



INDIAN RAILWAY
STATIONS DEVELOPMENT
CORPORATION LIMITED

04b

Handbook for Architectural Design of Commercial Assets

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Preface

The Development Control plays an important role in guiding and facilitating the physical Development. Since the commercial development along with station redevelopment in the railway land is to be done under Section 11 of the Railways Act 1989, there was a need to have set of Manuals/Guidelines to guide the entire development. In fact the Union cabinet has approved (in terms of communication received from Ministry of Railways, GOI vide letter No. 2011/LMB.WCS/22/07/25 Pt.1 dated 17.10.2018) that 'Railways/RLDA/IRSDC shall consult urban local bodies/other statutory authorities while approving its plans in terms of powers conferred to it under Section 11 of the Railways Act 1989 so that the development in Railway Land is harmonious with surrounding development, generally following National Transit Oriented Development (TOD) Policy. No change in Land Use is required pan India by Railways for developing railway land for commercial use.' It is further approved that IRSDC shall be the Nodal Agency and the main Project Development Agency for redevelopment/development of all stations. MoHUA has also conveyed the approval of Union Cabinet to Chief Secretaries of All States/UTs to incorporate suitable provisions in the local byelaws/ development control norms in congruence with the National TOD Policy as well as relevant provisions of the Railways Act to facilitate Railways/RLDA/IRSDC to proceed with their development plans in consultation with local bodies/other statutory authorities, at the earliest.

Accordingly as the Nodal Agency for station redevelopment, IRSDC took upon the responsibility, on behalf of Railways/RLDA besides for guiding its own work for station redevelopment along with commercial development, to produce a series of Manuals/Guidelines to guide the Architects/Developers/Concessionaires as well as the Authority on the Procedures, Dos & Don'ts in preparing development plans and submitting the applications for approval of Layout Plans and Building Plans of the commercial development to IRSDC.

IRSDC aims to transform the railway stations and the adjoining land into a "RAILOPOLIS" - a Mini Smart 24/7 City Centre where one can live, work, play and ride while putting the land resources to optimal use following the National Transit Oriented Development Policy norms. The aim is to facilitate developments by streamlining policies and making the Manuals/Guidelines as transparent as possible to promote ease of doing business. The Manual on Form Based Codes explains various developments such as buildings set back, ground coverage, FAR, heights etc. while Manual on building plan approval and commercial assets covers the process for the approval of building plans. The Manuals are mandatory while the Guidelines are Recommendatory and the Development Agreement/Concession Agreement or any other legal agreement between IRSDC (Authority) and Developments/Concessionaires shall prevail over and above the guidelines.

The advantage of the Manual on Form Based Codes is that it facilitates flexibility in development of mix use (horizontal and vertical mixing) to make the development sustainable, user friendly and market responsive while most of the local building byelaws restrict mixing which is essential for development of TOD. The guidelines propose good practices related to Construction Standards that promote and protect health, safety and general welfare of the occupant and environment across its life cycle while permitting dynamic building use.

These "Manuals for Station (Re)development including Commercial Development" is a comprehensive set of documents which provide standards and guidelines in the following order of decreasing priority-

1. Safety Standards, (like fire safety, earthquake related controls, etc.)
2. Passenger and user comfort and convenience.
3. Environmental Conservation (Natural and Man-made)
4. Heritage Conservation
5. Design and aesthetic in harmony

These Manuals and Guidelines have been prepared over a period, after research, site visits, case studies, best practices, study of other similar national, international designs, National TOD Policy and Form Based Codes (as advised by MoHUA), National Building Codes, UBBL-2016 and Environment Management Guidelines issued by MoEF&CC. Some of these have also been applied and tested on the on-going projects of IRSDC.

PUBLIC CONSULTATIONS: The (draft) Manuals and Guidelines were posted on IRSDC's website. These documents are available for reference at- www.irsdc.in. The stakeholder consultation was held via six (6) national webinars during April 2021- July 2021. The attendees were provided with a brief overview of salient features of the Manual, Guidelines, etc. Over 1300 participants, which included about 25 Government Agencies, Educational Institutions, Professional Bodies, Centres of Excellence, and senior professionals, attended, and shared their valuable feedback during the Webinars and over emails.

These Manuals and Guidelines have now been adopted for Station Redevelopment Works after incorporating relevant feedback and other suggestions by all the stakeholders. Further, final draft Manuals and Guidelines were discussed in the Plan Sanctioning and Monitoring Committee (PSMC) where subject experts were also invited as

special invitees in July 2021. IRSDC's Board of Directors (BOD) has also deliberated on this subject in August 2021 for adoption and application to the program of (re)development of Railway Stations along with Commercial Development. These Manuals and Guidelines are expected to transform the railway area around stations into model development as envisaged also by MoHUA and spur similar development in surrounding area.

STRUCTURE OF THIS HANDBOOK FOR ARCHITECTURAL DESIGN OF COMMERCIAL ASSETS

Sl. No.	Chapter	Content
1	Introduction	Background, Enabling Empowerment and Intent
2	Building Performance Parameters	Performance parameters for Architectural Elements, Multi-Modal Parking Design, Water Supply, Sanitation, Drainage, Electrical Infrastructure, Environmental Management Plan (EMP), Pollution Control, Structural Stability, Maintenance and Upgradation
3	Annexures	Design standards and guidelines for Structural Safety, Seismic Safety, Cyclone/ Windstorm Protection and Landslides Protection.

The manuals and guidelines are intended to be comprehensive for promoting balance and orderly development of railway stations and surrounding city area. Manuals and Guidelines inter-alia provide the framework, necessary technique, norms and standards, and development promotion techniques. Conditions may vary from place to place and accordingly these manuals and guidelines may be applied to all situations and places by adopting to local conditions. These manuals and guidelines fulfil the need for a planning process which facilitate efficient and dynamic station development in overall urban framework.

The manuals and guidelines are also intended to be a possible reference for various aspects of urban planning and design by State Governments, Development Authorities, Private Sector and Planning Organizations.

(Sanjeev Kumar Lohia)

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Section 0.1: About this Handbook

The Handbook for Architectural Design of Commercial Assets generally follows principles of National TOD Policy, Form Based Codes as propagated by MoHUA and National Building Code.

NBC 2016 Provisions-The Chapter 3 of General Building Rules of NBC 2016, Volume-1, acknowledges Transit Oriented Development as the means of urban development around Transit Hubs. It also mentions that-

*“However, it can also be applied to existing brownfield cities where new expansion/development are taken up backed up with an effective mass rapid transport system and new nodes. **The Authorities may take up appropriate studies to evaluate suitability of TOD concept under relevant situations.**”*

Taking cues from the above, this handbook recommends a few changes to applicable sections of NBC 2016 in order to meet the recommendations of National TOD Policy. These changes are to accommodate Mixed Use, Mixed Income Development with active frontages, ‘zero’ setbacks and Demand Management based Parking provisions. Following are the key principles of changes-

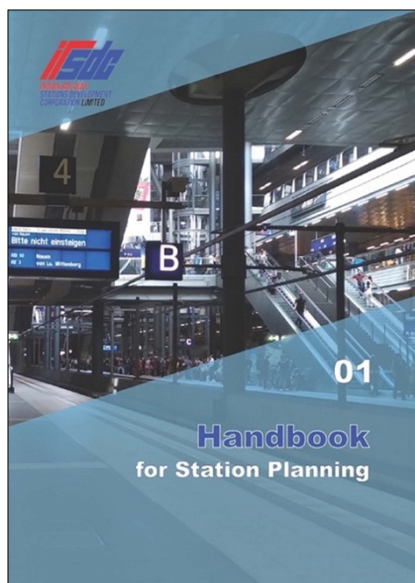
1. This handbook does not change any conditions of NBC 2016 related to human, building and environment **safety**.
2. This handbook adopts the conditions of **comfort** in NBC 2016 with further value additions.
3. In line with NBC 2016, this handbook provides more **flexibility for architectural design** of commercial assets while upholding the former two principles.



Manual for Building Plan Approval of Commercial Assets contains procedures for various Building Permit Applications, Fees, Details and Formats.

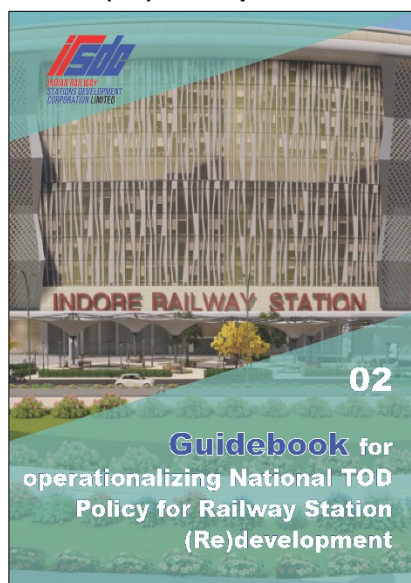
Table 1: Remaining parts of the Manuals for Station (Re)development including Commercial Development

**Handbook for Station Planning
(for internal use only)**



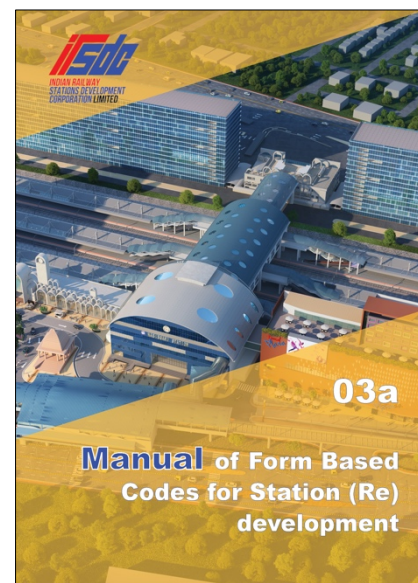
This document contains Norms, Standards and Tools for Design of Station Operational Areas.

**Guidebook for operationalizing
National TOD Policy for Railway
Station (Re)development**



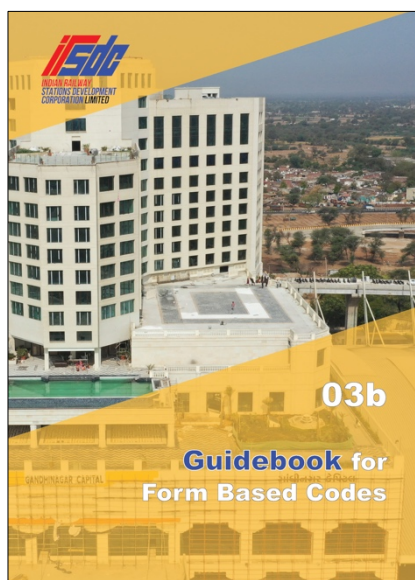
This document contains Tools and Processes for Layout Planning within the Railway Land, with the intent of 'Land Value Capture' for optimum monetization.

**Manual of Form Based Codes
for Station (Re)development**



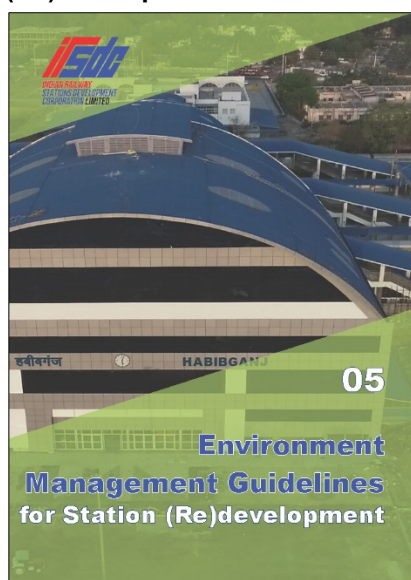
This document contains (a) Development Control Norms (b) Format for preparation of Layout Regulating Plans and (c) Parameters of Property Development Card.

