back which had got separated due to error)

20.2. Most of them do not check at the time of taking handover from Developer whether fire safety regulations are met and try to find out what provisions are made for fire safety and evacuation. Fire drills are conducted only if a notice is received from Fire Brigade.

20.3. Most of them do not conduct regular fire drills in their building. They also do not conduct any awareness program on Electrical safety for the residents.

20.4. Most of them do not ensure whether the developer and the contractor has handed over necessary documentation related to Electrical and Fire safety.

20.5. However, most of them have shown willingness to have awareness programs on Electrical and Fire safety if conducted by any organization like MGP.

21. MGP Recommendations

Based on the surveys conducted, discussions held with different stakeholders and our own observations following recommendations are being made.

21.1. **Adequacy of Standards** No recommendations are being made relating to adequacy of the applicable standards as it has been observed that present standards

adequately define the requirements related to Electrical Safety. Presently the Codes like NBC and NEC are not mandatory it is recommended that they shall be made mandatory through the Rules and Regulations specified by every State.

21.2. Adequacy of prevailing Acts, Rules and Regulations: Real Estate (Regulation and Development) Act – RERA

21.2.1. The Developer shall ensure that details of the Electrical (MEP) Consultant and the Electrical Contractor, who prepared the Electrical Plans shall be furnished to the State RERA at the time of registration of the Project and shall be made accountable for their work. Such details shall be displayed on the website of the State RERA along with other project details. It is pertinent to note that the qualifications to be an Electrical Consultant are not specified nor they are having any registration or licences, as issued to the Electrical Contractors. This results in any one claiming himself to be an Electrical Consultant. It is highly recommended that Electrical installations being very important aspect and given the high number of fire accidents in the residential sector Electrical Consultants shall be made accountable under the RERA Framework.

21.2.2. The Developer shall submit the Electrical plans and drawings for the internal works and external works along with the approved architectural and structural plans to RERA while registering the project. Further the same shall be annexed to Agreement for Sale at the time of execution. “As Built Drawings” for the individual residential or commercial unit shall be referred to in the Agreement for Sale and handed over home buyer at the time of possession. These drawings shall be made available on the website of State RERA where the project is registered.

21.2.3. The Developer shall specify the percentage of the project cost allocated for the Electrical Installation and shall have a stipulated budget for the Safety installation.

21.2.4. It is further recommended that the Electrical Consultants’ and Electrical Contractors’ Self Regulatory Organisations (SRO) working in the field of Real Estate be registered with the State RERAs for the development of the sector and they can specify the criteria for becoming Electrical Consultants. The SRO shall be responsible for the best practices in the industry and fix the roles and responsibility of the Consultants.

21.2.5. As Housing is a subject in the concurrent list the present RERA provides for fire safety but is silent on Electrical Safety though electrical faults is one of the main reasons of fire in the residential buildings. It is left to Electrical Contractors

to follow the Safety provisions under the Electricity Act and the Rules and Regulations made thereunder. Hence, it is recommended that following be included in the RERA Rules and Regulations of every State. Since RERA is not implemented in the State of West Bengal, the State Law should also be amended to make the said provision.

21.2.6. Responsibility shall be defined on the Electrical Consultants and the Electrical Contractors for Electrical Installations in the Housing Sector by asking them **to submit declarations/self-certification** for complying with the provisions in general and Safety provisions in particular of the Electricity Act 2003, CEA Regulations 2010 and amendments of 2015, 2018 and 2019

21.3. National Electricity Code 2011 (Presently under revision)

21.4. National Building Code 2016

21.4.1. Regulation 12 of the CEA Regulations provides that the provisions of the NEC may be followed to carry out the purposes of the Regulations. It mandates the material and apparatus used in the electrical installations shall be in conformity with the codes specified by BIS and International Electrotechnical Commission. Hence is necessary that the provisions of NEC are made-mandatory and that adherence to the same be ensured to maintain high quality standards.

