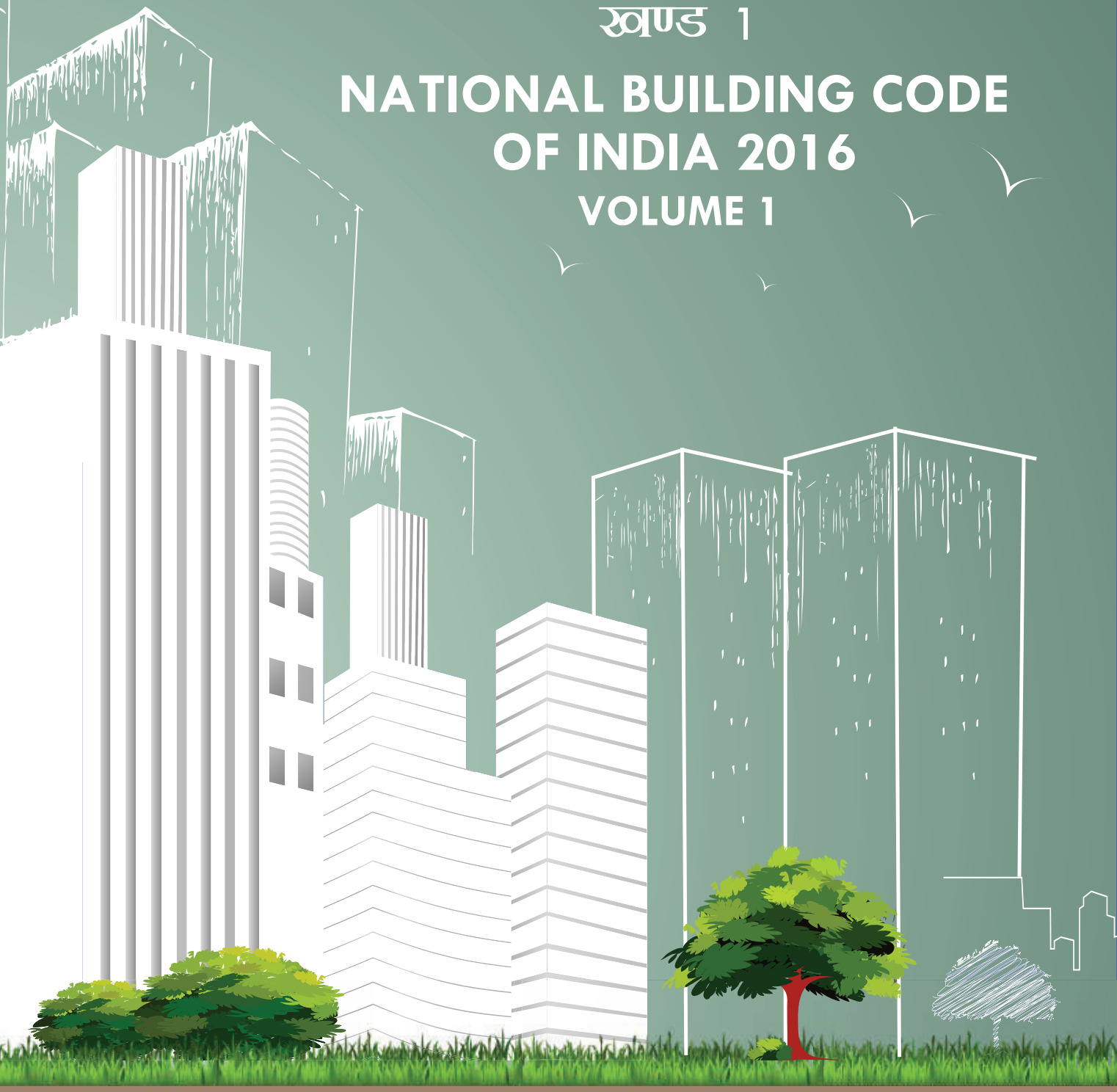
भारत की राष्ट्रीय भवन निर्माण संहिता 2016

खण्ड 1

NATIONAL BUILDING CODE OF INDIA 2016

VOLUME 1



भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

भारत की राष्ट्रीय
भवन निर्माण संहिता 2016
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FOREWORD

Construction programmes are interwoven in a large measure in all sectors of development, be it housing, transport, industry, irrigation, power, agriculture, education or health. Construction, both public and private, accounts for about fifty percent of the total outlay of the planned expenditure in the country. Half of the total money spent on construction activities is spent on buildings for residential, industrial, commercial, administrative, educational, medical, municipal and entertainment uses. It is estimated that about half of the total outlay on buildings is on housing. It is imperative that for such a large national investment, optimum returns are assured and wastage in construction is avoided.

Soon after the Third Five Year Plan, the Planning Commission decided that the whole gamut of operations involved in construction, such as administrative, organizational, financial and technical aspects, be studied in depth. For this study, a Panel of Experts was appointed in 1965 by the Planning Commission and its recommendations are found in the 'Report on Economies in Construction Costs', published in 1968.

One of the facets of building construction, namely, controlling and regulating buildings through municipal byelaws and departmental handbooks, received the attention of the Panel and a study of these regulatory practices revealed that some of the prevailing methods of construction were outmoded; some designs were overburdened with safety factors and there were other design criteria which, in the light of newer techniques and methodologies, could be rationalized; and building byelaws and regulations of municipal bodies which largely regulate the building activity in the country, wherever they exist, were outdated. They did not cater to the use of new building materials and the latest developments in building designs and construction techniques. It also became clear that these codes and byelaws lacked uniformity and they were more often than not 'specification oriented' and not 'performance oriented'.

These studies resulted in a recommendation that a National Building Code be prepared to unify the building regulations throughout the country for use by government departments, municipal bodies and other construction agencies. The then Indian Standards Institution (now Bureau of Indian Standards) was entrusted by the Planning Commission with the preparation of the National Building Code. For fulfilling this task, a Guiding Committee for the preparation of the Code was set up by the Civil Engineering Division Council of the Indian Standards Institution in 1967. This Committee, in turn, set up 18 specialist panels to prepare the various parts of the Code. The Guiding Committee and its panels were constituted with architects, planners, materials experts, structural, construction, electrical, illumination, air conditioning, acoustics and public health engineers and town planners. These experts were drawn from the Central and State Governments, local bodies, professional institutions and private agencies. The first version of the Code was published in 1970.

After the National Building Code of India was published in 1970, a vigorous implementation drive was launched by the Indian Standards Institution to propagate the contents and use of the Code among all concerned in the field of planning, designing and construction activities. For this, state-wise implementation conferences were organized with the participation of leading engineers, architects, town planners, administrators, building material manufacturers, building and plumbing services installation agencies, contractors, etc.

These conferences were useful in getting across the contents of the Code to the interests concerned. These conferences had also helped in the establishment of Action Committees to look into the actual implementation work carried out by the construction departments, local bodies and other agencies in different states. The main actions taken by the Action Committees were to revise and modernize their existing regulatory media, such as specifications, handbooks, manuals, etc, as well as building byelaws of local bodies like municipalities at city and town levels, *Zilla Parishads*, *Panchayats* and development authorities, so as to bring them in line with the provisions contained in the National Building Code of India. In this process, the Indian Standards Institution rendered considerable support in redrafting process.

The National Building Code of India is a single document in which, like a network, the information contained in various Indian Standards is woven into a pattern of continuity and cogency with the interdependent requirements of Parts/Sections carefully analyzed and fitted in to make the whole document a cogent continuous volume. A continuous thread of 'preplanning' is woven which, in itself, contributes considerably to the economies in construction particularly in building and plumbing services.

The Code contains regulations which can be immediately adopted or enacted for use by various departments, municipal administrations and public bodies. It lays down a set of minimum provisions designed to protect the safety of the public with regard to structural sufficiency, fire hazards and health aspects of buildings; so long as these basic requirements are met, the choice of materials and methods of design and construction are left to the ingenuity of the building professionals. The Code also covers aspects of administrative provisions, development control rules and general building requirements; fire safety requirements; stipulations regarding materials and structural design; rules for design of electrical installations, lighting, air conditioning and heating, installation of lifts; provisions for ventilation, acoustics and plumbing services, such as water supply, drainage, sanitation and gas supply; measures to ensure safety of workers and public during construction; and rules for erection of signs and outdoor display structures. The Code today also covers provisions relating to structural use of glass; escalators and moving walks; information and communications enabled installations; solid waste management; landscape planning and design; and asset and facility management.

Some other important points covered by the Code include 'industrialized systems of building' and 'architectural control'. The increase in population in the years to come will have a serious impact on the housing problem. It has been estimated that the urban population of India will continue to increase with such pace as to maintain the pressure on demand of accommodation for them. Speed of construction is thus of utmost importance and special consideration has to be given to industrialized systems of building. With increased building activity, it is also essential that there should be some architectural control in the development of our cities and towns, if creation of ugliness and slum-like conditions in our urban areas is to be avoided.

Over a period of time, the importance of providing an environment which is conducive to younger and elder persons and the persons with disabilities, alike, has been well highlighted. The Code covers provisions on accessibility to facilitate implementation of this important aspect in all public buildings. Similarly, all building construction and built environment should take into consideration the aspects of sustainable development, which have since been duly provided in a separate chapter in the Code which should be read along with other chapters. The objective is that the building activity should be in complete harmony with the environment be it planning, design, construction or operation and maintenance. With the passage of time, more and more complex buildings including very tall buildings are being built requiring inputs and involvement of professionals from different disciplines, who should work together in harmony following an integrated multi-disciplinary approach since covered in the Code.

Above comprehensive coverage under the Code is the result of its implementation and review from time to time. Since the publication of 1970 version of the National Building Code of India, a large number of comments and useful suggestions for modifications and additions to different parts and sections of the Code were received as a result of use of the Code by all concerned, and revision work of building byelaws of some States. Based on the comments and suggestions received, the National Building Code of India 1970 was first revised in 1983 and then in 2005.

Some of the important changes in 1983 version included: addition of development control rules, requirements for greenbelts and landscaping including norms for plantation of shrubs and trees, special requirements for low income housing; fire safety regulations for high rise buildings; revision of structural design sections based on new and revised codes, such as Concrete Codes (plain and reinforced concrete and prestressed concrete), Earthquake Code, Masonry Code; addition of outside design conditions for important cities in the country, requirements relating to noise and vibration, air filter, automatic control, energy conservation for air conditioning; and guidance on the design of water supply system for multi-storeyed buildings.

Since the publication of 1983 version of National Building Code of India, the construction industry had gone through major technological advancement. In next two decades, substantial expertise had been gained in the areas of building planning, designing and construction. Also, lot of developments had taken place in the techno-legal regime and techno-financial regime, apart from the enormous experience gained in dealing with natural calamities like super cyclones and earthquakes faced by the country. Further, since the revision in 1983, based on the changes effected in the Steel Code, Masonry Code and Loading Code, as also in order to update the fire protection requirements, three amendments were brought out to the 1983 version of the Code. Considering these, it was decided to take up a comprehensive second revision of the National Building Code of India.