**Guidebook for Form Based
Codes**



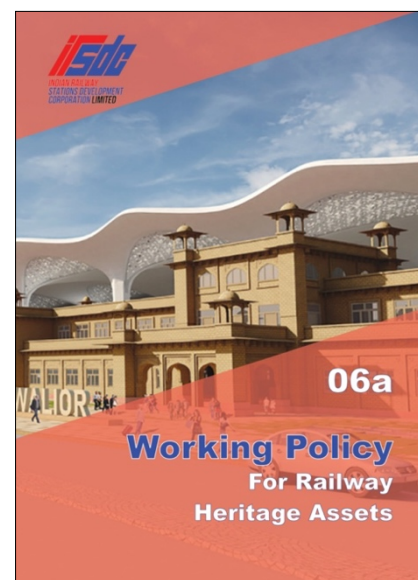
This document assists in preparation of Layout Regulating Plans and Property Development Card.

**Environment Management
Guidelines for Railway Station
(Re)development**



This document contains guidelines for integrating provisions of Environment Management during Layout Planning and is based on the recommendations issued by MoEF&CC, NGT and other statutory bodies.

**Working Policy for Railway
Heritage Assets**



This document contains Working Policy for the desired response to Railway Heritage Assets.

Section 0.2: Inventory of Abbreviations and Definitions

0.2.1. Abbreviations

1.	BIS	:	Bureau of Indian Standards
2.	BUA	:	Built up area
3.	BVC	:	Buildable Volume Card
4.	cm	:	Centimeter
5.	CSoR	:	Construction Supervisor on Record
6.	CUDSG	:	Colorado Urban Design Standards and Guidelines (USA)
7.	DCR	:	Development Control Norms
8.	E.C.S	:	Equivalent Car Space
9.	GOI	:	Government of India
10.	IPT	:	Intermediate Para-Transit
11.	IRC	:	Indian Road Congress
12.	IRSDC	:	Indian Railway Stations Development Corporation Limited
13.	IS	:	Indian Standard
14.	Kg	:	Kilogram
15.	LP	:	Layout Plan
16.	LPCD	:	Litre Per Capita per Day
17.	m	:	Meter
18.	MBBL	:	Model Building Bye Laws- 2016
19.	mm	:	millimeter
20.	MoEF&CC	:	Ministry of Environment, Forest and Climate Change
21.	MoHUA	:	Ministry of Housing and Urban Affairs
22.	MoR	:	Ministry of Railways
23.	MOSSR	:	Manual of Standards and Specifications for Railways
24.	NBC	:	National Building Code 2016
25.	NMA	:	National Monument Authority
26.	NTOD	:	National Transit Oriented Development Policy
27.	PDC	:	Property Development Card
28.	RoW	:	Right-of-Way
29.	SDRP	:	Structural Design Review Panel
30.	SEoR	:	Structural Engineer on Record
31.	SQM/ sq.m	:	Square meter
32.	UBBL	:	Unified Building Byelaws of Delhi-2016
33.	UTTIPEC	:	Unified Traffic and Transportation Infrastructure Centre
34.	URDPFI	:	Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines

0.2.2. Definition of Technical Terms

- Buildable Volume Card** shall refer to the drawing that provides the Form Based Code parameters applicable to the Sub-Plot number(s) mentioned in the drawing to which all Development in the Sub-Plot(s) must conform.
- Building Sanction** shall mean the Sanction issued by Authority permitting applicant to undertake the construction of the proposed building. It does not constitute acceptance of correctness, confirmation, approval or endorsement of:
 - The Right to Construct on a Sub Plot for which the Building Construction Permit has been granted
 - Workmanship, soundness of material and structural safety of the proposed building and shall not bind or render the Authority liable in any way regarding (a) and (b) above.
- Building Occupancy cum Completion Certificate** shall mean the Certificate issued by the Authority to the applicant, which verifies whether the design and specifications of the proposed building comply with Manuals for Station (Re)Development including Commercial Development and can be put to use.
- Building Performance Parameters:** These parameters contain minimum standards conforming to Building spaces, Building features and their behavior.
- Built Up Area** shall mean the total constructed area under roof on all floor(s) of a building (including cantilevered portion, mezzanine floors, service floors, underground floors, bridges across road RoWs, Guard rooms, ESS and any other buildings) or part thereof, which shall include carpet area, thickness of walls, balconies, staircases, mumty rooms, corridors, covered public passages and other building appurtenances. It shall only exclude open to sky terraces and areas as specified in Development Agreement, if any.

6. **Commercial Assets:** As per Section 11 of Railway Act, all assets for Commercial usage are 'Commercial Buildings'
7. **Footpath** shall mean a portion of right of way of road used for the movement of pedestrian traffic. It shall include adjoining Dead Width and Multi Utility Zones.
8. **Layout Plan (Railway Station Layout Plans):** A Layout Plan shall be prepared for the Layout Area and will indicate the configuration and sizes of all developable areas including Sub-plots, location of all proposed and existing Public, Major and Minor Roads with their widths, dimensions of plots, location of drains, public facilities and services and electric lines etc; area statement indicating the total area of the site, area under buildable envelopes, roads, open spaces, appropriate social infrastructure, as required by specific sections of the development control norms.
9. **Property Line** shall mean the line defining the boundary of a sub-plot.
10. **Right-of-way** of Road shall mean the area of land reserved for public use as a street, which may also include areas devoted to movement of vehicles or pedestrians, footpaths, natural and landscape features, public amenities and trunk infrastructure of all types (either underground, at surface or above ground).
11. **Sub-Plot** shall mean land parcels identified in the Layout Plans designated for commercial development.
12. **Underground Structure** shall mean all permanent constructions below Plinth Level.

0.2.3. Inventory of Building Spaces and Features

1. **Atrium/ Atria:** It is a partly/ fully enclosed space with a minimum double height which is partly/ fully covered with light roofing/ R.C.C and could be constructed upon. In a building, there may be more than one atrium at ground or at any other level.
2. **Automated Multi-level Parking:** Multi Level Parking spaces operated Mechanically or Computerized or Robotic Means.
3. **Balcony:** A horizontal cantilevered/non-cantilevered/projected slab including parapet and handrail balustrade, at any floor level including terrace to serve as a passage or sit out place with at least one side fully open, except being provided with railing or parapet wall for safety.
4. **Basement or Cellar:** The lower story of a building below or partly below ground level.
5. **Ceiling:** A part of a building which encloses and is exposed overhead in a room, protected shaft or circulation space. (The soffit of a roof light is included as a part of the surface ceiling, but not the frame. An upstand below a roof light would be considered as a wall).
6. **Chimney:** An upright shaft containing one or more flues provided for the conveyance to the outer air of any product of combustion resulting from the operation of heat-producing appliance or equipment employing solid, liquid or gaseous fuel.
7. **Circulation Space:** A space (including a protected stairway) mainly used as a means of access between a room and an exit from the building or compartment.
8. **Column:** A structural member that supports axial load primarily by inducing compressive stress along the fibers.
9. **Corridor:** A common passage or circulation space including a common hall.
10. **Courtyard:** A space permanently opens to the sky, enclosed fully or partially by buildings within the building envelope.
11. **Drain:** A line of pipes including all fittings and equipment such as manholes, inspection chambers, traps, gullies and floor traps used for the drainage of a building, or a number of buildings or yards appurtenant to the buildings, within the same curtilage. Drain shall also include open channels used for conveying surface water.
12. **Enclosed Staircase:** A staircase separated by fire fire-resistant walls from the rest of the building.
13. **Entrance:** A doorway or a passageway used as a means of accessing a building or a site.
14. **Escalator:** A power-driven, inclined, continuous stairway used for raising or lowering passengers or goods.
15. **Exit:** An exit may be a doorway; corridor; passageway(s) to an internal staircase, or external staircase, or to a verandah or terrace(s), which have access to the street, or to the roof of a building or a refuge area. An exit may also include a horizontal exit leading to an adjoining building at the same level.
16. **False Ceiling:** A ceiling suspended below a floor, which contributes to the fire resistance of the floor.
17. **Fire Staircase:** A protected stairway communicating with the accommodation area only through a firefighting lobby.
18. **Fire Tower/Staircase:** An enclosed staircase which can only be approached from the various floors through landings or lobbies separated from both the floor areas and the staircase by fire fire-resisting doors and open to the outer air.
19. **Foundation:** That part of the structure which is in direct contact with and transmitting loads to the ground.
20. **Lift/Elevator:** An appliance designed to transport persons or materials or vehicle between two or more levels in vertical or substantially vertical directions, by means of a guided car platform.
21. **Open Space:** An area, forming an integral part of the site, left open to the sky.

22. **Parapet:** A low wall or railing built along the edge of a roof or a floor; maximum 1.5m for low-rise or maximum 1.8m for high-rise.
23. **Parking Space:** An area enclosed or unenclosed, covered or open, sufficient in size to park vehicles, together with a driveway connecting the parking space with a street or alley and permitting ingress and egress of the vehicles.
24. **Plinth:** The portion of a structure between the surface of the surrounding ground and surface of the floor, immediately above the ground.
25. **Podium:** A raised platform constructed as top most level of any single/ multilevel parking which can be used for landscaping, plantation, tot-lot, swimming pool, deck, assembly space, movement, building tower/s, etc.
26. **Protected Stairway:** A stair discharging through a final exit to a place of safety (including any exit passageway between the foot of the stair and the final exit) that is adequately enclosed with fire-resisting construction.
27. **Ramp:** A sloping surface joining two different levels, as at the entrance or between floors of a building.
28. **Refuge Area:** A location in a building designed to hold occupants during a fire or other emergency, when evacuation may not be safe or possible. Occupants can wait there until rescued or relieved by firefighters.
29. **Room:** An enclosed space within a building that is not used solely as a circulation space. (The term includes not only conventional rooms, but also walk-in cupboards that are not fittings, and large spaces such as warehouses and auditoria. The term does not include voids such as ducts, ceiling voids and roof spaces.).
30. **Stack parking:** For parking cars in which a hydraulic lift/ platform is used to place cars in spaces on top of each other.
31. **Terrace:** A flat open to sky roof of a building or a part of a building having parapet, not being a cantilever structure.
32. **Travelator:** A power-driven moving path used for transporting people and goods within the same level.
33. **Ventilator:** An opening in a wall for ventilating the space inside.
34. **Wall-Boundary Wall:** The boundary of the land belonging to the building, or where the land abuts a road, railway, canal or river, the centerline of that road, railway, canal, or river.
35. **Water Closet (WC):** A privy with arrangement for flushing the pan with water. It does not include a bathroom.
36. **Window:** An opening to the outside other than a door which provides all or part of the required natural light or ventilation or both to an interior space and not used as a means of egress/ingress.