21.4.2. Electrical Consultant and/or Contractors be made responsible for the work done by them and they should give a declaration or Certificates to RERA with regard to the following:)

21.4.2.1. Undertaking for Quality Assurance

21.4.2.2. Agreement between Developer and Electrical Contractor

21.4.2.3. Certificate conforming adherence to Architectural Planning Requirements

21.4.2.4. Certificate conforming adherence to Guidelines for Electrical Works – Wiring Installation

21.4.2.5. Membership of SRO

21.4.2.6. Certificate for use of materials conforming adherence to relevant Indian or International Standards

21.4.2.7. Certificate conforming adherence to Guidelines for concealed wiring at site

21.5. Recognition of the role of Electrical Consultant in ensuring Electrical safety at the design and execution stage. It should be made compulsory to get the Electrical

drawings made by the Electrical Consultant approved by Electrical Inspector/CESE before commencement of work.

21.6. Stage-wise checks by the Electrical Inspectorate/CESE/Consultant during construction and Periodic checks within Defect Liability Period should be made compulsory and these stage-wise reports should be considered as an input to the Architect to release phase wise payment from Separate Bank account (escrow).

21.7. The Electrical (MEP) Consultant should also inspect all the materials used by the Electrical Contractor prior to use and certify them for quality and conformance to relevant Indian standards.

21.8. Necessary documentation to prove that the work is done by Certified electricians. The Electrical Inspector/CESE should confirm it.

21.9. (Standard Definition of structural Defect be included in the RERA Rules for the States so as to include the Electrical Installation Defects during the Defect liability period.)

21.10. **Electricity Act 2003:** No recommendations as the present provisions are adequate.

21.11. **CEA Regulations 2010 and amendments of 2015, 2018 and 2019:** No recommendations as the present provisions are adequate.

21.12. **National Electricity Code 2011 (Presently under revision):** No recommendations regarding amendments as the NEC is presently under revision. **Though provisions of NEC are only recommendatory it is advised that adherence to the same be ensured to maintain high quality standards.**

21.13. **National Building Code:** No recommendations as the present provisions are adequate.

22. Present systems and Procedures of Government Authorities involved: Following changes are recommended:

22.1. It should be made compulsory to get the Electrical drawings made by the Electrical Consultant approved by Electrical Inspector before commencement of work.

22.2. Stage-wise/Periodic checks by the MEP consultant/CESE should be made compulsory and these reports should be submitted to the Electrical Inspector.

- 22.3. The Electrical (MEP) Consultant should also inspect all the materials used by the Electrical Contractor prior to use and certify them for quality and conforming to relevant Indian standards.
- 22.4. Certification of work by **Chartered Electrical Safety Engineer (CESE)** as mandated by CEA Regulations 2015 be implemented with immediate effect. Electrical Inspector should not approve the installation unless the certification is available.
- 22.5. Government Electrical Inspector/CESE must inspect the installation before the wiring is concealed. He must take samples of materials like cables and wires used and check that these conform to relevant BIS Standards.
- 22.6. He must take photographs to keep records of the workmanship. If it is found that workmanship is sub-standard and proper care has not been taken while cable routing, cable bending, cable bunching etc. the Electrical Contractor should be asked to redo the work properly.

23. Practices followed by Professionals: Developer

- 23.1. Developer must appoint an Electrical Consultant/Contractor before the Architect takes up preparation of working civil and structural drawings. The Electrical Consultant should prepare Electrical layout drawings showing location of various Electrical equipment and cable and wire routing which should be considered by the Architect for making provision in columns, beams, flooring and walls. There should be close coordination between the Architect and Electrical consultant at this stage.
- 23.2. Developer must take proper cost estimate from Electrical Consultant and make provision for the same in his budget. There should be no compromise of Electrical safety.
- 23.3. In case a Developer is ordering the electrical items on his own or through the Electrical Contractor he must ensure that these items are checked by Electrical Consultant/CESE to ensure the quality and conformance to BIS /IEC Standards.
- 23.4. Where the Electrical Consultant is appointed by the Electrical Contractor, the Developer must get the credentials of the Electrical Consultant verified.
- 23.5. Developer must ensure that the Electrical Contractor employs certified wiremen who are skilled/properly trained electricians to do the actual wiring work.
- 23.6. Snag list or discrepancy report prepared on final observation submitted by Electrical consultant should be acted upon and should not be neglected.