The major changes incorporated in the second revision of the Code in 2005 were: incorporation of a new Part 0 'Integrated approach–Prerequisite for applying provisions of the Code' emphasizing on multi-disciplinary team approach for successfully accomplishing building/development project; addition of new chapters on significant

areas like structural design using bamboo, mixed/composite construction, and landscape planning and design; incorporation/modification of number of provisions relating to reform in administrative aspects, also detailing therein provisions to ensure structural sufficiency of buildings to facilitate implementation of the related requirements to help safely face the challenges during natural disasters like earthquake; incorporation of planning norms and requirements for hilly areas and rural habitat planning, apart from incorporation of detailed planning norms for large number of amenities; categorization of fire safety aspects distinctly into fire prevention, life safety and fire protection giving detailed treatment to each based on current information, developments and latest practices followed in the country; assigning due importance to the aspects like energy conservation and sustainable development in various parts and sections through appropriate design, usage and practices with regard to building materials, construction technologies and building and plumbing services giving due consideration to renewable resources like bamboo and practices like rain water harvesting; incorporation of the revised Earthquake Code, IS 1893 (Part 1) : 2002 'Criteria for earthquake resistant design of structures: Part 1 General provisions and buildings (*fifth revision*)' for due implementation of the provisions thereof in applicable seismic zones of the country, by the Authorities.

Two amendments were thereafter issued to the Code in 2015; first to include a new chapter relating to sustainability namely, Part 11 'Approach to Sustainability', and the second to modify/include certain provisions in Part 4 'Fire and Life Safety'.

Due to large scale changes in the building construction activities, such as change in nature of occupancies with prevalence of high rises and mixed occupancies, greater dependence and complicated nature of building services, development of new/innovative construction materials and technologies, greater need for preservation of environment and recognition of need for planned management of existing buildings and built environment, there has been a paradigm shift in building construction scenario. A comprehensive revision has therefore been brought out to address all these aspects and also reflect the changes incorporated in various standards which are considerably utilized in the Code. The major changes incorporated in this third revision of the Code are as follows:

a) Provisions for association of need based professionals and agencies have been updated to ensure proper discharge of responsibilities for accomplishment of building project.
b) With a view to ensuring ease of doing business in built environment sector, a detailed provision for streamlining the approval process in respect of different agencies has been incorporated in the form of an integrated approval process through single window approach for enabling expeditious approval process, avoiding separate clearances from various authorities.
c) Further, with a view to meeting the above objective, the provision on computerization of approval process has been detailed, enabling online submission of plans, drawings and other details, and sanction thereof, aiding in speedier approval process.
d) The mechanism of ensuring certification of structural safety of buildings by the competent professional and peer review of design of buildings, have been further strengthened.
e) Requirements for accessibility in buildings and built environment for persons with disabilities and the elderly have been thoroughly revised and updated.
f) Provisions on fire and life safety have been thoroughly revised to meet the challenges of modern complex building types including the high rises.
g) Latest structural loading and design and construction codes including those relating to wind load, earthquake resistant design of buildings, steel design and foundations have been incorporated with a view to ensuring structural safety of buildings including against a disaster.
h) Provisions relating to all building and plumbing services have been updated keeping also in view the latest international practices as related to the country.
j) Provisions have been updated to ensure utilization of number of new/alternative building materials and technologies to provide for innovation in the field of building construction.
k) Construction management guidelines have been incorporated to aid in timely completion of building projects with desired quality in a safe manner within the budgeted cost.
m) Guidance has been provided for making buildings and built environment energy efficient and environmentally compatible, through the newly introduced and updated chapter on sustainability, namely Part 11 'Approach to Sustainability'.
n) New chapters have been added on structural use of glass; escalators and moving walks; information and communication enabled installations; solid waste management; and asset and facility management. The new Part on Approach to Sustainability has also been duly incorporated in the Code.

The specific major changes incorporated in each Part/Section of the Code have been enlisted in the Foreword of the respective Part/Section.

The Code now published is the third revision or fourth version representing the present state of knowledge on various aspects of building construction. The process of preparation of the 2016 version of the Code has thrown up a number of problems; some of them were answered fully and some partially. Therefore, a continuous programme will go on by which additional knowledge that is gained through technological evolution, users' views over a period of time pinpointing areas of clarification and coverage, and results of research in the field, would be incorporated in to the Code from time-to-time to make it a living document. It is, therefore, proposed to bring out changes to the Code periodically.

The provisions of this Code are intended to serve as a model for adoption by local bodies, Public Works Departments and other government construction departments, and other construction agencies. Existing PWD codes, municipal byelaws and other regulatory media could either be replaced by the National Building Code of India or suitably modified to cater to local requirements in accordance with the provisions of the Code. Any difficulties encountered in adoption of the Code could be brought to the notice of the National Building Code Sectional Committee for corrective action.

COMMITTEE COMPOSITION

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Shri H. S. Dogra

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National Fire Service College, Nagpur	Shri Shamim
Oil Industry Safety Directorate, New Delhi	Shri A. K. Arora
Proion Consultants, New Delhi	Shri Sandeep Goel
School of Planning and Architecture, New Delhi	Dr V. K. Paul
Tamil Nadu Fire and Rescue Services Department, Chennai	Shri S. Vijayasekar
Telangana State Disaster Response and Fire Services Department, Hyderabad	Shri P. Venkateshwar Shri K. Jairam Naik (*Alternate*)
The Indian Institute of Architects, Mumbai	Shri Kapil Mehta Shri Ajay Puri (*Alternate*)
The Institution of Engineers (India), Kolkata	Dr M. P. Chowdiah Shri K. B. Rajoria (*Alternate*)
UL India Pvt Ltd, Bengaluru	Shri V. Jagdish Shri G. Karthikeyan (*Alternate*)
Uttar Pradesh Fire Service, Lucknow	Shri P. K. Rao Shri Aman Sharma (*Alternate*)
West Bengal Fire & Emergency Services, Kolkata	Shri D. P. Biswas Shri Gopal K. Bhattacharya (*Alternate*)
In personal capacity (*SJR Verity, VIVA-305, Amrita College Road, Kasavanahalli, Bengaluru 560035*)	Shri T. R. A. Krishnan
In personal capacity (*A-347, Defence colony*, *New Delhi 110024*)	Shri R. C. Sharma
In personal capacity (*'Isa Vasyam' TC-18/1023, B-8/2-Lakshmi Nagar, Kesavadasapuram, Thiruvananthapuram 695004*)	Shri V. Suresh

Panel for Building Materials, CED 46:P3

Organization	*Representative(s)*
In personal capacity (*8th Floor, Flat No. 2, Tower 6, ATS-One Hamlet, Sector 104, Noida 201301*)	Shri T. N. Gupta (***Convener***)
Building Materials & Technology Promotion Council, New Delhi	Dr Shailesh Kumar Agrawal Shri J. K. Prasad (*Alternate*)

Organization	*Representative(s)*
CSIR-Central Building Research Institute, Roorkee	Dr A. K. Minocha Dr S. R. Karade (*Alternate*)
Central Public Works Department, New Delhi	Chief Engineer (CSQ) Shri Mathura Prasad (*Alternate*)
Delhi Development Authority, New Delhi	Representative
Directorate General Border Roads, New Delhi	Representative
DLF Limited, Gurugram	Representative
Housing & Urban Development Corporation Limited, New Delhi	Chairman and Managing Director Shri Akhilesh Kumar (*Alternate*)
Indian Institute of Technology Guwahati, Guwahati	Representative
Indian Institute of Technology Madras, Chennai	Dr Amlan K. Sengupta Dr Manu Santhanam (*Alternate*)
Indian Buildings Congress, New Delhi	Shri Deepak Narayan
Indian Plywood Industries Research & Training Institute, Bengaluru	Shri K. Shyama Sundar Shri M. Pavan Kumar (*Alternate*)
Inter-University Accelerator Centre, New Delhi	Shri M. K. Gupta
Larsen & Toubro Limited, Chennai	Representative
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Brig Girish Joshi Lt Col Gaurav Kaushik (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Director General Shri V. V. Arora (*Alternate*)
The Indian Institute of Architects, Mumbai	Shri Anurag Roy Shri Atul Gupta (*Alternate*)
The Institution of Engineers (India), Kolkata	Shri Anil Gattani Shri A. V. Patil (*Alternate*)
In personal capacity (*220, Sector 21-A, Faridabad 121001*)	Shri M. M. Goyal

Panel for Loads, Forces and Effects, CED 46:P4

Organization	*Representative(s)*
In personal capacity (*c/o Academy of Scientific & Innovative Research CSIR Campus, Taramani, Chennai 600113*)	Dr Nagesh R. Iyer **(*Convener*)**
Association of Consulting Civil Engineers (India), Bengaluru	Shri Manoj Mittal
Building Materials & Technology Promotion Council, New Delhi	Dr Shailesh Kumar Agrawal Shri A. K. Tiwari (*Alternate*)
Central Public Works Department, New Delhi	Chief Engineer (CDO) Shri Rajesh Khare (*Alternate*)
Creative Design Consultants & Engineers Pvt Ltd, Ghaziabad	Shri Aman Deep
CSIR-Central Building Research Institute, Roorkee	Dr Achal Kumar Mittal Dr Ajay Chourasia (*Alternate*)
CSIR-Structural Engineering Research Centre, Chennai	Dr J. Rajasankar Dr G. S. Palani (*Alternate*)
Delhi Tourism and Transportation Development Corporation, New Delhi	Shri Shishir Bansal
India Meteorological Department, New Delhi	Dr Devendra Pradhan Shri K. N. Mohan (*Alternate*)
Indian Association of Structural Engineers, New Delhi	Shri Mahesh Tandon Shri R. Gogia (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	Dr Vasant Matsagar Dr Dipti Ranjan Sahoo (*Alternate*)
Indian Institute of Technology Jodhpur, Jodhpur	Dr C. V. R. Murthy
Indian Institute of Technology Roorkee, Roorkee	Dr D. K. Paul
Larsen & Toubro Limited, Chennai	Shri Surya Prakash Karri Shri Krishna Somaraju (*Alternate* 1) Shri Praveen Kumar Rai (*Alternate* 2)
Mahendra Raj Consultants Pvt Ltd, New Delhi	Shri Mahendra Raj Shri S. S. Maan (*Alternate*)

Organization	*Representative(s)*
Mehro Consultants, New Delhi	Shri S. C. Mehrotra Shri Deepak Thakur (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora Shri B. S. Rao (*Alternate*)
National Institute of Disaster Management, New Delhi	Representative
The Institution of Engineers (India), Kolkata	Shri U. P. Waghe Shri Anil Gattani (*Alternate*)
In personal capacity (*L-802, Design Arch, e-Homes, Sector-5, Vaishali, Ghaziabad 201010*)	Dr A. S. Arya
In personal capacity (*B-03-3, Raheja Atlantis, NH 8, Sector 31-32A, Gurugram 122001*)	Dr Prem Krishna
In personal capacity (*'Isa Vasyam' TC-18/1023, B-8/2-Lakshmi Nagar, Kesavadasapuram, Thiruvananthapuram 695004*)	Shri V. Suresh