0.2.4. Inventory of Legal Terms

1. **Alteration:** A structural change, such as an addition to the area or height, or the removal of a part of a building, or any change to the structure, such as the construction of cutting into for removal of any wall, partition, column, beam, joist, floor or other support, or a change to or closing of any required means of ingress or egress or a change to the fixture or equipment.
2. **Approved:** Approved by the Authority having jurisdiction.
3. **Carpet Area (Set of Rooms/ Flat/ Apartment):** The net usable floor area of an apartment, excluding the area covered by the external walls, areas under services shafts, exclusive balcony or verandah area and exclusive open terrace area, but includes the area covered by the internal partition walls of the apartment.
4. **Covered Area:** Ground area covered immediately above the plinth level covered by the building.
5. **Authority having Jurisdiction:** 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'.
6. **Boundary:** The boundary of the land belonging to the building, or where the land abuts a road, railway, canal or river, the centerline of that road, railway, canal or river.
7. **Building Height:**
 - a. The vertical distance in the case of flat roofs is measured from the highest surrounding road level/ ground level up to the top of structural slab, excluding machine room, irrespective of location of entry level.
 - b. In the case of pitched roofs, up to the point where the external surface of the outer wall intersects the finished surface of the sloping roof, and in case of gable facing the road, the mid-point between the eaves level and the ridge.
 - c. Architectural features serving no other function except that of decoration and other building components shall be excluded for the purpose of taking height.
 - d. If the building does not abut on a street, the height shall be measured from the highest level of the ground immediately adjacent to the building.
8. **Building Line:** The line up to which the plinth of a building adjoining a street or an extension of a street or on a future street may lawfully extend. It includes the lines indicated in any Scheme or Layout Plan, or in these Codes.

9. **Conversion:** The change in nature of occupancy to another occupancy or part thereof resulting into change of use.
10. **Disabilities, Hearing:** Deafness or hearing handicaps that might make an individual insecure in public areas because he is unable to communicate or hear warning signals.
11. **Disabilities, Non-Ambulatory:** Impairment that, regardless of cause or manifestation, for all practical purposes, confined individuals to wheel chair.
12. **Disabilities, Semi-Ambulatory:** Impairment that cause individuals to walk with difficulty or insecurity. Individuals using braces or crutches, amputees, arthritis, spastics and those, with pulmonary and cardiac ills shall be semi-ambulatory.
13. **Disabilities, Sight:** Total blindness or impairment affecting sight to the extent that the individual functions in public areas is insecure or exposed to danger.
14. **Dwelling Unit/Tenement:** An independent housing unit with separate facilities for living, cooking (maximum one kitchen) and sanitary requirement.
15. **External Wall:** An outer wall of a building not being a party wall even though adjoining a wall of another building and also means a wall abutting on an interior open space of any building.
16. **Fire Door:** A fire-resistive door approved for openings for fire separation.
17. **Fire Lift:** One of the lifts specially designed for use by fire service personnel in the event of fire.
18. **Floor:** The lower surface in a storey on which one normally walks in a building. The general term, floor, unless otherwise specifically mentioned, shall not refer to a mezzanine floor. *(Note: The sequential numbering of floor shall be determined by its relation to the determining entrance level. For floors at or wholly above ground level the lowest floor in the building with direct entrance from the road/street shall be termed as Ground floor, the other floors above ground Floor shall be numbered in sequence as Floor 1, Floor 2, etc. with number increasing upwards.)*
19. **Floor Plans:** Plans and drawings for relevant floors.
20. **Floor Plan- Stilt Floor Plan:** Stilt or stilt floor means non habitable portion of a building above ground level consisting of structural columns supporting the super structure with at least two sides open for the purpose of parking cars, scooters, cycles and landscaping.
21. **Ground Coverage:** The portion of the building within the outer surface of the structural wall/column/slab measured at ground level excluding the projection/balcony/canopy/ porch/void/shaft/ permitted free from FAR and cladding/curtain wall up to 150mm shall be considered as ground coverage.
22. **Occupancy Type:** A purpose group identified in Appendix D.
23. **Owner:** The owner is a person, group of persons, a Company, Trust, Institute, Registered Body, State or Central Government & it's attached/ subordinate Departments, Undertaking and like in whose name the property stands registered in the revenue records/ government records/ any other legal documents up to the satisfaction of Authority.
24. **Permit:** A permission or authorization in writing by the Authority to carry out the work regulated by the Codes.
25. **Plinth Area:** The built-up covered area measured at the floor level of the basement or of any storey.
26. **Pre-Code Building Permit:** Validity of building permit granted before the enforcement of these building bye-laws.
27. **Storey:** The portion of a building included between the surface of any floor and the surface of the floor next above it, or if there be no floor above it, then the space between any floor and the ceiling next above it.

0.2.5. Inventory of Technical items and features

1. **Access:** Approach to a plot or a building from a road/ street.
2. **Clear Opening Width:** Clear distance measured between the inside face of the doorframe (or door stop) and the face of the door when open at 90 degrees. Door furniture and ironmongery may be disregarded when measuring the clear opening width.
3. **Clear Width:** Clear distance measured between walls or other fixed obstructions (except permitted localized obstructions) or across a path. Skirtings totaling up to 50mm total thickness and shallow projecting ducts or casings above 1800mm may be discounted when measuring clear widths.
4. **Clear Height:** Clear Height measured from the top of Finished Floor Level up to the bottom of the finished ceiling (or false ceiling) level.
5. **Combustible Material:** A material, if it burns or adds heat to fire when tested for combustibility in accordance with good practice.
6. **Drainage:** The removal of any liquid by a system constructed for this purpose.
7. **Emergency Lighting:** Lighting provided for use when the supply to the normal lighting fails.
8. **Escape Route:** Route forming the part of the means of escape from any point in a building to a final exit.
9. **Fire Resistance:** The time during which it fulfills its function of contributing to the fire safety of a building when subjected to prescribed conditions of heat and load or restraint. The fire resistance test of structures shall be done in accordance with good practice.

10. **Fire Resisting Material:** The materials or elements of construction having property to withstand the standard fire exposure.
11. **Fire Separation:** The distance in meters measured from other buildings on the site, or from other sites, or from the opposite of a street or other public space to the building.
12. **Floor:** The lower surface in a storey on which one normally walks into a building. The general term, floor, unless otherwise specifically mentioned, shall not refer to a mezzanine floor.
13. **Landing:** A platform or part of floor structure at the end of a flight of stairs or ramp.
14. **Level:** Gradient not exceeding 1:60.
15. **Lift Machine:** Part of the lift equipment comprising the motor(s) and the control gear therewith, reduction gear (if any), brakes and winding drum or sheave, by which the lift car is raised or lowered.
16. **Load - Dead Load:** The load due to the weight of all walls, permanent partitions, floors, roofs, and finishes including services, and all other permanent construction.
17. **Load - Imposed Load:** The load assumed to be produced by the indented occupancy or use, including the weight of movables partitions, distributed, concentrated, impact, inertia and snow loads, but excluding wind loads.
18. **Load-Live Load:** The variable load assumed to be produced by the indented occupants.
19. **Load-Wind Load:** The load due to the effect of wind pressure or suction.
20. **Masonry:** An assemblage of masonry units properly bonded together with mortar.
21. **Means of Escape:** Structural means whereby [in the event of fire] a safe route or routes is or are provided for persons to travel from any point in a building to a place of safety.
22. **Mechanical Ventilation:** The mechanical system(s) or equipment(s) used to circulate air or to replace stale air with fresh air.
23. **Non-Combustible Material:** A material which does not burn nor add heat to fire when tested for combustibility.
24. **Road/Street Level or Grade:** The officially established elevation or grade of the central line of the street upon which plot fronts and if there is no officially established grade, the existing grade of the street at its mid-point.
25. **Road/Street Line:** The line defining the side limits of a street.
26. **Room Height - Under Slab:** The vertical distance measured from the finished floor surface to the finished ceiling surface.
27. **Room Height:** The vertical distance measured from the finished floor surface to the finished ceiling surface. Where a finished ceiling is not provided, the underside of the joists or beams or tie beams shall determine the upper point of measurement for determining the head room.
28. **Room Height-Under False Ceiling:** The vertical distance measured from the finished floor surface to the finished false ceiling surface.
29. **Soffit:** The lowest underside of a structural member such as a beam, coffer slab or flat slab.
30. **Wheel Chair:** Chair used by disabled people for mobility. The sizes of wheel chairs are mentioned below:
 - a. Small wheel chair: 0.75 x 1.05 m
 - b. Large wheel chair: 0.80 x 1.50 m
31. **Wheelchair Accessible:** Category 3 dwelling constructed to be suitable for immediate occupation by wheelchair user where the planning authority specifies that optional requirement M4(3)(2)(b).

Chapter 1: Introduction

Section 1.1: Background

1.1.1. The **Handbook for Architectural Design of Commercial Assets** within Sub-Plots contain relevant clauses from NBC-2016 applicable to regulate Architectural Design of Commercial Development within Railway Land. This shall enable the Developers¹ to prepare Architectural and Engineering Design and proposals as per the prior approval of Railway Station Layout Plan.

1.1.2. These Codes have been derived from:

- National Building Code of India-2016 (NBC) (IN)
- Model Building Bye-Laws-2016 (MBBL) (IN)
- Unified Building Bye-Laws (UBBL) of Delhi-2016 (IN)
- Manual for Standards and Specifications for Railway Stations (IN)
- Urban and Regional Development Plans Formulation and Implementation Guidelines (IN)
- UTTIPEC Street Design Guidelines (IN)
- Indian Road Congress Codes (IN)
- Municipal Corporation of Delhi, Ease of Doing Business (IN)
- Real Estate (Regulation and Development) Act, 2016 (IN)
- Building Regulations in the United Kingdom (UK)

Section 1.2: Enabling Empowerment

1.2.1. Railway Board, Ministry of Railway, GOI, vide letter no 2011/LMB/WCS/22/07/25 Pt 1 dtd. 17.10.2018, conveyed approval of Union Cabinet that Indian Railway Stations Development Corporation Ltd (IRSDC), as the nodal agency and main Project Development Agency (PDA) for redevelopment/development of all stations and further approved that 'Railways/ RLDA/ IRSDC shall consult urban local bodies/ other statutory authorities while approving its plans in terms of powers conferred to it under Section 11 of the Railways Act 1989 so that the development in Railway Land is harmonious with surrounding development, generally following National Transit Oriented Development (TOD) Policy. No Change of Land Use is required PAN India by Railways for developing railway land for commercial use.'

1.2.2. IRSDC being a Nodal Agency for planning, approving and implementing Station (Re)Development Works on principles of TOD shall approve its own building plans as per the Section 11 of The Railway Act 1989 (Amendment 2008).

1.2.3. This handbook is applicable for the proposed commercial development on Railway Land identified in the Railway Station Layout Plans.

Section 1.3: Intent

1.3.1. The **Handbook for Architectural Design of Commercial Assets within Sub-Plots** contain the Minimum Standards that building spaces, features and their respective behaviors must conform to.

1.3.2. This Handbook and the Manual for Building Plan Approval of Commercial Assets must be read in consonance with the approved Railway Station Layout Plan as well as the Property Development Card (PDC) or Buildable Volume Card (BVC) applicable to the Sub Plot². The PDC/ BVC shall hold supremacy in Building Plan scrutiny and sanction.

¹ 'Developer' shall be an individual or entity appointed to develop Sub-Plot

² Subject Sub-Plot means the concerned Sub-Plot for which application is being made.