24. Practices followed by Professionals: Electrical Consultants

24.1. Though Electrical Consultants are not mentioned in present Electricity Act 2003 or CEA Regulations they play an important part in ensuring Electrical safety in today's scenario. Earlier when buildings were small, houses had fewer equipment like lights, fans and maybe water heaters and there were no stringent Electrical safety requirements the Electrical Contractor's competence could be relied upon to maintain adequate safety. However, in present era of High-rise buildings and stringent Rules, Regulations and Standards adherence cannot be left to Electrical Contractor's workmanship and self-certification in accordance with CEA (Safety) Regulations. Hence, it is essential that Electrical Consultants play a larger role. The designs and drawings should be made by them considering the Standards and Regulations and they should also carry out stage-wise ~~and~~ periodic supervision/inspection of work and be made accountable for their work. This will ensure parity with procedure followed to ensure quality of civil construction where Architect and Structural Engineer are responsible for the design, adherence to prevailing Standards, Codes and Regulations and supervision to ensure workmanship. (On the same lines design and drawings of Electrical Services shall be made by Electrical Consultant and erection work shall be done by the Electrical Contractor. Electrical Contractor may be a Consultant and vice versa, but shall be considered from the point of view of two different expertise).

24.2. Electrical Consultant should be appointed at the initial stages itself and should work along with the Architect in preparing the layouts, civil and structural drawings and prepare Electrical drawings in coordination with him. The Electrical drawings prepared by him should be submitted to the Electrical Inspector for approval and civil drawings should be finalized taking into account requirements of Electrical Consultant and comments made by the Electrical Inspector. This will avoid any last minute problems and ensure Quality and Electrical safety.

24.3. Electrical Consultant should check and certify that all materials used are conforming to BIS Standards. Developers should not compromise quality to save on cost.

- 24.4. Electrical Consultants should carry out periodic inspection of work being done by the contractor and submit reports to developer and architect. Application for final approval to Electrical Inspector shall be made only after clearance by him.
- 24.5. There should be accreditation of Electrical Consultants to ensure that only those who are well qualified and experienced can practice as consultants. Proper norms for accreditation should be laid down.

25. Practices followed by Professionals: Electrical Contractors

- 25.1. Developers must ensure that the Electrical Contractor appointed have a valid Licensed to operate as such. We are given to understand that often a non-licensed contractor is appointed for executing the actual work while a licensed contractor will be appointed to perform the statutory functions only.
- 25.2. Electrical Contractor should procure only ISI branded equipment like cables and wires, MCCB, MCB, Switches and plugs and sockets. He must get the same 4779 by the Electrical Consultant as there are many spurious makes available in Tier 2 and 3 cities and rural areas.
- 25.3. All internal wiring should be copper and should be FRLS and above grade.
- 25.4. Wiring used for Critical Services circuits like Fire Protection equipment, Emergency lighting etc., shall be of Fire Survival grade and should have insulation withstand of 950 degree C for 3 hours.
- 25.5. Current density in wires should not be more than that allowed by Standard. Adequate safety factor should be considered for concealed wiring.
- 25.6. Fire retardant barriers must be provided at appropriate places to prevent spread of fire.
- 25.7. Earthing of installation should be done with proper care under expert supervision.
- 25.8. Electrical Contractor must ensure that he uses only Certified wiremen and supervisors for doing the work.
- ~~25.9.~~ The consumer has no means to inspect the concealed wiring done by the Electrical Contractor, there has to be some mechanism who will confirm that the that the work done by the Electrical Contractor is in accordance with the Electrical Design made by the Electrical Consultant and also the standards and quality has been complied with. We recommend that the Electrical Consultant and Chartered

Electrical Safety Engineer shall be authorised to conduct such inspection and certify that the wiring is done as per design, standards and quality.

- 25.10. Electrical Contractor should appoint a Chartered Electrical Safety Engineer to get the installation inspected for Electrical safety and his certificate should be submitted the Electrical Inspector for approval. Electrical Inspector should not accept application for approval unless accompanied by certificate of Chartered Electrical Safety Engineer.
- 25.11. Electrical contractor should handover “As built” drawings to developer who in turn should handover the same to the flat buyer/ society office bearers. These drawings must show the size and material of the wires/cables used and the route map of concealed wiring.
- 25.12. Electrical Contractor should handover to flat buyers/society office bearers list of safety instructions to be followed after takeover of the flat/amenities and also conduct a demonstration of the same.