Panel for Soils and Foundations, CED 46:P5

Organization	*Representative(s)*
In personal capacity (*188/90, Prince Anwar Shah Road, Kolkata 700045*)	Dr N. Som (***Convener***)
Afcons Infrastructure Limited, Mumbai	Shri P. S. Bansod Shri V. Ramamurty (*Alternate*)
Bharat Heavy Electricals Limited, Noida	Shri C. Pushpakaran Shri Hitesh Kumar (*Alternate*)
Cengrs Geotechnica Pvt Ltd, Noida	Shri Sanjay Gupta Shri Ravi Sundaram (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr Pradeep Kumar Shri Anindya Pain (*Alternate*)
Central Public Works Department, New Delhi	Shri M. K. Sharma Shri Saurabh Gupta (*Alternate*)
Creative Design Consultants & Engineers Pvt Ltd, Ghaziabad	Shri Aman Deep
Delhi Development Authority, New Delhi	Chief Engineer (Design) Shri Vijay Shanker (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	Dr J. T. Shahu Dr R. Ayothiraman (*Alternate*)
Indian Institute of Technology Madras, Chennai	Representative
Indian Association of Structural Engineers, New Delhi	Shri Sushil K. Dhawan Dr Abhay Gupta (*Alternate*)
Indian Geotechnical Society, New Delhi	Maj Gen (Retd) S. N. Mukherjee Shri Sanjay Gupta (*Alternate*)
ITD Cementation Pvt Ltd, Mumbai	Shri Hemendra Chaudhary
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Brig Girish Joshi Col Pradeep Tiwari (*Alternate*)
NTPC Limited, New Delhi	Dr D. N. Naresh Shri Jitendra Kumar (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora Shri P. N. Ojha (*Alternate*)
National Institute of Disaster Management, New Delhi	Dr Chandan Ghosh Dr Amir Ali Khan (*Alternate*)
The Institution of Engineers (India), Kolkata	Prof G. B. Choudhari Dr S. S. Basarkar (*Alternate*)
In personal capacity (*C-4-B, CDS Regal Palm Garden, 383, Velachery, Chennai 600042*)	Shri A. Vijayaraman

Panel for Timber and Bamboo, CED 46:P6

Organization	*Representative(s)*
In personal capacity (*Pratap Nursery Lane, Near Gurudwara, Panditwari, Dehra Dun 248007*)	Shri K. S. Pruthi (***Convener***)

Organization	*Representative(s)*
Bamboo Society of India, Bengaluru	Dr K Sundar Naik Shri K. S. Anand (*Alternate*)
Building Materials & Technology Promotion Council, New Delhi	Dr Shailesh Kumar Agrawal Shri C. N. Jha (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr B. Singh Dr B. S. Rawat (*Alternate*)
Central Public Works Department, New Delhi	Chief Engineer (CSQ) Shri Mathura Prasad (*Alternate*)
Creative Design Consultants & Engineers Pvt Ltd, Ghaziabad	Shri Aman Deep
Forest Research Institute (ICFRE), Dehra Dun	Shri Rajesh Bhandari Shri R. S. Topwal (*Alternate*)
Forum of Scientists, Engineers and Technologists, Kolkata	Shri Rabi Mukhopadhyay Shri Parthasarathi Mukhopadhyay (*Alternate*)
Housing & Urban Development Corporation Limited, New Delhi	Chairman and Managing Director Shri Akhilesh Kumar (*Alternate*)
Indian Association of Structural Engineers, New Delhi	Dr Dulal Goldar Shri Hari Om Gupta (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	Dr Suresh Bhalla
Indian Plywood Industries Research and Training Institute, Bengaluru	Shri Anand Nandanwar Shri Narasimhamurthy (*Alternate*)
Iyer and Mahesh Architects, Thiruvanthapuram	Shri N. Mahesh Shri K. Gangadharan (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shrimati Upinder Kaur Shrimati Rachna (*Alternate*)
North East Centre for Technology Application and Reach, Shillong	Shri Ajay Kumar Shri Krishna Kumar (*Alternate*)
The Institution of Engineers (India), Kolkata	Shri Krishna Kumar
Wonder Grass Initiative Pvt Ltd, Nagpur	Shri Vaibhav Kaley
In personal capacity (*103/II, Vasant Vihar, P.O. New Forest, Dehra Dun 248006*)	Shri S. S. Rajput

Panel for Masonry, CED 46:P7

Organization	*Representative(s)*
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora (***Convener***)
Adlakha Associates Pvt Ltd, New Delhi	Shri P. K. Adlakha Shri V. K. Sethi (*Alternate*)
Association of Consulting Civil Engineers (India), Bengaluru	Shri Umesh B. Rao Dr Raghunath S. (*Alternate*)
Bhabha Atomic Reaseach Centre, Trombay	Shri K. Srinivas Shri H. E. Iyer (*Alternate*)
Building Materials & Technology Promotion Council, New Delhi	Dr Shailesh Kumar Agrawal Shri Pankaj Gupta (*Alternate*)
Central Public Works Department, New Delhi	Shri A. K. Jha Shri Rajesh Khare (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr Achal Kumar Mittal Dr Ajay Chourasia (*Alternate*)
CSIR-Structural Engineering Research Centre, Chennai	Dr A. Ramachandra Murthy Ms Smitha Gopinath (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (Design) Shri Vijay Shanker (*Alternate*)
Indian Association of Structural Engineers, New Delhi	Shri R. Gogia Ms Sangeeta Wij (*Alternate*)
Indian Institute of Science, Bengaluru	Dr B. V. Venkatarama Reddy Dr K. S. Nanjunda Rao (*Alternate*)

Organization	*Representative(s)*
Indian Institute of Technology Delhi, New Delhi	Representative
Indian Institute of Technology Kanpur, Kanpur	Dr Durgesh C. Rai
Indian Institute of Technology Madras, Chennai	Dr Arun Menon
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Brig Rajiv Sahani Shri Jai Prakash (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Shri Satish Sharma
The Institution of Engineers (India), Kolkata	Shri P. T. Tawase Shri Azad Jain (*Alternate*)

Panel for Plain, Reinforced and Prestressed Concrete, CED 46:P8

Organization	*Representative(s)*
In personal capacity (*7A, Autumn Hue, Seasons PPD Apartments, Kuravankonam, Kowdiar, Thiruvananthapuram 695003*)	Shri Jose Kurian (***Convener***)
Association of Consulting Civil Engineers (India), Bengaluru	Shri M. S. Sudharshan
BBR (India) Pvt Ltd, Bengaluru	Shri P. Jayachandran Shri Bharat Bhushan (*Alternate*)
Central Public Works Department, New Delhi	Chief Engineer (CDO) Shri Rajesh Khare (*Alternate*)
Creative Design Consultants & Engineers Pvt Ltd, Ghaziabad	Shri Aman Deep
CSIR-Central Building Research Institute, Roorkee	Shri S. K. Singh Shri S. C. Bose Gurram (*Alternate*)
CSIR-Central Road Research Institute, New Delhi	Shri J. B. Sengupta Shri Binod Kumar (*Alternate*)
CSIR-Structural Engineering Research Centre, Chennai	Dr K. Ramanjaneyulu Dr B. H. Bharathkumar (*Alternate*)
Delhi Development Authority, New Delhi	Shri Vijay Shanker
Gammon India Limited, Mumbai	Shri Sarada Prasana Mohanty
Hindustan Prefab Limited, New Delhi	Shri Rajesh Goel Shri S. K. Jain (*Alternate*)
Indian Association of Structural Engineers, New Delhi	Shri S. C. Mehrotra Dr Rajeev Goel (*Alternate*)
Indian Concrete Institute, Chennai	Shri A. K. Jain Shri K. P. Abraham (*Alternate*)
Indian Institute of Science, Bengaluru	Representative
Indian Institute of Technology Madras, Chennai	Dr Amlan K. Sengupta
Larsen & Toubro Limited, Chennai	Shri K. Senthilnathan Shri Sthaladipti Saha (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Representative
Ministry of Road Transport and Highways, New Delhi	Chief Engineer, Standard & Research (Bridges)
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora Shri Satish Sharma (*Alternate*)
Research, Designs and Standards Organization (Ministry of Railways), Lucknow	Shri H. L. Suthar Shri Praveen Khorana (*Alternate*)
STUP Consultants Pvt Ltd, Mumbai	Shri S. G. Joglekar Dr N. Bandyopadhyay (*Alternate*)
Tandon Consultants, New Delhi	Shri Mahesh Tandon
The Institution of Engineers (India), Kolkata	Shri S. S. Chakraborty Dr M. A. Chakrabarti (*Alternate*)
In personal capacity (*A-4/110, Konark Apartments, Kalkaji, New Delhi 110019*)	Dr A. K. Mullick
In personal capacity (*M1F1, VGN Minerva Apartments, Guruswamy Road, Nolambur, Chennai 600095*)	Dr C. Rajkumar

Organization	*Representative(s)*
In personal capacity (*E-1, 402, White House Apartments, 15th Cross, 6th Main, R.T. Nagar, Bengaluru 560032*)	Shri S. A. Reddi
In personal capacity (*7046, Sector B, Pocket 10, Vasant Kunj, New Delhi 110070*)	Shri T. Viswanathan
In personal capacity (*EA-92, Maya Enclave, Hari Nagar, New Delhi 110064*)	Shri R. C. Wason

Panel for Steel, CED 46:P9

Organization	*Representative(s)*
In personal capacity (*II-2A, Rani Meyyammai Towers, Chennai 600036*)	Dr V. Kalyanaraman (***Convener***)
Association of Consulting Civil Engineers (India), Bengaluru	Shri S. C. Mehrotra
Central Public Works Department, New Delhi	Chief Engineer (CDO) Shri A. K. Gupta (*Alternate*)
Creative Design Consultants & Engineers Pvt Ltd, Ghaziabad	Shri Aman Deep
CSIR-Structural Engineering Research Centre, Chennai	Dr G. S. Palani Dr G. Raghava (*Alternate*)
Engineers India Ltd, New Delhi	Shri Anurag Sinha Shri Vikram K. Gupta (*Alternate*)
Indian Association of Structural Engineers, New Delhi	Dr K. Srinivasa Rao Dr Abhay Gupta (*Alternate*)
Indian Institute of Technology Madras, Chennai	Dr S. Arul Jayachandran
Institute for Steel Development and Growth, Kolkata	Shri Pydi Lakshmana Rao Shri Arijit Guha (*Alternate*)
Interarch Building Products Pvt Ltd, Noida	Shri Gautam Suri Shri Sunil Pulikkal (*Alternate*)
Jindal Steel and Power Limited, New Delhi	Shri Ashwani Kumar Ms Neha Sharma (*Alternate*)
Kalpataru Power Transmission Ltd, Gandhinagar	Shri B. B. Shah Shri Sujal B. Shah (*Alternate*)
Larsen & Toubro Limited, Chennai	Shri T. Venkatesh Rao
M. N. Dastur & Co (P) Ltd, Kolkata	Shri Satyaki Sen Shri Tapan Kumar Bhaumik (*Alternate*)
MECON Limited, Ranchi	Shri A. Krishna Rao Shri C. Krishnam Raju (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Brig Girish Joshi Lt Col Sandeep Khokher (*Alternate*)
PEB Manufacturers' Association, Navi Mumbai	Shri Gautam Suri Shri Manish Garg (*Alternate*)
Research, Designs and Standards Organization (Ministry of Railways), Lucknow	Shri A. K. Dadria Shri Srijan Tripathi (*Alternate*)
Steel Authority of India Ltd (Centre for Engineering & Technology), Ranchi	Shri R. M. Chattopadhyay Shri G. K. Mitra (*Alternate*)
Tata Consulting Engineers Limited, Mumbai	Shri Pratip Bhattacharya
Tata Steel Ltd, Jamshedpur	Shri Hariharaputhiran H.
The Institution of Engineers (India), Kolkata	Shri R. P. Gupta

Panel for Prefabrication and Systems Buildings, CED 46:P10

Organization	*Representative(s)*
L&T Metro Rail (Hyderabad) Limited, Hyderabad	Shri M. P. Naidu (***Convener***)
Adlakha Associates Pvt Ltd, New Delhi	Shri P. K. Adlakha
B. G. Shirke Construction Technology Pvt Ltd, Pune	Shri Yogesh P. Kajale Shri Sanjay M. Adsar (*Alternate*)