Chapter 2: Building Performance Parameters

Section 2.1: Building Performance Parameters as defined in Clause 1.3. are further detailed out in the following paragraphs by aggregating provisions of NBC, MBBL-2016 and other national/ international Codes as given in Para 1.1.2 which are necessary for safety and better living conditions of the occupants.

Section 2.2: Therefore, the following features shall be the Basis for Application of this Handbook-

2.2.1. Calculation of Occupancies shall be as per NBC 2016, Volume-I, Part 4 Fire and Life Safety, Section 4.3 - Table 3: Occupant Load.

2.2.2. For buildings with Equal Proportions (plus minus 15%) of Floor use, the aggregate occupancy of a building shall be calculated as **Aggregate of Occupancies for All Floors as per their Actual Use**. For example, if a building has 300 sq. m. floor space for residential, 200 sq. m. floor space for commercial, and 200 sq. m. floor space for school, the occupancy shall be calculated as: $(300/12.5 + 200/6 + 200/4) = 107$ persons.

2.2.3. For buildings with Unequal Proportions (where variation in proportion is higher than 15%), the occupancy shall be **calculated based on the Highest Occupant Load** amongst all the uses possible or planned within the building.

2.2.4. In case a building has been sanctioned for any particular Occupant Load, its use can change subject to Prior Approval from the Authority.

2.2.5. The same principle shall be followed for calculation of Capacity Factor as per the NBC 2016, Sections 4.4.2.3 and 4.4.2.4 - Tables 4 and 5 respectively.

Section 2.3: Architectural Elements

2.3.1. The Layout Plan/ total railway land considered for development is designated as plot area and its sub-division into use premises is called as Sub-Plot.

2.3.2. Boundary Wall

Railway Station Areas are to be planned on Principles of Transit Oriented Development and Form Based Controls which encourage 'Zero-Setbacks' and 'Built to edge' active frontages where Boundary Walls are not envisaged.

However, In case boundary walls are required, these will be allowed in the form of Transparent (or Semi-Transparent, ensuring adequate visibility through them) fencing above a low wall of 0.45m height -- and the total height of fencing not exceeding 1.80m from the crown of the adjacent street, if such a street exists. In the absence of such a street, the height of the boundary wall shall be measured from the natural ground level along the outer edge of the Sub-Plot. For Sub-Plots within close proximity of Heritage Buildings (notified or not notified) or Heritage Areas, the controls for Boundary Walls shall be as per approved proposals.

For Railway Operational Areas, requirements of MSSR, 2009 (including modifications of 2020) shall be applicable

2.3.3. Minimum Clearance Height within Buildings

Source: NBC 2016, Vol-1, Part 3, Section 12, Clause 12.2.1 Height

All habitable and circulation spaces in a building shall have a minimum clearance height³ of 2.75m.

2.3.4. Railings (Parapet)

Source: MBBL 2016, Chapter 4, Clause 4.12: Parapet

³ From top of the finished floor till bottom of the ceiling or false ceiling, whichever is lower.

- 2.3.4.1. Parapet walls and handrails provided on the edges of roof/terrace, balcony, etc. shall not be less than 1.0m and more than 1.50m in height (shall not apply where roof/terrace is not accessible by a staircase). However, on the terrace floor in the portion where DG Set, Water Tank, and other services equipment are installed, lightweight screen shall be constructed to hide such equipment.
- 2.3.4.2. For buildings of height 24m and above, the parapet wall/railing shall be 1.8m or as per the approval of Fire Department, whichever is minimum.
- 2.3.4.3. An additional handrail at 1.00m shall be provided in the railing if the height of the railing is 1.20m or above in the public areas.

2.3.5. Exit Requirements

Minimum exit requirements shall be as per applicable Fire Regulations of local/ civic authorities.

2.3.6. Staircases

Source: NBC 2016, Vol-1, Part 3, Section 12.18, Clause 12.18.1 to 12.18.3

All staircases in all buildings shall conform to specifications listed in the National Building Code (NBC) of India 2016, Part III - Development Control Rules and General Building Requirements and the Fire Laws relevant to each location, as defined in the State/City Fire Laws and Codes.

- i. **Minimum Clear Width:** *Staircases to be provided as per the Local Bye-Laws/ NBC and for mixed-use (vertical) buildings 2m of minimum clear width of flights is advisable to take care of change of building use/occupancy in future.*
- ii. **Minimum Tread:** The minimum width of tread without nosing shall be 300mm.
- iii. **Maximum Riser:** The maximum height of riser shall be 150mm. The number of risers shall be limited to 12 per flight.
- iv. **Minimum Headroom:** The minimum headroom in a passage under the landing of a staircase shall be 2.20m. The minimum clear headroom in any staircase shall be 2.20m.
- v. **Minimum Height of Handrails:** The minimum height of handrails along staircases shall be 1.00m from the top of the riser to the top of the handrail *after leaving the Minimum Clear Width of the Staircase.*

2.3.7. Fire Staircase

Source: NBC 2016, Vol-1, Part 4: Fire and Life Safety, Section 4.4.2.4.3 Staircases

- i. **Minimum Clear Width:** Staircases to be provided as per the Local Bye-Laws/ NBC and **for mixed-use (vertical) buildings 2m of minimum clear width of flights is advisable to take care of change of building use/occupancy in future.**
- ii. **Minimum Tread:** The minimum width of tread without nosing shall be 300mm.
- iii. **Maximum Riser:** The maximum height of riser shall be 150mm. The number of risers shall be limited to 12 per flight.
- iv. The staircases may be internal or external staircases.
- v. In case of internal staircases, a handrail shall be provided on one side of the staircase of width less than 1500mm, and on both sides of the staircase of width 1500mm and more.
- vi. **Minimum Headroom:** The minimum headroom in a passage under the landing of a staircase shall be 2.20m. The minimum clear headroom in any staircase shall be 2.20m.
- vii. All external stairs shall be directly connected to the ground.
- viii. External stairs shall have straight flight, not less than 1500mm wide.
- ix. In case of external staircases, handrails are to be provided on both sides, and shall be of a height not less than 1000mm and not exceeding 1200mm.
- x. No external staircase shall be inclined at an angle greater than 45° from the horizontal.
- xi. Fire Staircase shall be located such that it can be easily visible and accessed without hindrances in case of emergencies.

2.3.8. Fire Tower/Firefighting Shaft

Source: NBC 2016, Vol-1, Part 4, Section 2.24 Firefighting Shaft (Fire Tower) and UBBL 2016, Chapter 9, Clause 9.3.13. Fire Tower

- i. The firefighting shaft shall be equipped with Fire Doors of 120 minutes fire resistance rating.
- ii. Fire Towers shall be considered the safest escape routes for multistoried buildings. Their number, location and size shall depend on the building concerned, and its associated escape routes.
- iii. A fire lift, internal hydrant, hose reel, etc. shall be required in the fire tower.

- iv. For buildings with over 8 storeys or 24.0m in height, at least one exit shall preferably be a fire tower.
- v. The fire towers shall be constructed of walls with a two-hour fire-resistance rating, and have no openings other than the exit doorways.
- vi. Platforms, landings and balconies in the fire towers shall also have the same fire-resistance rating.
- vii. The area of the lobby shall be a minimum of 6.00sq. m., with minimum length of any side as 2.00m.
- viii. To enable fire services personnel to reach the upper floors with the minimum delay, one fire lift per 1200 sq.m of floor area shall be provided and shall be available for the exclusive use of the firemen in an emergency.
- ix. It shall have loaded capacity of not less than 545 kg (8 persons lift) with automatic closing doors of minimum 0.8 m width.

2.3.9. Service Ducts and Shafts

Source: NBC 2016, Vol-1, Part 4, Clause 3.4.5.4 Service ducts and shafts & 3.4.5.5 Refuse Chute

- 2.3.9.1. Openings in walls or floors which are necessary to be provided to allow passages of all building services like cables, electrical wirings, telephone cables, plumbing pipes, etc, shall be protected by enclosure in the form of ducts/ shafts having fire resistance not less than 120 min.
- 2.3.9.2. The inspection door for electrical shafts/ ducts shall not be less than 120 min. Medium and low voltage wiring in shafts/ ducts shall either be armored type or run through metal conduits. Space between electrical cables/ conduits and walls/ slabs shall be filled with a fire stop material with fire resistance rating not less than 120 min.
- 2.3.9.3. For Plumbing Shafts in the core of the building, with shaft door opening inside building the shafts shall have inspection doors having fire resistance rating not less than 30 min. Plumbing shaft doors which open in the wet areas or in naturally ventilated areas or no external wall of the building may not be fire rated.
- 2.3.9.4. Refuse chutes, shall have opening at least 1m above roof level for venting purpose and they shall have an enclosure wall of non-combustible material with fire resistance of not less than 120 min. They shall not be located within the staircase enclosure or service shafts, or air conditioning shafts. Refuse chutes inspection panel and doors shall be tight fitting with 60 min. fire resistance. Sprinkler protection system shall be provided for the refuse chutes. Refuse chutes shall be at least 6m away from exits.

2.3.10. Fire Command Centre

Source: NBC 2016, Vol-1, Part 4, Clause 3.4.12 Fire Command Centre (FCC)

- 2.3.10.1. Fire Command Center shall be on the entrance floor of the building having direct access. The control room shall have the main fire alarm panel with communication system (suitable public address system) to aid floors and facilities for receiving the message from different floors.
- 2.3.10.2. Fire Command Centre shall be constructed with 120 min rating walls with a fire door and shall be provided with emergency lighting. All controls and monitoring of fire alarm systems, pressurizing systems, smoke management systems shall happen from this room.

2.3.11. Lifts

Source: NBC 2016, Vol-2, Part 8, Section 5: Installation of Lifts, Escalators and Moving Walks, Section 3, Clause 3.1 Conformity with Lifts Act and Rules, Clause 3.2 Conformity with The Electricity Act, 2003 and Rules/Regulations Thereunder and NBC 2016, Vol-1, Part 3, Section B-6.4 Lifts, Clause B-6.4.2 Lift Size, Clause B-6.4.3 Lift Door, B-6.4.6 Handrails

- 2.3.11.1. Provision of lifts are mandatory for all public buildings of any height, like- Railway Stations and for all other buildings with height 15 m and above. For all other buildings lifts are advisable to ensure universal access.
 - i. The installation shall generally be carried out in conformity with the Lift Acts and Rules, wherever they are in force.
 - ii. All electrical work in connection with the installation of lifts shall be carried out by following the amended/updated provisions of The Indian Electricity Act, 2003.
 - iii. Lifts should be easily accessible from all entrances to the building.
 - iv. All floors shall be accessible 24 hours by the Lifts.
 - v. The Lifts provided in the buildings shall not be considered as a means of escape in case of emergency.

- vi. The minimum size of the lift car shall be 1500mm wide by 1500mm deep, that allows easy maneuverability of wheelchair users.
- vii. The clear opening of the entrance to the lift car shall be at least 900mm.
- viii. There shall be no difference in level between the lift door and the floor surface at each level. The gap between the lift door and the building floor shall not be more than 12mm.
- ix. Handrails shall be placed at a height of 900mm from the floor level of the Lift.
- x. **Fitness Certificate for lifts** shall be obtained from the concerned authority before occupation.