26. Home buyers/Residents of existing buildings

- 26.1. It is highly essential that awareness among new home buyers/ residents of old building needs to be increased as they are the ultimate users and sufferers in case any calamity occurs due to electrical shock or fires taking place due to short circuits which constitute nearly 40% (source) of all types of fires as mentioned before. Following steps are recommended.
- 26.2. Developer/Electrical Contractor should handover following documents to Home buyers/Society office bearers:
 - 26.2.1.1. All electrical drawings showing locations of all electrical equipment including main switchboard, Distribution Boards on each floor and each flat, cables and wire sizes, routing of cables from meter room to each floor and to each flat, concealed wiring map inside the flat, etc.
 - 26.2.1.2. Warranties of all equipment used
 - 26.2.1.3. Copy of Test Report of electrical installation
 - 26.2.1.4. Instructions/Troubleshooting chart/ Safety precautions to be taken by the residents to prevent Electrical fire/ shock.
- 26.2.2. Provisions made for escape in case of fires
- 26.2.3. Certificate of approval received from Electrical inspector

- 26.3. Wherever home buyers are getting the flat wiring done through their own Contractor they must get the above documents from their Electrical Contractor. They must also verify the validity of License of the Contractor and whether he is using Certified Wiremen for the job.
- 26.4. Same is applicable for residents of old buildings who may be getting their house wiring renovated.
- 26.5. Electrical Inspector/Fire Brigade should conduct regular awareness programs for Housing Societies regarding Electrical safety with the help of NGOs working in this field.

27. Society Office Bearers

- 27.1. Society Office Bearers should ensure that they receive following documents from the Developer/ Electrical Contractor at the time of handover:
- 27.2. All electrical drawings showing locations of all electrical equipment including Emergency Generator, main switchboard, Distribution Boards on each floor and each flat, cables and wire sizes, routing of cables from meter room to each floor and to each flat etc.
- 27.3. Drawings of Electrical wiring i.e. routing of underground cables, locations of switches done in outdoor installations Gardens, swimming pool etc.
- 27.4. Warranties of all equipment used
- 27.5. Safety precautions to be taken by the residents to prevent Electrical fire/ shock.
- 27.6. Provisions made for escape in case of fires
- 27.7. Certificate of approval received from Electrical inspector
- 27.8. Insurance is required to be mandatorily taken by the Housing Societies for the fire and other calamities. Generally only the construction cost is covered. The same shall include the cost of electrical installations.
- 27.9. Society office bearers should arrange through Electrical Inspector or NGOs working in the field of Electrical safety **periodic awareness programs** for their residents.

28. Other General Points

- 28.1. It is observed that the Fire brigade on a case to case basis inspects various buildings for fire safety. However, during their checks they only check the provisions made for extinguishing the fires and for evacuation of people in case of fires but they do not look into Electrical safety provisions. **Hence, it is recommended that checking of Electrical safety be made as a part of Fire**

safety checking. For this the Fire brigade can take help from either the Electrical Inspector office or Chartered Electrical Safety Engineer. Fire Act provides for Building Inspection twice a year, we recommend that similar provisions be included in the Electrical Installation. Fire Safety shall ensure Electrical Safety is inspected by the Electrical Inspector or the Chartered Electrical Safety Engineer. It is suggested by some experts that the Fire Brigade shall have two separate Wings. One which looks into the fire safety and the other which looks into the fire fighting operation.

- 28.2. **Periodic (every 3 or 5 years) inspection of Electrical installation by Chartered Electrical Safety Engineer be made mandatory as per provisions of CEA Regulations 2015.**
- 28.3. State Government should conduct Awareness programs on Electrical safety in buildings with the help of Consumer organizations.
- 28.4. Every year there should be an Electrical Safety Week when seminars, debates should be organized all over India by Government and Electrical Equipment Manufacturers to spread awareness about Electrical safety in buildings ~~with~~ through NGOs and Consumer organisations.
- 28.5. **Earth Leakage Circuit Breakers (ELCB/RCD) of 30 mA setting should be made compulsory for every flat to avoid electrical shock. In addition for the complete installation ELCB/RCD with either 100 mA or 300 mA setting should be chosen for installation at point of supply source based on requirement to avoid earth leakage which can lead to short circuit and resultant fire.**

List of Annexures

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