Organization	*Representative(s)*
Building Materials & Technology Promotion Council, New Delhi	Shri J. K. Prasad
Central Public Works Department, New Delhi	Chief Engineer (CSQ) Shri Mathura Prasad (*Alternate*)
Creative Design Consultants & Engineers Pvt Ltd, Ghaziabad	Shri Aman Deep
CSIR-Central Building Research Institute, Roorkee	Dr Ajay Chourasia Shri Narender Kumar (*Alternate*)
CSIR-Structural Engineering Research Centre, Chennai	Dr J. Prabakar Dr Jolly Annie Peter (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (Design) Shri Vijay Shanker (*Alternate*)
Hindustan Prefab Limited, New Delhi	Shri Rajesh Goel Shri Satish Kumar Jain (*Alternate*)
Indian Institute of Technology Madras, Chennai	Representative
Indian Association of Structural Engineers, New Delhi	Shri Mahesh Tandon Shri N. Jain (*Alternate*)
Indian Concrete Institute, Chennai	Shri Rajkumar Pillai
Institute for Steel Development and Growth, Kolkata	Shri Arijit Guha
Kirby Building Systems India Ltd, Hyderabad	Representative
Larsen & Toubro Limited, Chennai	Shri S. Veeramani Shri C. K. Somaraju (*Alternate*)
Lloyd Insulations (India) Ltd, New Delhi	Shri Ajay Singh Shri Jitendra Kumar Jain (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Brig Girish Joshi Lt Col Gaurav Kaushik (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora Shri B. S. Rao (*Alternate*)
PEB Manufacturers' Association, Navi Mumbai	Shri Gautam Suri
Pranav Construction Systems Pvt Ltd, Navi Mumbai	Representative
Shirish Patel and Associates Consultants Pvt Ltd, Mumbai	Shri Shirish B. Patel Shri P. H. Srinivasachar (*Alternate*)
Systems Building Technologists, New Delhi	Shri G. B. Singh
Tata Bluescope Steel Ltd, Pune	Shri Krishnakant Rane
The Indian Institute of Architects, Mumbai	Shri S. R. Sikka
The Institution of Engineers (India), Kolkata	Dr R. K. Bhandari Shri Hemant S. Vadalkar (*Alternate*)

Panel for Constructional Practices and Safety, CED 46:P11

Organization	*Representative*(*s*)
In personal capacity (*102, Shraddha Temple Tree, Rustam Bagh, Bengaluru 560017*)	Shri P. Krishnan (***Convener***)
Adlakha Associates Pvt Ltd, Delhi	Shri P. K. Adlakha
Builders Association of India, Mumbai	Shri S. Senthil Kumar Shri Neerav Parmar (*Alternate*)
Central Public Works Department, New Delhi	Chief Engineer (CSQ) Shri Mathura Prasad (*Alternate*)
Construction Industries Development Council, New Delhi	Shri P. R. Swarup Shri Sunil Mahajan (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Shri S. K. Negi Shri S. K. Singh (*Alternate*)
Director General of Factory Advice Service and Labour Institute, Mumbai	Shri S. N. Borkar Shri B. N. Jha (*Alternate*)
Engineers India Ltd, New Delhi	Shri A. K. Mishra Shri D. Jana (*Alternate*)

Organization	*Representative(s)*
Gammon India Limited, Mumbai	Shri Prakash Tikare Shri Sylvester F. Pereira (*Alternate*)
Hindustan Prefab Limited, New Delhi	Shri Rajesh Goel Shri S. K. Jain (*Alternate*)
Indian Association of Structural Engineers, New Delhi	Shri Manoj Mittal Shri R. Gogia (*Alternate*)
Indian Buildings Congress, New Delhi	Shri Deepak Narayan
Indian Plywood Industries Research & Training Institute, Bengaluru	Shri Jagadish Vengala Shri Anand Nandanwar (*Alternate*)
L&T Metro Rail (Hyderabad) Limited, Hyderabad	Shri M. P. Naidu
Larsen & Toubro Limited, Chennai	Shri S. Selvaganpathy Shri N. Ramachandran (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Brig Dinesh Kumar Gupta Shri B. Varshney (*Alternate*)
NBCC (India) Limited, New Delhi	Shri H. S. Yadav Shri S. C. Jain (*Alternate*)
School of Planning and Architecture, New Delhi	Dr V. K. Paul
The Indian Institute of Architects, Mumbai	Shri Kailash Chandra Jatia Shri C. M. Sapra (*Alternate*)
The Institution of Engineers (India), Kolkata	Shri D. S. Sachdev Dr H. M. Raje (*Alternate*)
In personal capacity (*7A, Autumn Hue, Seasons PPD Apartments, Kuravankonam, Kowdiar, Thiruvananthapuram 695003*)	Shri Jose Kurian
In personal capacity (*Pratap Nursery Lane, Near Gurudwara, Panditwari, Dehra Dun 248007*)	Shri K. S. Pruthi
In personal capacity (*'Isa Vasyam' TC-18/1023, B-8/2-Lakshmi Nagar, Kesavadasapuram, Thiruvananthapuram 695004*)	Shri V. Suresh
In personal capacity (*220, Ankur Apartment, Mother Dairy Road, Patparganj, New Delhi 110092*)	Dr V. Thiruvengadam
In personal capacity (*K-11, Kailash Colony, New Delhi 110048*)	Shri Balbir Verma

Panel for Lighting and Ventilation, CED 46:P12

Organization	*Representative(s)*
In personal capacity (*435/6, New Adarsh Nagar, Roorkee 247667*)	Dr Ishwar Chand (***Convener***)
Ab Initio, Thane	Shri Shirish Deshpande
Bureau of Energy Efficiency, New Delhi	Shri Saurabh Diddi Shri Ashish Saraswat (*Alternate*)
Central Public Works Department, New Delhi	Shri Chaitanya Kumar Varma Shri D. K. Tulani (*Alternate*)
CEPT University, Ahmedabad	Shri Rajan Rawal Shri Yash Shukla (*Alternate*)
Chandigarh College of Architecture, Chandigarh	Dr Pradeep Bhagat
CSIR-Central Building Research Institute, Roorkee	Shri N. Babu Balam Shri Ibrahim Sohel (*Alternate*)
CSIR-National Physical Laboratory, New Delhi	Dr Parag Sharma Shri V. K. Jaiswal (*Alternate*)
Director General Factory Advice Service and Labour Institute, Mumbai	Shri S. N. Borkar Shri B. N. Jha (*Alternate*)
Indian Institute of Technology Delhi (Centre for Energy Studies), New Delhi	Representative
Indian Society for Lighting Engineers, New Delhi	Shri Gulshan Aghi Shri Gaurav Arora (*Alternate*)
Kaleidoscope, Noida	Shri Amor Kool
Larsen & Toubro Limited (Sustainability Group), Chennai	Shri R. Balakrishnan

Organization	*Representative(s)*
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shri D. K. Tyagi Shri Jaya Prakash (*Alternate*)
Ministry of New and Renewable Energy, New Delhi	Dr A. K. Tripathi Shri H. C. Borah (*Alternate*)
Municipal Corporation of Greater Mumbai, Mumbai	Executive Engineer Shri R. K. Rahate (*Alternate*)
Philips India Limited, Kolkata	Shrimati Sudeshna Mukhopadhyay Shri Ashish Bahal (*Alternate*)
School of Planning and Architecture, New Delhi	Dr V. K. Paul Dr Anil Dewan (*Alternate*)
Siddhirja Environment Technologies Pvt Ltd, Noida	Shri Ankur Khandelwal
Space Design Consultants, New Delhi	Prof Vinod Kumar Gupta
The Indian Institute of Architects, Mumbai	Prof Ashok B. Lall
The Institution of Engineers (India), Kolkata	Shri R. N. Rajpoot
In personal capacity (*262, Solanipuram, Roorkee 247667*)	Dr P. K. Bhargava
In personal capacity (*Shree Bhavan, Moh. Neelkhudana, Sikhola Chowk, Jwalapur, Haridwar 249407*)	Shri Shree Kumar

Panel for Electrical Installations, CED 46:P13

Organization	*Representative(s)*
In personal capacity (*Pine 002, SJR Park Vista Apartments, Haralur Road, Bengaluru 560012*)	Shri J. N. Bhavani Prasad (***Convener***)
AECOM India Private Limited, Noida	Shri Kishor Kumar
Aeon Integrated Building Design Consultants, New Delhi	Shri Puneet Gupta
Bureau of Energy Efficiency, New Delhi	Shri Saurabh Diddi Shri Ashish Saraswat (*Alternate*)
C&S Electric Limited, New Delhi	Shri P. S. Teji Shri Yashwant Sarathe (*Alternate*)
Central Electricity Authority, New Delhi	Shri R. K. Verma Shri A. K. Rajput (*Alternate*)
Central Public Works Department, New Delhi	Shri Chaitanya Kumar Varma Shri D. K. Tulani (*Alternate*)
Chief Electrical Inspectorate, Govt of Tamil Nadu, Chennai	Chief Electrical Inspector Senior Electrical Inspector (Hqrs) (*Alternate*)
DEHN India Pvt Ltd, Gurugram	Shri Vikas Almadi Shri Brijesh Malik (*Alternate*)
Delhi Metro Rail Corporation, New Delhi	Shri Sanjeev Kumar Shri Ashok Tewari (*Alternate*)
Engineers India Ltd, New Delhi	Shri B. R. Bhogal Shri Harish Kumar (*Alternate*)
ITC Ltd, Gurugram	Shri I. K. Suresh
Larsen & Toubro Limited, Chennai	Shri D. Maheswaran Shri K. K. Jembu Kailas (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shri D. K. Tyagi Shri Sunil Agarwal (*Alternate*)
Ministry of New and Renewable Energy, New Delhi	Representative
OBO Bettermann (I) Pvt Ltd, Chennai	Shri S. Gopakumar
Proion Consultants, New Delhi	Shrimati Shruti Goel
Public Works Department (Electrical Division), Govt of Maharashtra, Mumbai	Shri Sandeep A. Patil Shri Hemant Sali (*Alternate*)
Schneider Electric India Pvt Ltd, Gurugram	Shri Amitabha Sarkar Shri Rajkumar Singh (*Alternate*)
Siemens Limited, Chennai	Shri Kishor Yadao
Solar Energy Corporation of India, New Delhi	Shri C. K. Singh

Organization	*Representative(s)*
The Institution of Engineers (India), Kolkata	Prof Samiran Choudhuri Lt Gen (Retd) S. K. Jain (*Alternate*)
In personal capacity (*C-20, Sector 47, Noida 201301)*	Shri N. Nagarajan