2.3.12. Lift Lobbies

Source: MBBL 2016, Chapter 5, Section 5.4.4 Lifts and NBC 2016, Vol-2, Part 8, Section 5: Installation of Lifts, Escalators and Moving Walks, Section 5A Lift Arrangements and Planning Dimensions, Clause 5.2

- i. In a dual-line arrangement (lifts opposite each other), the lobby shall be between 1.5 times to 2.5 times the depth of one car.
- ii. For in-line (single line) arrangements, the lobby shall be typically half of the above recommendations.
- iii. The Lift Lobby shall not be used as a thoroughfare and shall meet applicable fire regulations.

2.3.13. Escalator

Source: NBC 2016, Vol-2, Part 8, Section 5: Installation of Lifts, Escalators and Moving Walks, Section 5 Lift Arrangements and Planning Dimensions, 5B Escalators and Moving Walks

- i. It is important that the boarding and alighting areas adjacent to an escalator or travelators are not part of another circulation route for safe boarding and alighting at landings.
- ii. The area of this space is defined as a distance between the handrails plus 160mm, multiplied by a depth of 2.00m to 2.50m -- depending on the configuration of the escalator or moving walk.
- iii. Fitness Certificate for escalators and travellers shall be obtained from the concerned authority before occupation.

2.3.14. Refuge Balcony/Area

Source: NBC 2016, Vol-1, Part 4: Fire and Life Safety, Annex E, Section E-4 Horizontal Exits/ Refuge Area

Refuge Area: An area within the building for temporary use during emergency exit and generally serves as a staging area protected from the effect of fire and smoke.

- i. Refuge area shall be provided in buildings of height of more than 24m.
- ii. Refuge area provided shall be planned to accommodate the occupants of two consecutive floors (where the refuge is provided and the floor above) -- by considering an area of 0.30 sq.m. per person for the calculated number of occupants, and shall additionally include one wheelchair space area of 0.90 sq.m. For every 200 occupants, a portion thereof -- based on the occupant load served by the area of refuge, or a minimum of 15 sq.m., whichever is higher -- shall be provided as under:
 - a. The Refuge Area shall be provided on the periphery of the floor, and open-to-air at least on one side, protected with suitable railings.
 - b. Refuge area(s) shall be provided at/or immediately above 24m, and thereafter at every 15m or so.
- iii. Refuge Areas for apartment buildings of height above 60m., while having balconies, shall be provided at 60m. and thereafter at every 30m.
- iv. Refuge Areas shall be directly accessible from common lobby in the building

2.3.15. Doorways

Source: NBC 2016, Vol-1, Part 4, Clause 4.4.2.4.1 Doorways.

- i. Every exit doorway shall open onto an enclosed stairway, or a horizontal exit of a corridor, or passageway providing continuous and protected means of exit.
- ii. No exit doorway shall be less than 1000mm in width except of Assembly buildings, where the door width shall be not less than 2000mm. Doorways shall be not less than 2100 mm in height.
- iii. To prevent confusion regarding the direction of the exit no mirrors shall be placed on exit doors.
- iv. Exit doorways shall open in the direction of travel, without the use of a key.
- v. Signs for Lift Landings and, Floor Numbering, Stair and Lifts Identifications, Stair re-entry, etc. shall be as Annex D of Part 4 of NBC 2016, Volume I, or its latest version.

2.3.16. Passageway/Corridors

Source: NBC 2016, Vol-1, Part 4, Clause 4.4.2.4.2 Corridors and passageways of means of egress and Annex D.

- i. Corridors and passageways shall be of a width not less than the calculated aggregate width of exit doorways leading from them, in the direction of travel to the exit.
- ii. The minimum clear width of a corridor in a residential building shall be 1.35m for single loaded and 1.8 m for double loaded and in all other buildings shall be 1.5m for single loaded and 2m for double loaded. For Assembly Buildings the minimum clear width of the Corridor shall be 2m.

2.3.17. Pedestrian Ramps

Source: NBC 2016, Vol-1, Part 4, Clause 4.4.2.4.3.5 Ramps, MBBL-2016, Chapter 11, Clause 11.8.3 Ramps, and Chapter 5, %4.7 Ramps

- i. The slope of a ramp shall not exceed 1-in-12 (8 percent).
- ii. Any change in travel direction on the ramp shall be preceded by landings of 1.50m × 1.50m size.
- iii. Each landing shall be not less than 1500mm long in the direction of travel.
- iv. Handrails at a height of 800-1000mm shall be provided on all ramps on both sides.
- v. The ramps should have a non-slippery surface material.
- vi. Ramp shall lead directly to outside open space at ground level or courtyards of safe place.
- vii. For building above 24.0 m. in height, access to ramps from any floor of the building shall be through smoke fire check door.
- viii. In case of nursing homes, hospitals etc. area exceeding 300 sq.m. at each floor one of the exit facilities shall be a ramp of not less than 2.4 m. in width for stretcher and not for vehicular movement.

2.3.18. Ramps for Basement Parking

Source: MBBL 2016, Chapter 4, Clause 4.24.7.1 Ramps

- i. The ramp to the basement and parking floors shall not be less than 7.2 m wide for two-way traffic and 4.0 m wide for one way traffic, provided with a gradient of 1:10 for cars and 1:15 for heavy vehicles. At curved portions of the ramp or for circular ramps the slope should not be more than 1:12.
- ii. Ramp may also be provided in a setback area which can be sloped considering unhindered movement of fire Engine and in no case the gradient shall be less than 1: 10.
- iii. All structural design/safety aspects as per latest BIS Manual & NBC, shall be complied along with consideration of weight of Fire Engine & its maneuverings.
- iv. The minimum width of the ramps in hospitals shall be 2.4 m for stretcher and not for vehicular movement. In this case, handrails shall be provided on both sides of the ramp.
- v. Ramps shall lead directly to outside open space at ground level or courtyards or safe places.
- vi. Basement entry/ exists, and other provisions for fire safety shall be as per applicable fire safety regulations (Local regulations, if available. Else, as per National Building Codes).

2.3.19. Atrium

Source: MBBL 2016, Chapter 5, Clause 5.5.11 General

Atrium/Atria at any floor shall be permitted in all buildings and provided at any floor. It will be counted only once in the FAR. It may be enclosed by light roofing or R.C.C as per development control norms provided in 03a Manual for Form based Codes for Station (Re)Development. Construction over Atrium may be allowed.

2.3.20. Windows

Source: NBC 2016, Vol-1, Part 3, Section 8.4, Clause 8.4.1 Projections into Open Spaces

- i. Sunshades over windows/ventilators or other openings not more than 0.75m wide.
- ii. The opening controls of windows for wheelchair users shall be provided at a height of 800mm-1000mm from the floor level.
- iii. Windows shall provide an unobstructed viewing zone for wheelchair users between 600mm and 1400mm.
- iv. Curtain or Venetian Blind controls/ Ropes shall be at 800-1000 mm height from the finished floor level for wheelchair users/ short stature persons.
- v. Window handles should be at least 80mm long.

2.3.21. Toilets for Differently Abled

Source: MBBL 2016, Chapter 8, Clause 8.7 Toilets

One special W.C. in a set of toilets shall be provided for the use of differently abled with essential provision of *washbasin* near the entrance for the differently abled.

- i. The minimum size shall be 1500 mm x 1750 mm.
- ii. Minimum clear opening of the door shall be 900mm and the door shall swing out.
- iii. Suitable arrangement of vertical/horizontal handrails with 50mm clearance from wall shall be made in the toilet.
- iv. The W.C. seat shall be 500mm from the floor.

Section 2.4: Multi-Modal Parking Design

Source: Draft Master Plan of Delhi for 2041, URDPFI Guidelines- Volume-I- Clause 8.2.6. passenger Car Units (PCU) and 8.2.8.1. Equivalent Car Space (ECS) for different vehicles

Mode	ECS Standard by mode	Avg. Area including circulation (sq. m.)	Distribution by mode per 1 ECS (TOD Scheme)
Cars	1	23	0.6
Commercial Vehicles (Tier-1 cities)	3.5	80.5	
Commercial Vehicles (Tier-2 & 3 cities*)	2.5	57.5	
Motorcycle, scooter	0.25	5.75	0.1
Auto Rickshaws	0.5	11.5	0.1
Bicycle & Cycle rickshaws	0.1	2.3	0.1
Bus/ Shared Vehicles (Tier-1 cities)	3.5	80.5	0.1
Bus/ Shared Vehicles (Tier-2 & 3 cities*)	2.5	57.5	
Total =			1
Emergency Vehicles	3.5	80.5	As per requirements stated by IRSDC

* Requirements for Tier-2 & 3 cities are as per URDPFI Guidelines, as the standard Commercial Vehicle and Bus sizes are smaller than that in Tier-1 cities.

2.4.1. Design of Parking for Cars

Source: NBC 2016, Vol-1, Part 3, Section 10 Off-Street Parking Spaces, Clause 10.3

- i. Individual and common parking space for a car shall at least be 3.00m x 6.00m and 2.75m x 5.00m, respectively. In case of high-rise buildings parking would be permitted at any or all of the following:
 - a. Open Area: 23 sq.m per E.C.S
 - b. Basements: 32 sq.m per E.C.S
 - c. Stilts: 28 sq.m per E.C.S
 - d. Podium: 28 sq.m per E.C.S
 - e. Roof top: 28 sq.m per E.C.S
 - f. Stacked Parking: 16 sq.m / Multi-level (with ramp): 30 sq.m/ Multi level- Automated parking: 16 sq.m per E.C.S is also permitted.
- ii. Each car parking space should be connected to the street providing access to the plot through an access/exit lane.
- iii. The minimum width of the access/exit lane shall be 3.00m and 6.00m for unidirectional and bidirectional movements, respectively where the lane provides access/exit to more than 10 car parking spaces.
- iv. The hard surface approach road to the building and space all around it shall be capable of taking the weight of fire engine, weighing upto 45 ton having 6.0 m width (with 9.0 m turning circle at the corners) for building upto 40.0 m in height and 9.0 m width (with 12.0 m turning circle at the corners). In case of buildings more than 40.0 m in height shall be provided and the layout for the same shall be done in consultation with Fire Department. The said open space shall be kept free of obstructions and shall be motorable.
- v. The minimum turning radius along the centre of the lane shall be 5.0m.
- vi. The maximum slope of access/exit lane at any point along the lane shall be 1:7.

- vii. A minimum clear height of 2.40m shall be maintained at all points in the parking space and access/exit lanes.

2.4.2. Design of Parking for Two Wheelers

- i. The minimum dimension of a space provided for parking a two-wheeler shall be 1.1m x 2.5m.
- ii. Each two-wheeler parking space should be connected to the street providing access to the plot through an access/ exit lane.
- iii. The minimum width of the access/exit lane shall be 2.00m and 4.00m for unidirectional and bidirectional movements, respectively where the lane provides access/exit to more than 10 two-wheeler parking spaces.
- iv. The minimum turning radius along the centre of the lane shall be 4.50m.
- v. The maximum slope of access/exit lane at any point along the lane shall be 1:7.
- vi. A minimum clear height of 2.40m shall be maintained at all points in the parking space and access/exit lanes.

2.4.3. Design of Parking for Emergency Vehicles

Source: NBC 2016, Vol-1, Part 3, Annex D, Clause D-2.8 Vehicular Access

- i. Necessary provision shall be made by the plot owner for parking of emergency vehicles like Ambulance, Fire tender, Police, etc.
- ii. A Right-of-Way (RoW) of width at least 6m shall be provided upto the entrance to the building to facilitate emergency vehicle movement.

2.4.4. Design of Parking for Handicap Parking

Source: URDPFI Guidelines, Vol-1, Chapter 8, Clause 8.2.18. Special Requirements for Barrier Free Built Environment for Differently abled and Elderly Persons

Parking spaces for individuals with physical disabilities, when placed between two perpendicular, angular and parallel parking spaces, should be 3.60m to 3.80m wide. The length of the aisle should be 6.50m, 6.30m and 7.30m for 90°, 45-60° and parallel parking respectively.

2.4.5. Design of Parking for Bus

Source: MPD 2041, Section 22.12 Transport, Table 22.43 Indicative On-site Parking (ECS) Requirements for projects

- i. The minimum dimension of a space provided for parking a bus shall be 12m x 4m.
- ii. The minimum width of the access/exit lane shall be 7.50m and 9.00m for unidirectional and bidirectional movements respectively.
- iii. The minimum turning radius along the centre of the lane shall be 12.00m.
- iv. The maximum slope of access/exit lane at any point along the lane shall be 1:7.
- v. A minimum clear height of 5.50m shall be maintained at all points in the parking space and access/exit lanes.

2.4.6. Design of Parking for Intermediate Para Transit

Cycle-Rickshaw, E-Rickshaw, and Auto-Rickshaw together shall be referred to as Intermediate Para Transit (IPT).

- i. The minimum dimension of a space provided for parking an IPT shall be 1.5m x 3.0m.
- ii. The minimum width of the access/exit lane shall be 2.0m and 3.3m unidirectional and bidirectional movements respectively.
- iii. The minimum turning radius along the centre of the lane shall be 3.0m.
- iv. The maximum slope of access/exit lane at any point along the lane shall be 1:12.
- v. A minimum clear height of 2.40m shall be maintained at all points in the parking space and access/exit lanes.

2.4.7. Design of Parking for Bicycle

Source: UTTIPEC, 2009 – Street Design Guidelines, Chapter 5- Design Toolkit: Mandatory Components, Section 6F: Other Geometric Guidelines for Cycle Tracks

- i. The minimum dimension of a space provided for parking a bicycle shall be 1.1m x 2.5m.
- ii. For Public Bicycle Sharing Docks, the space required shall be as per system specifications. In case of absence of systems specifications, the minimum dimension per dock shall be 1.1m x 2.5m.

- iii. Cycle Track Capacity:
 - a. For One-way Traffic: Two Lane - 2.5m to 5.0m; Three Lane - Over 5.0m
 - b. For Two-Way Traffic: Two Lane - 2.5m; Three Lane - 2.0m to 5.0m; Four Lane - Over 5.0m
 - c. The length of grade should not exceed from 90m (295 ft) to 500m (1640 ft) for the gradient of 1:3 to 1:7, respectively.
- iv. Vertical clearance: The minimum headroom provided should be 2.25m (7.38 ft).

2.4.8. Design of Pedestrian path in parking areas (Basement, Stilt, etc.)

Source: *Auckland Design Manual, Chapter 5, Clause 5.3.2 Pedestrian access and legibility* (<http://www.aucklanddesignmanual.co.nz/sites-and-buildings/mixed-use/guidance/accommodatingcars/accessandwayfinding/pedestrianaccessandlegibility>)

Pedestrian path in parking areas shall be provided with a minimum width of 1.2m and following design controls.

- i. Create pedestrian paths that are distinct from vehicle aisles. In shaded parking areas, use paint finishes, and in outdoors use a surface texture change to highlight this difference.
- ii. Avoid requiring pedestrians to share a route with vehicles in order to access the parking area exit.
- iii. Consider pedestrian crossings where vehicle and pedestrian paths cross, especially at or near building entrances.
- iv. Create pedestrian 'safe refuge areas' where people may need to congregate, for instance around ticketing machines or lift lobbies. Raise these areas on kerbed footpaths and protect with bollards if necessary.
- v. Where pedestrian routes include a footpath level raised above the vehicle aisle, provide ramps at crossing points to improve accessibility.
- vi. Make walking routes clear, direct and intuitive. Routes to and from car parking areas should arrive in a safe, well-lit area. Highlight pedestrian routes with special lighting or surface treatments that clearly indicate the way out.
- vii. Pedestrians should not need to venture through a side or rear entrance to access parking.

Section 2.5: Water Supply

Adequate water supply storage facilities, as published in the NBC 2016 of India, Part IX: Plumbing Services, Section I, shall be provided in all buildings. The use of groundwater as a source of water supply shall conform to regulations of the Central Ground Water Authority.

Section 2.6: Sanitation

Adequate sanitation facilities, as published in the NBC 2016 of India, Part IX: Plumbing Services, Section II, shall be provided in all buildings.

Section 2.7: Drainage

Source: *NBC 2016, Vol-2, Part 9: Plumbing Services, Section 2, Clause 4.2 Drainage and Sanitation Requirements*

2.7.1. General

- i. Adequate drainage facilities, as published in the NBC 2016 of India, Part IX Plumbing Services, Section II, shall be provided in all buildings.
- ii. The manner in which it is intended to connect the drainage system of a building to a public sewer shall be subject to approval by the Authority.
- iii. All buildings having a minimum sewerage discharge of 1000 litres per day and above shall incorporate wastewater recycling system. Design and specifications of wastewater recycling system shall conform to the norms published by the Central Ground Water Authority.
- iv. There should be at least one water tap, and arrangement for drainage, in the vicinity of each water closet or group of water closets in all buildings.
- v. Each dwelling unit in premises (abutting a sewer or with a private sewage disposal system) shall have at least one water closet, one kitchen wash place or a sink, and one bathing place or shower, to meet the basic requirements of sanitation and personal hygiene.
- vi. For Residences:
 - a. Dwelling with individual convenience shall have at least the following fitments:
 - i. One bathroom provided with a tap and a floor trap;
 - ii. One water closet with flushing apparatus with an ablution tap; and

- iii. One tap with a floor trap, or a sink in the kitchen, or wash place. Where only one water closet is provided in a dwelling, it is desirable to have the bath and water closet accommodated separately.
- b. Dwellings without individual conveniences shall have the following fitments:
 - i. One water tap with floor trap in each tenement,
 - ii. One water closet with flushing apparatus and one ablution tap bath for every two tenements, and
 - iii. One bath with water tap and floor trap for every two tenements.
- vii. The requirement of water supply for various occupancies in buildings shall be as per Table 2-1: Per Capita Water Requirement for Various Occupancies/Uses to Table 2-2: Flushing Storage Capacities.
- viii. The water and tank requirements shall be based on intended use(s) of floor and its spaces, permits for which shall be sought during Building Construction Permit and Post-Occupancy change(s).
- ix. The Authority shall be apprised where water demand is optimized through recycling and other means and would be assessed based on overall water balance calculations.
- x. The requirement of sanitary fittings and installations for different occupancies in buildings shall be as per the updated/amended NBC 2016.

Table 2-1: Per Capita Water Requirement for Various Occupancies/ Uses

S. No.	Type of Occupancy	Consumption (litre per capita occupancy)
1.	Residential <ul style="list-style-type: none"> a) EWS/LIG dwelling units (Litre Per Capita per Day (LPCD)/Dwelling unit) b) MIG and above category flats/houses/floors (LPCD/Dwelling unit) c) Hotels with lodging accommodation (per bed) 	135 225 180
2.	Educational <ul style="list-style-type: none"> a) Day Schools (per head per day) b) Boarding Schools (per head per day) 	45 135
3.	Institutional (Hospitals) <ul style="list-style-type: none"> a) No. of beds not exceeding 100 b) No. of beds exceeding 100 c) Staff quarters and hostels 	340 450 135
4.	Assembly – Cinema halls, Auditoria, etc (per seat accommodation)	15
5.	Government or Semi-public business	45
6.	Mercantile (Commercial) <ul style="list-style-type: none"> a) Restaurants (per customer) b) Other business building 	70 45
7.	Industrial <ul style="list-style-type: none"> a) Factories where bathrooms are to be provided b) Other business building 	45 30
8.	Storage (including warehouses)	30
9.	Hazardous	30
10.	Intermediate Stations (excluding Mail and Express stops)	45 (25)*
11.	Junction Stations	70 (45)*
12.	Terminal Stations	45
13.	International and Domestic Airports	70

*The values in brackets are for such stations where bath facilities are not provided.

Table 2-2: Flushing Storage Capacities

S.No.	Classification of building	Storage capacity (litre)
1.	For tenements having common convenience	900 litre per WC seat
2.	For residential premises other than tenement having common conveniences	270 litre net for one WC seat each, and 189 litre. for each additional seat in the same flat
3.	For factories and workshops	900 litre per WC seat, and 180 litre per urinal
4.	For cinemas, public assembly hall, etc	900 litre per WC seat, and 350 litre per urinal

Table 2-3: Domestic Storage Capacities

S.No.	No. of Floors	Storage Capacity (litre)	Remarks
For premise occupied tenements with common conveniences:			
1.	Ground Floor	Nil	Provided down-take fittings are installed
2.	Floors 2, 3, 4, 5 and upper floors	500 litre per tenement	-
For premise occupied as flats or blocks			
1.	Ground Floor	Nil	Provided down-take fittings are installed
2.	Floors 2, 3, 4, 5 and upper floors	500 litre per tenement	-

Explanatory Notes:

- If the Premises are situated at a higher level than the road in front, storage of water at the ground level shall be similar to the floors above.
- Provided that the total domestic storage calculated as per Table 2-3 is not less than the storage calculated on the number of down-take fittings, then storage shall be permitted according to scale given below:
 - Down-take taps 70 litre each
 - Showers 135 litre each
 - Bathtubs 200 litre each

Section 2.8: Electrical Infrastructure

Electrical infrastructure, as published in the NBC 2016, Part 8- Building Services, Section II, shall be provided in all buildings.

Section 2.9: Environmental Management Plan (EMP)

Refer Manual 05- Environment Management Guidelines for preparation of Environment Management Plans, issued by MoEF&CC vide letter dt.28.05.2020.

2.9.1. Rainwater Management

- *The roof and terrace of a building, and the remaining area of the Sub-Plot, shall be provided with an effective rainwater drainage system.*
- *Rainwater shall not be discharged into adjacent plots.*
- *Rainwater should be diverted to green areas, recharge pits or stormwater drains. The manner of channeling rainwater discharge shall be as specified in Manual 05- Environment Management Guidelines.*
- *Sub-Plots should have adequate Rainwater Harvesting Structure and storage. It should also have Recharge pits.*

Section 2.10: Pollution Control**2.10.1. Air Pollution**

Sufficient devices to be installed to maintain the desired Air Quality Index (AQI) both indoor and outdoor. All buildings shall conform to provisions of the Air Pollution Control Act, 1981.

2.10.2. Water Pollution

Source: MBBL 2016 Chapter 14, Table 14.3 Environmental Conditions for Building and Construction

Separation of grey and black water should be done by the use of dual plumbing. All buildings shall conform to provisions of Water (Prevention and Control of Pollution) Act, 1974 (Amended in 1988).

2.10.3. Noise Pollution

Source: The Noise Pollution (Regulation and Control) Rules, 2000 and NBC 2016, Vol-2, Part 8, Section 4: Acoustics, Sound Insulation and Noise Control.