Panel for Air Conditioning and Heating, CED 46:P14

Organization	*Representative(s)*
AECOM India Private Limited, Noida	Dr Prem C. Jain (***Convener***)
Aeon Integrated Building Design Consultants, New Delhi	Shri Ashish Rakheja
ASHRAE India Chapter, New Delhi	Shri Sunil Kher
Blowtech Air Devices Pvt Ltd, Noida	Shri Sushil K. Choudhury
Blue Star Limited, Chennai	Shri B. Thiagarajan Shri M. Srinivas Reddy (*Alternate*)
Bureau of Energy Efficiency, New Delhi	Shri Sanjay Seth Shri Saurabh Diddi (*Alternate*)
Caire Consult, Greater Noida	Shri Ankit Jain
Carrier Airconditioning & Refrigeration Ltd, Gurugram	Shri Arun Bhatia Shri Bimal Tandon (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr B. M. Suman Dr Shorab Jain (*Alternate*)
Central Public Works Department, New Delhi	Shri Chaitanya Kumar Varma Shri D. K. Tulani (*Alternate*)
CEPT University, Ahmedabad	Shri Rajan Rawal Shri Yash Shukla (*Alternate*)
Climaveneta Climate Technologies (P) Ltd, Bengaluru	Shri Anil Dev Shri Anil Sharma (*Alternate*)
Comfort Care System Pvt Ltd, New Delhi	Shri Yogesh Malhotra
Daikin Airconditioning India Pvt Ltd, Gurugram	Shri Kanwaljeet Jawa Shri Sanjay Goyal (*Alternate*)
Delhi Fire Service, Govt of NCT of Delhi, New Delhi	Shri A. K. Sharma Dr G. C. Misra (*Alternate*)
Delhi Metro Rail Corporation, New Delhi	Shri A. K. Gupta Shri A. K. Singh (*Alternate*)
Eskayem Consultants Pvt Ltd, Mumbai	Shri K. Ramachandran
IBM India Pvt Ltd, Mumbai	Shri Sudipta Sanyal
Indian Green Building Council, Hyderabad	Shri S. Srinivas Shri Praveen Kumar Soma (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	Dr Sanjeev Jain
Indian Society for Heating, Refrigeration and Air Conditioning Engineers, Delhi	Shri D. Nirmal Ram Shri Ashwini Mehra (*Alternate*)
International Ground Source Heat Pump Association, India Chapter, New Delhi	Shri Richie Mittal
Kanwal Industries Corporation, Noida	Shri Pawandeep Singh
Kirloskar Chillers Private Limited, Pune	Shri Avinash Manjul Shri Gaurang Dabholkar (*Alternate*)
Malaviya National Institute of Technology, Jaipur	Dr Jyotirmay Mathur
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shri D. K. Tyagi Shri R. N. Sinha (*Alternate*)
Schneider Electric India Pvt Ltd, Gurugram	Dr Satish Kumar
Sterling India Consulting Engineers, New Delhi	Shri G. C. Modgil Ms Khushboo Modgil (*Alternate*)
Suvidha Engineers India Ltd, Noida	Shri Ashok K. Virmani Shri Sanjay Mookerjee (*Alternate*)

Organization	*Representative(s)*
The Institution of Engineers (India), Kolkata	Shri Pradeep Chaturvedi
UL India Pvt Ltd, Bengaluru	Shri V. Manjunath
Voltas Limited, New Delhi	Shri Ashwani Sharma Shri Pankaj Goel (*Alternate*)
In personal capacity (*C-9, 9511, Vasant Kunj, New Delhi 110070*)	Dr R. S. Agarwal
In personal capacity (*262, Solanipuram, Roorkee 247667*)	Dr P. K. Bhargava
In personal capacity (*435/6, New Adarsh Nagar, Roorkee 247667*)	Dr Ishwar Chand
In personal capacity, (*E 203, Belaire, Golf Course Road, Gurugram 122022*)	Shri Prabhat Goel

Panel for Acoustics, Sound Insulation and Noise Control, CED 46:P15

Organization	*Representative(s)*
Suri and Suri Consulting Acoustical Engineers, Noida	Shri Gautam Suri (***Convener***)
All India Radio, New Delhi	Shri Animesh Chakraborty Shri Jitender Pruthi (*Alternate*)
Central Public Works Department, New Delhi	Shri Rajesh Kumar Dhiman Shri Arun Kumar Tyagi (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr S. K. Panigrahi Dr B. M. Suman (*Alternate*)
CSIR-National Physical Laboratory, New Delhi	Dr Mahavir Singh Dr Naveen Garg (*Alternate*)
Indian Institute of Science, Bengaluru	Prof M. L. Munjal
Indian Institute of Technology Kharagpur, Kharagpur	Dr A. R. Mohanty
Indian Institute of Technology Madras, Chennai	Prof S. Narayanan Prof P. Chandramouli (*Alternate*)
Indian Institute of Technology Roorkee, Roorkee	Dr E. Rajasekar
Lloyd Insulations (India) Ltd, New Delhi	Shri N. Srinivas Shri Umesh Khanna (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shri A. K. Arora Shrimati Upinder Kaur (*Alternate*)
P. S. Subramanian Associates, Chennai	Dr S. Kandaswamy Dr P. Senthil Kumar (*Alternate*)
School of Planning and Architecture, New Delhi	Dr Shuvojit Sarkar
The Indian Institute of Architects, Mumbai	Shri Indra Nath Basu
The Institution of Engineers (India), Kolkata	Shri K. V. Chaubal Shri P. K. Adlakha (*Alternate*)
In personal capacity (*608/L-1, Solani Enclave, New Adarsh Nagar, Roorkee 247667*)	Shri R. K. Srivastava

Panel for Installation of Lifts and Escalators, CED 46:P16

Organization	*Representative(s)*
TAK Consulting Pvt Ltd, Mumbai	Shri T. A. K. Mathews (***Convener***)
Builders Association of India, Mumbai	Representative
Central Public Works Department, New Delhi	Shri Chaitanya Kumar Varma Shri Sham Sunder Garg (*Alternate*)
Electrical Inspectorate, Govt of NCT of Delhi, New Delhi	Shri Mukesh Kumar Sharma Shri Jogender Singh (*Alternate*)
Chief Electrical Inspectorate, Govt of Tamil Nadu, Chennai	Shri V. Jayavel Shri P. Manohar (*Alternate*)
Delhi Development Authority, New Delhi	Shri Sandeep Mehta Shri Navneet Kumar Mittal (*Alternate*)
Delhi Fire Service, Govt of NCT of Delhi, New Delhi	Shri A. K. Sharma Dr G. C. Misra (*Alternate*)

Organization	*Representative(s)*
Directorate of Maharashtra Fire Services, Mumbai	Shri M. V. Deshmukh Shri Santosh Warick (*Alternate*)
ECE Industries Limited, Ghaziabad	Shri M. Balasubramanian Shri K. Mohan (*Alternate*)
Fujitec India Pvt Ltd, Chennai	Shri S. P. Rao Shri R. Rajesh (*Alternate*)
Inspectorate of Lifts, Directorate of Electricity, Kolkata	Representative
Johnson Lifts Pvt Ltd, Chennai	Shri T. Subramanian Shri V. Karthikeyan (*Alternate*)
Kone Elevator India Pvt Ltd, Chennai	Shri P. M. Tipnis Shri P. Gurumoorthy (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shri D. K. Tyagi Shri Sunil Agarwal (*Alternate*)
Otis Elevator Company (India) Limited, New Delhi	Shri Abhijit Dandekar Shri H. N. Prashanth (*Alternate*)
Public Works Department, Govt of Maharashtra, Mumbai	Shri Sandeep A. Patil Shri Sanjay Bhasme (*Alternate*)
Schindler India Pvt Limited, Mumbai	Shri Nimish Deshpande Shri Ronnie Dante (*Alternate*)
TAK Consulting Pvt Ltd, Mumbai	Ms Anandi Khandekar
The Indian Institute of Architects, Mumbai	Shri J. B. Karamchandani Shri Vijay Garg (*Alternate*)
The Institution of Engineer (India), Kolkata	Dr R. K. Dave
In personal capacity (*K-33A, First Floor, Green Park, New Delhi 110016*)	Shri S. K. Dheri
In personal capacity [*4, Vidharbha Samrat Co-op. Housing Society, 93 C, V. P. Road, Vile Parle* (*W*) *Mumbai 400056*]	Shri A. S. Herwadkar

Panel for Plumbing Services, CED 46:P17

Organization	*Representative(s)*
Indian Plumbing Association, New Delhi	Shri B. S. Aswathnarayan (B. S. A. Narayan) (***Convener***)
AECOM India Private Limited, Noida	Shri B. V. Shiva Kumar
Brihan Mumbai Licensed Plumbers' Association, Mumbai	Shri D. K. Daiya Shri B. M. Shah (*Alternate*)
Central Ground Water Board, Faridabad	Member (SML) Regional Director (*Alternate*)
Central Pollution Control Board, New Delhi	Dr A. B. Akolkar Dr Sanjeev Agrawal (*Alternate*)
Central Public Health and Environmental Engineering Organization, New Delhi	Representative
Central Public Works Department, New Delhi	Chief Engineer (CSQ) Shri Rabindra Kumar (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr Ajay Chourasia Shri Ibrahim Sohel (*Alternate*)
CSIR-National Environmental Engineering Research Institute, Nagpur	Shri A. S. Dubey Shri M. Karthik (*Alternate*)
Delhi Development Authority, New Delhi	Shri D. P. Singh Shri Anil Kumar Tyagi (*Alternate*)
Delhi Jal Board, New Delhi	Chief Engineer (Central & North)
East Delhi Municipal Corporation, Delhi	Shri Vijay Prakash Shri Ajay Kumar Mittal (*Alternate*)
Indian Plumbing Association, New Delhi	Shri M. K. Gupta Shri H. R. Ranganath (*Alternate*)

Organization	*Representative(s)*
Indraprastha Gas Limited, New Delhi	Shri Pankaj Sharma Shri Avijit Narayan (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shri D. K. Tyagi Shri Jaya Prakash (*Alternate*)
Municipal Corporation of Greater Mumbai, Mumbai	Deputy Hydraulic Engineer (Planning & Control) Executive Engineer (Planning & Research) (*Alternate*)
Nous Hospital Consultants Pvt Ltd, New Delhi	Dr K. B. Sood
Proion Consultants, New Delhi	Shri Sandeep Goel
Tata Consulting Engineers Limited, Mumbai	Shri Dheeraj Kaushik
The Indian Institute of Architects, Mumbai	Shri Uday Pande
The Institution of Engineers (India), Kolkata	Shri P. C. Tyagi
In personal capacity (*B/58A, Gangotri Enclave, Alaknanda, New Delhi 110019*)	Shri J. D'Cruz
In personal capacity (*610, Technology Apartments, 24 Patparganj, New Delhi 110092*)	Shri Subir Paul

Panel for Landscaping, Signs and Outdoor Display Structures, CED 46:P18

Organization	*Representative(s)*
In personal capacity (*167/8, Sarai Julena, Okhla Road, New Delhi 110025*)	Prof M. Shaheer (***Former Convener***)
Integral Designs International Studio Pvt Ltd, New Delhi	Shri Samir Mathur (***Convener***)
Central Public Works Department, New Delhi	Shri Rajesh Kumar Dhiman Shri Arun Kumar Tyagi (*Alternate*)
Delhi Development Authority, New Delhi	Representative
Delhi Urban Arts Commission, New Delhi	Shri Samir Mathur Shrimati Sonali Bhagwati (*Alternate*)
Housing & Urban Development Corporation Limited, New Delhi	Shrimati Usha Prasad Mahavir Shrimati Varsha Punhani (*Alternate*)
Indian Society of Landscape Architects, Ahmedabad	Shri Sachin Jain Ms Savita Punde (*Alternate*)
Institute of Town Planners, India, New Delhi	Dr S. K. Kulshrestha
M. S. Y. K. Design, New Delhi	Shri Yogesh Kapoor
Municipal Corporation of Greater Mumbai, Mumbai	Shrimati Minakshi Mane Shrimati Ashlesha Modak (*Alternate*)
National Institute of Design, Ahmedabad	Shri Anil Sinha Shri Immanuel Suresh (*Alternate*)
New Delhi Municipal Council, New Delhi	Shri Rakesh Goel
School of Planning and Architecture, New Delhi	Prof Rommel Mehta
South Delhi Municipal Corporation, New Delhi	Representative
The Indian Institute of Architects, Mumbai	Shri Mahesh Paliwal
The Institution of Engineers (India), Kolkata	Prof Jitendra Singh
The Maharaja Sayajirao University of Baroda, Vadodara	Prof S. R. Raval
Town and Country Planning Organization, Ministry of Urban Development, New Delhi	Shrimati Jasmin Bimra Mallik
In personal capacity (*D-198, Defence Colony, New Delhi 110024*)	Shri Ravindra Bhan
In personal capacity (*874/4, Near Pundalik Temple, Alto Porvorim, Goa 403521*)	Shrimati Vinita Vijayan Pugal