2.10.3.1. Noise shall not exceed 55 dB(A) for daytime (6.00 A.M. to 10.00 P.M.), and 45 dB(A) for night time (10.00 P.M. to 6.00 A.M.). In general, Noise control techniques may be classified into three categories:

- Noise Reduction at the source;

- ii. Noise Control of the transmission path; and
 - iii. The use of Noise Protective Measures at the receiver.
- 2.10.3.2. The noise level at the boundary of the public place, where loudspeaker or public address system or any other noise source is being used, shall not exceed 10 dB(A) above the ambient noise standards for the area -- or 75 dB(A), whichever is lower.
- a) Zoning

The zoning of the different Sub-Plots shall be done by taking into account, besides other aspects, the Noise Levels from different occupancies.

Wherever necessary, experts in the field may be consulted.
 - b) Green Belts and Landscaping

Where relief from noise is to be provided, green belts may be used with considerable width.

In case of Railway tracks, additional noise barriers may be provided in buildings for Noise Insulation. The extent of relief that may be derived from the above measures shall be estimated only after considering other environmental factors.

Only thick belts of plants and trees (greater than 30m) are of real value. Strong leafy trees may be planted to act as Noise Baffles. Shrubs or creepers may also be planted for additional protection between tree trunks.

Artificial mounds and banks should be formed wherever possible. A minimum of hard paving, and as much of grass as possible, may be used.
 - c) Railway Track and Highway Noise Barriers

A well-designed barrier of even a modest height (say 3m) can ensure that all open space areas are free from excessive noise levels. There are two types of such barriers:

 - i. Solely to reduces noise like free-standing walls and artificial mounds
 - ii. Forms a part of the building complex (barrier blocks) like single and multistoried utility buildings and garages.
 - d) Planning and Design against Indoor Noise
 - i. Sound Insulation of Non-Industrial Buildings by Constructional Measures
 - ii. The desired (acceptable) noise levels, and the recommended insulation values for the various areas, may be achieved by providing Sound Insulation Treatment constructional measures.
 - iii. All building activity shall be in accordance with the Noise Pollution (Regulation and Control) Rules, 2000.
 - e) Planning and Design against Outdoor Noise and Vibrations
 - i. Refer Clause 5.6 of 'Report on Updation/ Revision of Manual for Standards and Specifications for Railway Stations 2009 & Cost Optimization strategies for Station Redevelopment Projects' dated September, 2020.
 - ii. From the experience of stations already implemented, it is advisable that vibrations should not propagate in the structure of the building. For this purpose, mitigation measures should be put in place appropriately.
 - iii. Acoustics: General conditions of the acoustics as mentioned in the Development Agreement should be followed.
 - iv. Specific conditions related to vibrations, noise and acoustic can be made part of the Development Agreement by IRSDC.

Section 2.11: Structural Stability

2.11.1. Applicability

The following Structural and Seismic Safety Bye-Laws shall apply to all new buildings.

2.11.2. Additions and Alterations to Existing Buildings

An alteration or addition to an existing building that is not structurally independent shall be designed and constructed in such a way that the entire structure conforms to the structural and seismic safety requirements for new buildings.

No alteration or addition to an existing building shall be permitted unless the following three conditions are complied with:

- i. The alteration or addition complies with the requirements for new buildings.
- ii. The alteration or addition does not increase the seismic forces in any structural element of the existing building by more than 5% -- unless the capacity of the element, subject to the increased force, is still in compliance with the requirements for new buildings.

- iii. The alteration or addition does not decrease the seismic resistance of any structural element of the existing building -- unless the reduced resistance is equal to, or greater than, that required for new buildings.

2.11.3. Change of Use of Buildings or Part of a Building

When a Change of Use results in a structure being reclassified to a Higher Importance Factor (I) as defined in the IS:1893-2002 *Criteria for Earthquake Resistant Design of Structures (Fifth Revision)*, the building shall conform to seismic requirements for a new building with the Higher Importance Factor.

2.11.4. Design for Structural and Seismic Safety

For applicable Design Standards, and guidelines for Structural Safety, Seismic Safety, Cyclone/ Windstorm Protection and Landslides Protection, Refer Annexure-1.

2.11.4.1. Structural Design Basis Report

Source: MBBL 2016, Chapter 6, Clause 6.1.2 Structural Design Basis Report (SDBR)

A Structural Design Basis Report (SDBR) shall be prepared for all buildings and submitted along with the Notice of Commencement of Construction⁴

In compliance of the design with the above Indian Standard, the Structural Engineer on Record will submit a structural design basis report in the Proforma attached herewith covering the essential safety requirements specified in the Standard. The "Structural Design Basis Report (SDBR)" consists of four parts (Form No.6, MHA Expert Committee Report)

Part 1: General Information/ Data

Part 2: Load Bearing Masonry Buildings

Part 3: Reinforced Concrete Buildings

Part 4: Steel Buildings

- i. Drawings and Documents to be submitted for approval of appropriate authorities shall include SDBR as detailed below:
 - a) Part 1: Completed
 - b) Part 2: (if applicable) – completed
 - c) Part 3: (if applicable) – undertaking that completed Part 3 will be submitted before commencement of construction. Part 4: (if applicable) – undertaking that completed
 - d) Part 4 will be submitted before commencement of construction.
- ii. SDBR as detailed below shall be submitted to the appropriate authority as soon as design of foundation is completed, but not later than one month prior to commencement of construction.
 - a) Part 1: Completed
 - b) Part-2, Part-3 or Part-4: (if applicable) Completed

2.11.4.1.1. Seismic strengthening/retrofitting

Source: MBBL 2016, Chapter 6, Clause 6.1.3 Seismic strengthening/retrofitting

Prior to seismic strengthening/retrofitting of any existing structure, evaluation of the existing structure as regards to structural vulnerability in the specified wind/seismic hazard zone shall be carried out by an RSE/ RSDA. If as per the evaluation of the RSE/ RSDA the seismic resistance is assessed to be less than the specified minimum seismic resistance as given in the note below, action will be initiated to carry out the upgrading of the seismic resistance of the building as per applicable standard guidelines.

Note:

1. For masonry buildings reference shall be made to IS 4326 and IS 13935.
2. For concrete buildings and structures reference shall be made to IS15988: 2013 Seismic evaluation and strengthening of existing RCC buildings.

2.11.4.1.2. Buildings with Soft Storey

Source: MBBL 2016, Chapter 6, Clause 6.1.4 Buildings with Soft Storey

In case, buildings with number of storeys, such as the ground storey consisting of open spaces for parking that is "Stilt buildings" or any other storey with open halls, special arrangements are to be made to increase

⁴ The format for the Structural Design Basis Report is specified in the Structural Design Basis Report, Form 11, Government of Assam. (Guwahati Metropolitan Development Authority, n.d.)

the lateral strength and stiffness of the soft/open storey such as Steel bracing / Shear walls / Brick infills between columns. Dynamic analysis of building is to be carried out including the strength and stiffness effects of infills and inelastic deformations in the members, particularly, those in the soft storey, and the structural members are to be designed accordingly.

Alternatively, the following design criteria are to be adopted after carrying out the earthquake analysis, neglecting the effect of infill walls in other storeys:

- a) The columns and beams of the soft storey shall be designed for 2.5 times the storey shears and moments, calculated under seismic loads specified in the other relevant clauses; or,
- b) Besides the columns designed and detailed for the calculated storey shears and moments, shear walls shall be placed symmetrically in both directions of the building as far away from the centre of the building as feasible; to be designed exclusively for 1.5 times the lateral storey shear force calculated as before. For details of design and provisions, IS 1893, Part 1 shall be referred.

2.11.4.1.3. Review of structural design

Source: MBBL 2016, Chapter 6, Clause 6.1.5 Review of structural design

- i. The Competent Authority may create a Structural Design Review Panel (SDRP) consisting of senior SER's and SDAR's whose task will be to review and certify the design prepared by SER or SDAR whenever referred by the competent authority.
- ii. The Reviewing Agency shall submit addendum to the certificate or a new certificate in case of subsequent changes in structural design.
- iii. Table-2-4 gives requirements of SDRP for different seismic zones namely III, IV and V and for structures of different complexities.
- iv. In seismic Zone II, buildings & structures greater than 40m in height will require proof checking by SDRP as per detail at Sl. no.3 of Table 2-4.

Table 2-4: Proof Checking Requirements for Structural Design

S. No.	Type of Structure	Submission from SER or SDAR	To be Proof Checked
1	Load Bearing Buildings up to three storeys	SDBR	Not to be checked
2	Buildings upto seven storeys (R.C.C/Steel framed structure)	SDBR	To be checked
		Preliminary design	To be checked
3	Building greater than seven storeys (R.C.C/Steel framed structure)	SDBR	To be checked
		Preliminary design	To be checked
		Detailed structural design and structural drawings	To be checked
4	Special Structures	SDBR	To be checked
		Preliminary design	To be checked
		Detailed structural design and structural drawings	To be checked

Notes:

- i. The table 2-5 below may be referred for Occupant Load/Live load for different building types.

Table 2-5: Occupant Load/ Live load for different buildings types

S. No.	Type of Occupancy	Occupant Load per 100 sq. m. of Plinth or Covered Area
1	Residential, Institutional, Business and Industrial	10.0
2	Educational and mercantile	33.3
3	Assembly	
	With fixed or loose seats and dance floor	166.6
	Without seating facilities inc. dining rooms	66.6

- ii. At the preliminary proposal stage of a project, the objective is to undertake feasibility study/comparison of a number of possible alternatives of structural schemes and determine the most cost effective one, detailed structural calculations are not necessary for each alternative scheme. However, it is necessary to determine the member sizes and reinforcement content in order to determine the cost. By making conservative assumptions it is possible to derive simplified

calculations for both analysis and design. This is called “Preliminary or approximate analysis, and design”.

After the most cost-effective scheme is selected and signed-off by the Client, the detailed calculations are performed on the selected scheme to determine the precise structural members and composition (size, dimension and stress behavior), and this is called the “Detailed structural design”.

In the aforesaid, the design of structural members is typically assumed to account for all the stress loads applicable in the given project.

- iii. Special structure means large span structures such as stadium, assembly halls, or tall structures such as water tanks, TV tower, chimney, etc.

It will be seen from the Table 2-4 above that there is a wide range of structure typology, and the requirement by the Competent Authority for third party verification will depend on the type of structure.

2.11.4.2. Third-Party Verification of Structural Design

Third-party verification of the structural design of a building shall be required for all buildings. Third-party verification of structural design shall be undertaken by institutes of National Repute as per terms mentioned in clauses below. This certificate shall be submitted to the Authority at the time of application for Building Sanction.

2.11.4.2.1. For Structures in Airspace above Railway Station or other operational structures

- i. All structures in Airspace, above Stations, Platforms, Concourse, etc. to be vetted along with the respective operational area designs from Civil Engineering Institutes of National repute, like IITs, NITs.
- ii. The Developer/ Concessionaire shall submit certificate of Structural Safety in Design, as per Clause 2.11.4.2.3.
- iii. The Developer/ Concessionaire shall submit a certificate of Construction Safety as per Clause 2.11.4.2.4.
- iv. The Developer/ Concessionaire to have its own QA&QC policy, department, engineer, etc. as per agreement between Developer and the Authority and Clause 2.11.4.2.5
- v. Authority Engineers to be appointed by mutual consent of Developer/ Concessionaire and IRSDC to supervise and conduct surprise checks.

2.11.4.2.2. Structure in Sub-Plots for Commercial Use

- i. All structures 40m and above shall require Third-Party Verification as per clause 2.11.4.2 above.
- ii. All special structures less than 40m in height involving change in structural system, like columns etc. require Third-Party Verification as per clause 2.11.4.2 above.

2.11.4.2.3. Certification regarding structural safety in design

Source: MBBL 2016, Chapter 6, Clause 6.1.6 Certification regarding structural safety in design

Structural Engineer on Record (SEOR) shall give a certificate of structural safety of design as per proforma given in Form-3 and Form 14 (of the MHA Expert Committee Report) at the time of completion.

2.11.4.2.4. Constructional safety

Source: MBBL 2016, Chapter 6, Clause 6.1.7 Constructional safety

- i. **Supervision:** All construction except load bearing buildings upto 3 storeys shall be carried out under supervision of the Construction Supervisor or agency responsible for Managing on-site Construction for various seismic zones.
- ii. **Certification of structural safety in construction:** Construction Supervisor on Record (CSOR) shall give a certificate of structural safety of construction as per proforma given in Form-13 (of the MHA Expert Committee Report) at the time of completion.

2.11.4.2.5. Quality control and inspection

Source: MBBL 2016, Chapter 6, Clause 6.1.8 Quality control and inspection

All material and workmanship shall be of good quality conforming generally to 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 National Building Code of India.

- i. **Inspection:** All the construction for high-rise buildings higher than seven storeys, public buildings and special structures shall be carried out under quality inspection program prepared and implemented under the Quality Auditor on Record (QAR) or Quality Auditor Agency on Record (QAAR) in seismic zones IV & V.
- ii. **Certification of safety in quality of construction:** Quality Auditor on Record (QAR) or Quality Auditor Agency on Record (QAAR) shall give a certificate of quality control as per proforma given in Form-15. Quality Inspection Programme to be carried on the site shall be worked out by QAR/ QAAR in consultation with the owner, builder, CER / CMAR.

Notes: Sections 2.11.4.2.4 and 2.11.4.2.5 shall not be applicable for Government buildings that are designed and constructed under the supervision of in-house architects/engineers.

Section 2.12: Maintenance And Upgradation

2.12.1. Maintenance of Buildings

2.12.1.1. Responsibility for Maintenance of Buildings

It shall be the responsibility of the Developer of a building to ensure that the building is kept in good repair, such that its Structural Stability is not compromised.

2.12.1.2. Periodic inspection and Maintenance Certificate

All buildings shall require periodic inspection by a SEOR at intervals specified in the Schedule <____>. The SEOR shall inspect the building to ascertain and certify to the Authority, in the format prescribed in Form No. 45, that the building's Structural Stability has not been compromised due to lack of adequate maintenance. It shall be the responsibility of the Developer to submit the certificate to the Authority no later than one month after the date on which inspection is due.

If the certificate is not submitted within the stipulated period, the Authority may post notices on prominent locations on the building, or advertise a notice issued to the Developer, that the building has not been inspected for adequate maintenance as required by these Building Codes -- and that the building may not be safe for use. The format for this notice is prescribed in Form <____>.

It shall be the responsibility of the Developer to ensure that the posted notices are not removed until the Maintenance Certificate is submitted and accepted by the Authority. The cost of affixing and removing notices, and any additional audits for structural safety, etc. shall be payable by the Developer. If the Maintenance Certificate is not submitted within six months of the issue of notice, Authority shall revoke Building Occupancy Certificate for the building.

2.12.2. Maintenance of Lifts, Escalators and Travelators

2.12.2.1. Responsibility for Maintenance of Lifts, Escalators and Travelators

It shall be the responsibility of the Developer of a building to ensure that lifts, escalators and travelators in the building are kept in good repair, such that their use is safe.

2.12.2.2. Maintenance Protocol

Maintenance protocol for lifts, escalators and travelators shall be as per the latest versions of IS 1860: 1980 Code of Practice for Installation, Operation, and Maintenance of Electric Passenger and Goods Lift; IS 6620: 1972 Code of Practice for Installation, Operation, and Maintenance of Electric Service Lifts; and IS 4591: 1968 Code of Practice for Installation and Maintenance of Escalators.

2.12.2.3. NOC for operation and maintenance of Lifts, Escalators and Travelators

The developer has to obtain an NOC from the concerned authority for operation & maintenance of Lifts, Escalators and Travelators, before expiry of the initial NOC.

2.12.3. Maintenance of Fire Prevention and Safety Provisions

It shall be the responsibility of the Developer of a building to ensure that all the Fire Prevention and Safety Provisions in a building are kept in good working condition and not violated at all times.

2.12.3.1. NOC for Fire Prevention and Safety

The developer has to obtain an NOC from the concerned local body/ authority for Fire Prevention and Safety provisions in the buildings, before expiry of the initial NOC.

Annexure-I

1. Design for Structural and Seismic Safety

Source: MBBL 2016, Chapter 6, Clause 6.1.1 Additional provisions in building regulations/ bye-laws for natural hazard prone areas

1.1 Design Standards

The structural design of foundations, elements of masonry, timber, plain concrete, reinforced concrete, pre-stressed concrete, and structural steel shall conform to:

The provisions of the NBC 2016 of India, Part VI - Structural Design (Section - 1 Loads, Section - 2 Foundation, Section - 3 Wood, Section - 4 Masonry, Section - 5 Concrete, and Section - 6 Steel), and the following Indian Standards:

1.2 Structural Safety Guidelines

- i. IS 456: 2000 Code of Practice for Plain and Reinforced Concrete
- ii. IS 800: 1984 and 2007 Code of Practice for General Construction in Steel
- iii. IS 801: 1975 Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members in General Building Construction
- iv. IS 875 (Part 1): 1987 Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures - Part 1: Dead Loads -- Unit Weights of Building Materials And Stored Materials
- v. IS 875 (Part 2): 1987 Design Loads (Other Than Earthquake) for Buildings and Structures - Part 2; Imposed Load
- vi. IS 875 (Part 4): 1987 Design Loads (Other Than Earthquake) for Buildings and Structures - Part 4; Snow Loads
- vii. IS 875 (Part 5): 1987 Design loads (other than earthquake) for buildings and structures - Part 5; Special Loads and Load Combination
- viii. IS: 883: 1966 Code of Practice for Design of Structural Timber in Building
- ix. IS: 1904: 1986 Code of Practice for Design and Construction of Foundations in Soils: General Requirements
- x. IS 1905: 1987 Code Of Practice For Structural Use of Unreinforced Masonry
- xi. IS 2911 (Part 1): Section 1: 1979 Code of Practice for Design and Construction of Pile Foundation Section 1:
 - a) Part 1: Section 2 Based Cast-in-situ Piles
 - b) Part 1: Section 3 Driven Pre-cast Concrete Piles
 - c) Part 1: Section 4 Based Pre-cast Concrete Piles
 - d) Part 2: Timber Piles
 - e) Part3: Under-Reamed Piles
 - f) Part 4: Load Test on Piles
- xii. IS 456: Plain and Reinforced Concrete: Code of Practice
- xiii. IS 1893: Criteria for Earthquake Resistant Design of Structures
- xiv. IS 2062: 2011 Hot Rolled Medium and High Tensile Structural Steel - Specification
- xv. IS 8500: 1991 Structural Steel-Micro alloyed (Medium and High Strength Qualities) -- Specification
- xvi. IS 806: 1968 Code of Practice for Use of Steel Tubes in General Building Construction
- xvii. IS 811: 1987 Specification for Cold-formed Light Gauge Structural Steel Sections
- xviii. IS 1367 (All Parts) Technical Supply Conditions for Threaded Steel
- xix. IS 2155: 1982 Cold Forged Solid Steel Rivets for Hot Closing (6 to 16mm Diameter)
- xx. IS 1929: 1982 Cold Forged Solid Steel Rivets for Hot Closing (12 to 36mm Diameter)
- xxi. IS 1149: 1982 Specification for High Tensile Steel Rivet Bars for Structural Purposes
- xxii. IS 6639: 1972 Hexagon Bolts for Steel Structures
- xxiii. IS 3757: 1985 Specification for High Strength Structural Bolts
- xxiv. IS: 4000: 1992 High Strength Bolts in Steel Structures - Code of Practice
- xxv. IS 1363: 2002 Part 1 Hexagon Head Bolts, Screws and Nuts of Product Grade 'C'
- xxvi. IS 816: 1969 Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel
- xxvii. IS 814: 2004 Covered Electrodes for Manual Metal Arc Welding of Carbon and Carbon Manganese Steel -- Specification

- xxviii. IS 1395: 1982 Specifications for Low and medium Alloy Steel covered electrodes for manual metal arc welding
- xxix. IS 7280: 1974 Specifications for Bare wire electrodes for submerged arc welding of structural steel
- xxx. IS 3613: 1974 Acceptance tests for wire flux combination for submerged arc welding of Structural Steel
- xxxi. IS 6419: 1996 Welding rods and bare electrodes for gas shielded arc welding of structural steel -- Specification
- xxxii. IS 6560: 1996 Molybdenum and Chromium-Molybdenum Low Alloy Steel Welding Rods and Bare Electrodes for Gas Shielded Arc Welding -- Specification
- xxxiii. IS 813: 1986 Scheme of Symbols for Welding
- xxxiv. IS 9595: 1996 Metal-Arc Welding of Carbon and Carbon Manganese Steel -- Recommendations

1.3 Seismic Safety Guidelines:

- i. IS 1893: 2002 Criteria for Earthquake Resistant Design of Structures (Fifth Revision)
- ii. IS 13920: 1993 and 2016 Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces -- Code of Practice
- iii. IS 4326: 1993 Earthquake Resistant Design and Construction of Buildings -- Code of Practice (Second Revision)
- iv. IS 13828: 1993 Improving Earthquake Resistance of Low Strength Masonry Buildings -- Guidelines
- v. IS 13827: 1993 Improving Earthquake Resistance of Earthen Buildings -- Guidelines
- vi. IS 13935: 1993 and 2009 Repair and Seismic Strengthening of Buildings -- Guidelines
- vii. IS 1498: (1970) Classification and Identification of Soils for General Engineering Purposes

1.4 Cyclone/Wind Storm Protection Guidelines:

- i. IS 875(3): 1987 Code of Practice for Design Loads (other than Earthquake) for Buildings and Structures, Part 3, Wind Loads
- ii. Guidelines [based on IS 875(3): 1987] for Improving the Cyclonic Resistance of Low-rise Houses and Other Building

1.5 Landslides Protection Guidelines:

- i. IS 14458 (Part 1): 1998 Guidelines for Retaining Wall for Hill Area: Part 1 Selection of Type of Wall
- ii. IS 14458 (Part 2): 1997 Guidelines for Retaining Wall for Hill Area: Part 2 Design of Retaining/Breast Walls
- iii. IS 14458 (Part 3): 1998 Guidelines for Retaining Wall for Hill Area: Part 3 Construction of Dry-Stone Walls
- iv. IS 14496 (Part 2): 1998 Guidelines for Preparation of Landslide -- Hazard Zonation Maps in Mountainous Terrains: Part 2 Macro-Zonation.

Explanatory Note: Whenever an Indian Standard including those referred to in the NBC 2016 -- or the NBC is referred, the latest revision of the same shall be followed, except specific criteria, if any, mentioned against that Code.

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