Panel for Sustainability, CED 46:P19

Organization	*Representative(s)*
AECOM India Private Limited, Noida	Dr Prem C. Jain (***Convener***)
AECOM India Private Limited, Noida	Ms Sanyukta Pande
Ankoor Sanghvi Architects, Rajkot	Shri Ankoor Sanghvi

Organization	*Representative(s)*
Building Materials & Technology Promotion Council, New Delhi	Dr Shailesh Kumar Agrawal Shri J. K. Prasad (*Alternate*)
Bureau of Energy Efficiency, New Delhi	Shri Sanjay Seth
Central Public Works Department, New Delhi	Shri Mathura Prasad Shri Rajesh Khare (*Alternate*)
CEPT University, Ahmedabad	Shri Rajan Rawal
Confederation of Real Estate Developers' Association of India, New Delhi	Shri G. Yoganand Shri Hemant Dattaji Naiknavare (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Shri Yadvendra Pandey Dr Ashok Kumar (*Alternate*)
Delhi Development Authority, New Delhi	Engineer Member Shri Ashok Ghodeshwar (*Alternate*)
Design and Development, New Delhi	Shrimati Sheetal Rakheja
Indian Association of Structural Engineers, New Delhi	Dr Ravande Kishore Shri Manoj Mittal (*Alternate*)
Indian Buildings Congress, New Delhi	Shri P. Krishnan Shri P. S. Chadha (*Alternate*)
Indian Green Building Council, Hyderabad	Shri M. Anand Shri Punit Agarwal (*Alternate*)
Indian Institute of Science (Center for Sustainable Technologies), Bengaluru	Dr Monto Mani
Institute of Town Planners, India, New Delhi	Dr S. K. Kulshrestha
International Institute of Information Technology, Hyderabad	Dr Vishal Garg Dr Pradeep Kumar Ramancharla (*Alternate*)
Kaleidoscope, Noida	Shri Amor Kool
Karan Grover and Associates, Vadodara	Shri Karan Grover
Kone Elevator India Pvt Ltd, Chennai	Shri P. M. Tipnis Shri J. Sivaraman (*Alternate*)
Larsen & Toubro Limited, ECC Division, Chennai	Shri Rajan Venkateswaran Shri Sthaladipti Saha (*Alternate*)
Malaviya National Institute of Technology, Jaipur	Dr Jyotirmay Mathur Dr Sanjay Mathur (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shrimati Upinder Kaur Shri Mahesh Arjun Ruperee (*Alternate*)
Ministry of New and Renewable Energy, New Delhi	Dr A. K. Tripathi
Panika, Ahmedabad	Shri Nimish Patel Shrimati Parul Zaveri (*Alternate*)
Proion Consultants, New Delhi	Shri Sandeep Goel
School of Planning and Architecture, New Delhi	Dr V. K. Paul
Surat Municipal Corporation, Surat	Shri J. M. Patel Shri J. S. Shah (*Alternate*)
Sustainable Urbanism International, Bengaluru	Dr Jyoti Hosagrahar
The Energy and Resources Institute, New Delhi	Ms Mili Majumdar
The Indian Institute of Architects, Mumbai	Shri Prafulla Karkhanis Shri Abhijit Ray (*Alternate*)
The Institution of Engineers (India), Kolkata	Shri G. Prabhakar Shri B. Anantaramloo (*Alternate*)
Town and Country Planning Organization, Ministry of Urban Development, New Delhi	Shri Paresh Duria Dr Pawan Kumar (*Alternate*)
UL India Pvt Ltd, Bengaluru	Shri V. Manjunath Shri Puneet Randeo (*Alternate*)
In personal capacity [*Archana 105-B, Ambika Nagar, M. G. Road, Dombivali* (*W*)*, Mumbai 421202*]	Shri Santosh Deodhar

Organization	*Representative(s)*
In personal capacity (*8th Floor, Flat No. 2, Tower 6, ATS-One Hamlet, Sector 104, Noida 201301*)	Shri T. N. Gupta
In personal capacity (*L/109, Sarita Vihar, New Delhi 110076*)	Shri Ashok Khurana
In personal capacity (*102, Shraddha Temple Tree, Rustam Bagh, Bengaluru 560017*)	Shri P. Krishnan
In personal capacity (*7A, Autumn Hue, Seasons PPD Apartments, Kuravankonam, Kowdiar, Thiruvananthapuram 695003*)	Shri Jose Kurian
In personal capacity (*167/8, Sarai Julena, Okhla Road, New Delhi 110025*)	Prof M. Shaheer
In personal capacity (*'Isa Vasyam' TC-18/1023, B-8/2-Lakshmi Nagar, Kesavadasapuram, Thiruvananthapuram 695004*)	Shri V. Suresh

Panel for Glass and Glazing, CED 46:P20

Organization	*Representative*(*s*)
In personal capacity (*A2/16, Sri Agrasen Society, Plot No. 10, Sector 7, Dwarka, New Delhi 110075*)	Shri R. N. Dandekar (***Convener***)
AECOM India Private Limited, Noida	Shri Vijay K. Mattoo Shri Sunil Shahani (*Alternate*)
Ahluwalia Contracts India Limited, New Delhi	Shri Pradeep Kumar Shri Jaspal Singh Rawat (*Alternate*)
All India Glass Manufacturers' Federation, New Delhi	Shri Somasundaram Senthil Shri Rupinder Shelly (*Alternate*)
Bureau of Energy Efficiency, New Delhi	Representative
Central Public Works Department, New Delhi	Shri Mathura Prasad
Confederation of Construction Products and Services, New Delhi	Shri Shashi Kant Shri Deepak Gahlowt (*Alternate*)
Creative Design Consultants & Engineers Pvt Ltd, Ghaziabad	Shri Aman Deep Shri Barjinder Singh Ghai (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr Ashok Kumar Shri S. K. Negi (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (Design) Shri Vijay Shanker (*Alternate*)
Facade India Testing Inc, Thane	Shri V. S. Ravi Shri Pravin Gaikwad (*Alternate*)
Glazing Society of India, Chennai	Shri R. Subramanian Shri G. N. Gohul Deepak (*Alternate*)
GSC Glass Ltd, Greater Noida	Shri C. J. Singh
Indian Association of Structural Engineers, New Delhi	Shri S. C. Mehrotra Shri Mahesh Tandon (*Alternate*)
Indian Institute of Technology Madras, Chennai	Dr S. Arul Jayachandran
Indian Institute of Technology Roorkee, Roorkee	Dr Avlokita Agrawal Dr E. Rajasekar (*Alternate*)
Larsen & Toubro Limited, Chennai	Shri Sthaladipti Saha
Meinhardt Facade Technology India Pvt Ltd, Chennai	Shri Mahesh Arumugam
Municipal Corporation of Greater Mumbai (Mumbai Fire Brigade), Mumbai	Chief Fire Officer Deputy Chief Fire Officer (*Alternate*)
NBCC (India) Limited, New Delhi	Shri Hem Raj Shri H. S. Yadav (*Alternate*)
Saint-Gobain Glass India, Chennai	Shri Manish Srivastava Shri N. Murali (*Alternate*)
Schueco India Private Limited, Bengaluru	Shri Antony John Shri Piyush Kumar Srivastava (*Alternate*)
The Indian Institute of Architects, Mumbai	Shri Vijay Garg Shri Ashutosh Agarwal (*Alternate*)

Organization	*Representative(s)*
The Institution of Engineers (India), Kolkata	Shri P. K. Adlakha
Winwall Technology India Pvt Ltd, Chennai	Shri P. Jothi Ramalingam
In personal capacity (*K-33A, First Floor, Green Park, New Delhi 110016*)	Shri S. K. Dheri

Panel for Information and Communication Enabled Installations, CED 46:P21

Organization	*Representative(s)*
In personal capacity (*C-501, Shivam Apartments*, *Plot No. 14, Sector-12, Dwarka, New Delhi 110078*)	Shri A. K. Mittal (***Convener***)
Airports Authority of India, New Delhi	Shri D. K. Kamra Shri Vivek Chourey (*Alternate*)
Association of Unified Telecom Service Providers of India, New Delhi	Representative
Building Industry Consulting Service International - India District, Mumbai	Shri Ninad Mohan Desai
Cellular Operators Association of India, New Delhi	Shri Vikram Tiwathia Shrimati Vertika Misra (*Alternate*)
Central Industrial Security Force, New Delhi	Shri Naresh Kumar
Central Public Works Department, New Delhi	Shri Chaitanya Kumar Varma Shri D. K. Tulani (*Alternate*)
CMAI Association of India, New Delhi	Prof N. K. Goyal
Department of Telecommunication, Ministry of Communications, New Delhi	Shri V. K. Hirna Shri Arvind Chawla (*Alternate* 1) Shri Saurabh Chaturvedi (*Alternate* 2)
Gujarat International Finance Tec-City Company Limited, Gandhinagar	Shri Ramakant Jha Shri Nilesh Purey (*Alternate*)
Indian Buildings Congress, New Delhi	Shri Bhishma Kumar Chugh Shri P. S. Chadha (*Alternate*)
Internet Service Providers Association of India, New Delhi	Shri Brajesh Chandra Jain
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Col R. Baijal
Ministry of Electronics & Information Technology, New Delhi	Dr Anil Kumar Kaushik Shri Prakash Kumar (*Alternate*)
Ministry of Railways, New Delhi	Shrimati Vinita Narera
Proion Consultants, New Delhi	Shrimati Shruti Goel
Roads and Buildings Department, Govt of Telangana, Hyderabad	Shri G. Ramakrishna Kumar Deputy Chief Engineer (*Alternate*)
Sterlite Technologies, Pune	Shri S. N. Gupta Shri Priyadarshi Sidhartha (*Alternate*)
Telecom System Design & Manufacturers Association, New Delhi	Shri Bhupesh Yadav Shri Rahul Dubey (*Alternate*)
The Indian Institute of Architects, Mumbai	Representative
The Institution of Engineers (India), Kolkata	Representative
Town and Country Planning Organization, Ministry of Urban Development, New Delhi	Shri K. K. Joadder Shri R. Srinivas (*Alternate*)
UBICO Networks Pvt Ltd, Gurugram	Shri Nitin Kohli
In personal capacity (*Pine 002, SJR Park Vista Apartments, Haralur Road, Bengaluru 560012*)	Shri J. N. Bhavani Prasad

Panel for Asset and Facility Management, CED 46:P22

Organization	*Representative(s)*
In personal capacity (*411, Sector A, Pocket C, Vasant Kunj, New Delhi 110070*)	Shri Krishna Kant (***Convener***)
Airports Authority of India, New Delhi	Shri D. K. Kamra Shri Vivek Chourey (*Alternate*)

Organization	*Representative(s)*
C. B. Richard Ellis, Gurugram	Shri Aneesh Kadyan
Central Industrial Security Force, New Delhi	Dr K. C. Wadhwa Shrimati Harpreet Kaur (*Alternate*)
Central Public Works Department, New Delhi	Shri Prabhakar Singh Shri Pramod Kumar Singh (*Alternate*)
Climaveneta Climate Technologies (P) Ltd, Bengaluru	Shri Anil Dev Shri Nitin Joshi (*Alternate*)
Cushman and Wakefield India Pvt Ltd, Gurugram	Shri Dinesh Wadehra Shri Sajit Sankar (*Alternate*)
DLF Home Developers Limited, Gurugram	Shri Gautam Dey
Honeywell International India Pvt Ltd, Gurugram	Shri Varun Jain
Indian Buildings Congress, New Delhi	Shri Deepak Narayan
Jones Lang Lasalle Meghraj Building Operations Pvt Ltd, Gurugram	Shri Sumit Rakshit
Medanta Medicity, Gurugram	Shri Sanjay Batra
Military Engineer Services, Engineer-in-Chief's Branch, Army HQ, New Delhi	Shri D. K. Tyagi Lt Col Gaurav Kaushik (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Shri V. V. Arora Shri Brijesh Singh (*Alternate*)
Realty Automation and Security Systems Pvt Ltd, Pune	Shri Nitin Joshi
Security and Intelligence Services (India) Ltd, New Delhi	Shri Ritu Raj Sinha Brig (Retd) U. K. Dhar (*Alternate*)
In personal capacity (*H-43, Sector 39, Noida 201301*)	Shri Anil Kumar Arora
In personal capacity (*K-33A, First Floor, Green Park, New Delhi 110016*)	Shri S. K. Dheri
In personal capacity (*C-2/2324, Vasant Kunj, New Delhi 110070*)	Shri Chandra Pal
In personal capacity (*B-31, Manas Apartments, Mayur Vihar, Phase 1, Delhi 110091*)	Shri V. K. Sharma
In personal capacity (*D-39, Saket, New Delhi 110017*)	Shri Y. Taneja

Important Explanatory Note for Users of the Code

In any Part/Section of this Code, where reference is made to 'good practice' in relation to design, constructional procedures or other related information, and where reference is made to 'accepted standard' in relation to material specification, testing, or other related information, the Indian Standards listed at the end of the Part/Section shall be used as a guide to the interpretation.

At the time of publication, the editions indicated in the standards were valid. All standards are subject to revision and parties to agreements based on any Part/Section are encouraged to investigate the possibility of applying the most recent editions of the standards.

In the list of standards given at the end of a Part/Section, the number appearing within parentheses in the first column indicates the number of the reference of the standard in the Part/Section. For example:

a) Good practice [3(2)] refers to the Indian Standard given at serial number (2) of the list of standards given at the end of Part 3, that is, IS 4878:1986 'Byelaws for construction of cinema buildings (*first revision*)'.

b) Good practice [4(6)] refers to the Indian Standard given at serial number (6) of the list of standards given at the end of Part 4, that is, IS 1646:2015 'Code of practice for fire safety of buildings (General):Electrical installations (*third revision*)'.

c) Good practice [6-1(5)] refers to the Indian Standard given at serial number (5) of the list of standards given at the end of Section 1 of Part 6, that is, IS 15498:2004 'Guidelines for improving the cyclonic resistance of low rise houses and other buildings/structures'.

d) Accepted standard [6-2(6)] refers to the Indian Standard given at serial number (6) of the list of standards given at the end of Section 2 of Part 6, that is, IS 1498:1970 'Classification and identification of soils for general engineering purposes (*first revision*)'.

e) Accepted standards [6-5A(18)] refers to the Indian Standards given at serial number (18) of the list of standards given at the end of Subsection 5A of Part 6, that is, IS 516:1959 'Method of test for strength of concrete' and IS 5816:1999 'Method of test for splitting tensile strength of concrete (*first revision*)'.

f) Accepted standard [6-5B(20)] refers to the Indian Standard given at serial number (20) of the list of standards given at the end of Subsection 5B of Part 6, that is, IS 9103:1999 'Specification for admixtures for concrete (*first revision*)'.

INFORMATION FOR THE USERS ABOUT AVAILABILITY OF THE CODE IN GROUPS

For the convenience of the users, the National Building Code of India 2016 is available as a comprehensive volume as well as in the following five groups, each incorporating the related Parts/Sections dealing with particular area of building activity:

Group 1	**For Development/ Building Planning and Related Aspects**	Part 0	Integrated Approach — Prerequisite for Applying Provisions of the Code
		Part 1	Definitions
		Part 2	Administration
		Part 3	Development Control Rules and General Building Requirements
		Part 4	Fire and Life Safety
		Part 5	Building Materials
		Part 10	Landscape Development, Signs And Outdoor Display Structures
			Section 1 Landscape Planning, Design and Development
			Section 2 Signs and Outdoor Display Structures
		Part 11	Approach to Sustainability
Group 2	**For Structural Design and Related Aspects**	Part 0	Integrated Approach — Prerequisite for Applying Provisions of the Code
		Part 6	Structural Design
			Section 1 Loads, Forces and Effects
			Section 2 Soils and Foundations
			Section 3 Timber and Bamboo
			3A Timber
			3B Bamboo
			Section 4 Masonry
			Section 5 Concrete
			5A Plain and Reinforced Concrete
			5B Prestressed Concrete
			Section 6 Steel
			Section 7 Prefabrication, Systems Building and Mixed/ Composite Construction
			7A Prefabricated Concrete
			7B Systems Building and Mixed/ Composite Construction
			Section 8 Glass and Glazing
		Part 11	Approach to Sustainability
Group 3	**For Aspects Relating to Construction, and Asset/ Facility Management**	Part 0	Integrated Approach — Prerequisite for Applying Provisions of the Code
		Part 7	Construction Management, Practices and Safety
		Part 11	Approach to Sustainability
		Part 12	Asset and Facility Management
Group 4	**For Aspects Relating to Building Services**	Part 0	Integrated Approach — Prerequisite for Applying Provisions of the Code
		Part 8	Building Services
			Section 1 Lighting and Natural Ventilation
			Section 2 Electrical and Allied Installations
			Section 3 Air Conditioning, Heating and Mechanical Ventilation
			Section 4 Acoustics, Sound Insulation and Noise Control
			Section 5 Installation of Lifts, Escalators and Moving Walks
			5A Lifts
			5B Escalators and Moving Walks
			Section 6 Information and Communication Enabled Installations
		Part 11	Approach to Sustainability
Group 5	**For Aspects Relating to Plumbing Services and Solid Waste Management**	Part 0	Integrated Approach — Prerequisite for Applying Provisions of the Code
		Part 9	Plumbing Services (including Solid Waste Management)
			Section 1 Water Supply
			Section 2 Drainage and Sanitation
			Section 3 Solid Waste Management
			Section 4 Gas Supply
		Part 11	Approach to Sustainability

The information contained in different groups will serve the concerned professionals dealing with the respective areas. However, it is advisable that professionals essentially dealing with any of the above groups should also refer the other groups.

NATIONAL BUILDING CODE OF INDIA

PART 0 INTEGRATED APPROACH — PREREQUISITE FOR APPLYING PROVISIONS OF THE CODE

BUREAU OF INDIAN STANDARDS

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FOREWORD

This Code (Part 0) covers guidelines to be followed for judicious implementation of the provisions of various Parts/Sections of the National Building Code of India following an integrated approach.

In order to provide safe, healthy and sustainable habitat, careful consideration needs to be paid to the building construction activity. Building planning, designing and construction activities have developed over the centuries. Large number of ancient monuments and historical buildings all over the world bear testimony to the growth of civilization from the prehistoric era with the extensive use of manual labour and simple systems as appropriate to those ages to the present day mechanized and electronically controlled operations for designing and constructing buildings and for operating and maintaining systems and services. In those days, buildings were conceptualized and built by master builders with high levels of artisan skills. Technological and socio-economic developments in recent times have led to remarkable increase in demand for more and more sophistication in buildings resulting in ever increasing complexities. These perforce demand high levels of inputs from professionals of different disciplines such as architecture, civil engineering, structural engineering, functional and life safety services including special aspects relating to utilities, landscaping, etc, in conceptualization, spatial planning, design and construction of buildings of various material and technology streams, various services including operation, maintenance, repairs and rehabilitation aspects throughout the service life of the building.

This Code, besides prescribing various provisions, also allows freedom of action to adopt appropriate practices and provides for building planning, designing and construction for absorbing traditional practices as well as latest developments in knowledge in the various disciplines as relevant to a building including computer aided and/or other modern sensors aided activities in the various stages of conceptualization, planning, designing, constructing, maintaining and repairing the buildings. India being a large country with substantial variations from region to region, this Code has endeavoured to meet the requirements of different regions of the country, both urban and rural, by taking into consideration factors such as climatic and environmental conditions, geographical terrain, vulnerability to natural disasters, ecologically appropriate practices, use of eco-friendly materials, use of appropriate conventional and alternative technologies, reduction of pollution, protection and improvement of local environment and also socio-economic considerations, towards the creation of sustainable human settlements.

This Part of the Code dealing with ‘integrated approach’ gives an overall direction for practical applications of the provisions of different specialized aspects of spatial planning, designing and construction of buildings, creation of services, and proposes an integrated approach for utilizing appropriate knowledge and experience of qualified professionals, right from the conceptualization through construction and completion stages of a building project and indeed during the entire life cycle. The ‘integrated approach’ should not only take care of functional, aesthetic and safety aspects, but also the operational and maintenance requirements. Also, cost optimization has to be achieved through proper selection of materials, techniques, equipment installations, etc. Further, value engineering and appropriate management techniques should be applied to achieve the aim set forth for the purpose of construction of a building fully meeting the specified and implied needs of spatial functions, user requirements, safety and durability aspects, life and health safety, comfort, services, etc, in the building. Integration among various professionals/services may be facilitated by use of appropriate software, systems, tools, simulations, etc.

The aim of the ‘integrated approach’ is to get the maximum benefit from the building and its services in terms of objectives such as quality, timeliness and cost-effectiveness. In the team approach which is an essential pre-requisite for integrated approach, the aim clearly is to maximize the efficiency of the total system through appropriate optimization of each of its sub-systems, and ensuring coordination among various disciplines and agencies that are involved during planning, design, construction, operation and maintenance of buildings and the associated infrastructure. In other words, in the team, the timely inputs from each of the professional disciplines have to be so optimized that the total system’s efficiency becomes the maximum. It may be emphasized that maximizing the efficiencies of each sub-system may not necessarily assure the maximization of the efficiency of the total system. It needs hardly to be stated that specified or implied safety will always get precedence over functional efficiency

and economy. Further, progressive approach such as that relating to the concept of intelligent buildings would be best taken care of by the 'integrated approach' as laid down in this Part.

The continued effort towards development may progressively be aimed at leading us to achieve better and smarter solutions, such as through development of smart cities encompassing sustainability apart from utilizing optimum resources and delivering through intelligent ways, the various facilities and amenities. The integrated approach enshrined in this Part is of immense help in achieving the objective of such smart buildings and cities. It goes without saying that the objective of sustainable development as professed in Part 11 'Approach to Sustainability' of the Code can be best achieved through such an integrated approach.

Proper construction management and certification covering the various dimensions brought out above may go a long way in achieving the above goal of real integrated approach.

This Part was first introduced in 2005 as an adjunct to various other Parts/Sections of the Code. Based on the experience gained in the use of this Part, this revision has been brought out. The significant modifications incorporated in this revision include the following:

a) List of professionals who may be part of multi-disciplinary teams has been updated.
b) Considering the latest provisions relating to construction project management now included in the Part 7 'Construction Management, Practices and Safety' of the Code, the provisions in this Part relevant to construction project management functions have been accordingly updated.
c) Various considerations to be taken care of by the design teams, project/construction management team, and operation and maintenance team have been further reinforced considering the present day requirements and expectations from buildings and built environment.
d) Provisions relating to operation and maintenance have been further extended to include decommissioning and deconstruction (including demolition) to give importance to planned decommissioning and deconstruction after the useful service life of the built facility is over.
e) With the introduction of the new Part 11 'Approach to Sustainability' of the Code, appropriate references to sustainability wherever relevant to the integrated approach, have been taken care of.
f) Accessibility and universal design for ensuring barrier free environment for persons with disabilities has been emphasized by further reinforcing the provisions to this effect appropriately.
g) Annex A giving brief details of the coverage of various provisions under different Parts/Sections of the Code, has been updated, considering modification in the scopes of existing Parts/Sections and inclusion of new Parts/Sections.

NATIONAL BUILDING CODE OF INDIA

PART 0 INTEGRATED APPROACH — PREREQUISITE FOR APPLYING PROVISIONS OF THE CODE

1 SCOPE

This Code (Part 0) covers guidelines to be followed for judicious implementation of the provisions of various Parts/Sections of the National Building Code of India following an integrated approach.

2 TERMINOLOGY

For the purpose of this Part, the following definitions shall apply.

2.1 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'.

2.2 Building — Any structure for whatsoever purpose and of whatsoever materials constructed and every part thereof whether used as human habitation or not and includes foundation, plinth, walls, floors, roofs, chimneys, plumbing and building services, fixed platforms, verandah, balcony, cornice or projection, part of a building or anything affixed thereto or any wall enclosing or intended to enclose any land or space and signs and outdoor display structures. Tents/ *Shamianahs*/*Pandals*, tarpaulin shelters, etc, erected for temporary and ceremonial occasions shall not be considered as building.

2.3 Owner — A person, a group of persons or a body having a legal interest in land and/or building thereon. This includes freeholders, leaseholders or those holding a sublease, who will have legal right to occupation and have liabilities in respect of safety or building condition.

In the case of lease or sublease holders, as far as ownership with respect to the structure is concerned, the structure of a flat or structure on a plot belongs to the allottee/lessee till the allotment/lease subsists.

NOTE — For the purpose of the Code, the word 'owner' will also cover the generally understood terms like 'client', 'user', etc.

3 GENERAL

3.1 Buildings shall be classified as Residential, Educational, Institutional, Assembly, Business, Mercantile, Industrial, Storage and Hazardous in groups and sub-divisions as classified in Part 4 'Fire and Life Safety' of the Code.

For various related provisions of buildings with respect to administration; development control rules and general building requirements; building materials; fire and life safety; structural design; construction management, practices and safety; building and plumbing services; landscape development, signs and outdoor display structures; sustainability; asset and facility management, and other Parts/Sections of the Code may be referred to. For provisions on sustainability of buildings and built environment, reference to the concerned Part may be made, which while also referring to the other Parts/Sections as may be required, gives a comprehensive approach to sustainability.

3.2 The brief coverage in various Parts/Sections of the Code which cover detailed provisions on different aspects of development of land/building construction activity, are given in Annex A, with a view to providing an overview for the users of the Code.

4 TEAM APPROACH

4.1 A land development/building project and the built facility during its service life comprises the following major stages:

a) Location/siting,
b) Conceptualization and planning,
c) Designing and detailing,
d) Construction/execution,
e) Operation and maintenance, and
f) Decommissioning and deconstruction.

Each stage necessarily requires professionals of many disciplines who should work together as a well coordinated team to achieve the desired product delivery with quality and safety and other objectives, in an effective manner.

Appropriate multi-disciplinary teams (*see* **4.1.1** to **4.1.3**) need to be constituted to successfully meet the requirements of different stages. Each team may comprise need based professionals out of the following depending upon the nature, magnitude and complexity of the project:

1) Architect;
2) Civil engineer;
3) Structural engineer;
4) Geotechnical engineer;
5) Electrical engineer;
6) Plumbing engineer;

7) Fire protection engineer;
8) Heating, ventilation and air conditioning engineer;
9) Lift, escalator and moving walk specialist;
10) Acoustics specialist;
11) Information/communication technology engineer;
12) Health, safety and environment specialist;
13) Environment/sustainability specialist;
14) Town planner;
15) Urban designer;
16) Landscape architect;
17) Security system specialist;
18) Interior designer;
19) Quantity surveyor;
20) Project/construction manager;
21) Accessibility and universal design specialist;
22) Asset/facility manager; and
23) Other subject specialist(s).

It is important that leaders and members of design team, project management/construction management team, and operation and maintenance team, depending on the size and complexity of the project, are carefully selected considering their qualification, experience and expertise in these fields.

4.1.1 *Design Team*

In building projects, various aspects like form; space planning; aesthetics; fire and life safety; structural adequacy; plumbing services; lighting and natural ventilation; electrical and allied installations; air conditioning, heating and mechanical ventilation; acoustics, sound insulation and noise control; installation of lifts and escalators; building automation; data and voice communication; other utility services installations; landscape planning, design and development; urban planning; etc need to be kept in view right at the concept stage. The project requiring such multi-disciplinary inputs need a coordinated approach among the professionals for proper integration of various design inputs. For this, and to take care of the complexities of multi-disciplinary requirements, a design team of professionals from the required disciplines shall be constituted at the appropriate stage. Here, it is desirable that the multi-disciplinary integration is initiated right from the concept stage. The team shall finalize the plan. The composition of the team shall depend on the nature, magnitude and complexities of the project. Design is an evolutionary and participatory process, where participation of the owner constitutes a very important input at all stages, and the same shall be ensured by the design team.

To ensure proper implementation of the design, the design team, may be associated during the construction/ execution stage.

4.1.2 *Project Management and Construction Management Teams*

The objective of project management or construction management is primarily to achieve accomplishment of a project in accordance with the designs and specifications in a stipulated time and cost framework, etc, with a degree of assurance prior to commencement and satisfaction on completion and commissioning.

For large projects, separate teams of experienced professionals from the required disciplines may be constituted for project management (including planning and scheduling) and for construction management depending upon the complexities of the project. However, for smaller projects these teams may be combined. The teams shall be responsible for day-to-day execution, supervision, quality control, etc, and shall ensure inter-disciplinary coordination during the construction stage. The team shall be responsible to achieve satisfactory completion of the project in respect of all relevant project management functions like cost, time, quality, safety, etc. Some members of the design team may also be included in the project management team and/or associated actively during the project execution stage.

4.1.3 *Operation and Maintenance Team*

Operation, maintenance and repairs also require a multi-disciplinary approach to ensure that all the requirements of the users are satisfactorily met. During maintenance and repairs, the jobs requiring inter-disciplinary coordination have to be executed in such a manner as not only to cause least inconvenience to the user but also to ensure that there is no mismatch or damage to the structure, finishing, fittings and fixtures, and to preserve the integrity of other services. For carrying out routine maintenance/repair jobs, utilization of the services of trained technicians preferably having multi-disciplinary skills should be encouraged.

Special repairs, rehabilitation and retrofitting are specialized jobs which demand knowledge of the existing structure/installations. Association of concerned specialists may be helpful for these works.

The operation and maintenance team may also be known as asset and facility management or estate management team.

5 PLANNING, DESIGNING AND DEVELOPMENT

5.1 The main functions of design team (*see* **4.1.1**) constituted for the planning, designing and development, are as under:

a) Formalization of design brief in consultation with the owner.
b) Site survey and soil investigation.
c) Preparation of alternative concept designs, highlighting both their positive and negative aspects.
d) Selection of a concept in consultation with and with the consent of the owner.
e) Sizing the system.
f) Development of design, involving:
    1) Integration of architecture, structure and services,
    2) Synthesis of requirements of each discipline, and
    3) Interaction with each other within the design team and with the owner.
g) Preparation of preliminary designs and drawings and obtaining the owners' approval.
h) Preparation of preliminary cost estimates for approval of owner.
j) Preparation of work-breakdown structure and programme for pre-construction activities.
k) Assisting client to obtain approvals of the Authority/authorities.
m) Preparation of detailed specifications and construction working drawings with integration of engineering inputs of all concerned disciplines.
n) Preparation of detailed design of each discipline for various services.
p) Peer review/proof checking of the drawings/ designs in case of major/important projects, depending upon their complexity and sensitivity.
q) Preparation of detailed cost estimate.
r) Obtaining final approval of the client.
s) Preparation of bill of quantities, specifications and tender documents.

5.2 The following considerations, as may be applicable to the project, may be considered during planning, notwithstanding the other relevant aspects specifically prescribed in concerned Parts/Sections of this Code; these considerations in general are with the objective of addressing important issues like environmental protection, energy conservation, cultural issues, creating barrier free built-environment, safety aspects, etc, all of these leading towards sustainable development, and have to be applied with due regard to the specific requirements of size and type of project:

1) Geoclimatic, geological and topographical features.
2) Geotechnical considerations with respect to soil/rock, water table, etc.
3) Varied sociological pattern of living in the country.
4) Effective land use to cater to the needs of the society in a most convenient manner.
5) Modular planning and standardization to take care of future planning giving due consideration to the specified planning controls.
6) Emphasis on daylight utilization, natural ventilation, shielding, and window area and disposition; daylighting to be supplemented with an integrated design of artificial lighting.
7) Optimum utilization of renewable energy sources duly integrated in the overall energy system design; with consideration of active and passive aspects in building design including thermal performance of building envelope.
8) Rain water harvesting, integrated water management including recycle and reuse, etc.
9) Use of appropriate building materials considering aspects like energy consumption in production, transportation and utilization, recyclability, etc, and for deconstruction, for promoting sustainable development.
10) Requisite mandatory provisions for persons with disabilities.
11) Acoustical controls for buildings and the surroundings.
12) Promotion of artwork in buildings, especially, major/important buildings.
13) Due cognizance of recommendations of the Archaeological Survey of India with regard to national monuments and construction in archaeologically important sites.
14) Due cognizance of relevant provisions applicable to coastal regulation zone.
15) Conservation of heritage structures and areas, with due consideration to the concerns of the archaeological departments.
16) Environmental and social impact analysis.
17) Design of services with emphasis on aspects of energy efficiency, environment friendliness and maintainability.
18) Integrated waste management.
19) Voice and data communication, automation of building services, and intelligent building; use of security and surveillance system in important and sensitive buildings, such as access control for the people as well as for vehicle.
20) Interlinking of fire alarm system, fire protection system, security system, ventilation, electrical systems, etc.

21) Analysis of emergency power, standby power requirement and captive power systems.

22) Cost optimization through techniques like value engineering.

23) Adoption of innovative technologies giving due consideration to constructability and quality aspects.

24) Instrumentation of building, monitoring and use of information so generated to effect improvements in planning and design of future building projects, and use of such instrumentation to monitor any adverse effect on the building as well as neighbouring buildings.

6 CONSTRUCTION/EXECUTION (ACTUALIZATION)

6.1 The main functions of the teams (*see* **4.1.2**) constituted for Project Management/Construction Management may be to,

a) specify criteria for selection of constructors;
b) specify quality control, quality audit system and safety system;
c) short-list constructors;
d) have pre-bid meetings with the intending constructors;
e) receive and evaluate tenders;
f) select constructors;
g) execution and supervision;
h) monitor for quality, time and cost control and for other project management functions;
j) prepare/certify the completion (as-built) drawings;
k) assist in getting statutory approvals at various stages; and
m) ensure availability of operation manuals for field use.

6.2 Apart from the specific provisions laid down in the concerned Parts/Sections of the Code, the following considerations, as may be applicable to the project concerned, shall be given due attention:

a) Adopting scientific principles of construction project management, including quality, cost, time, and safety management.
b) Engagement of executing and supervising agencies, which meet the specified norms of skills, specialization, experience, resourcefulness, etc, for the work.
c) Ensuring inter-disciplinary coordination during construction.
d) Contract management and techno-legal aspects.
e) Completion, commissioning and trial run of installations/equipment and their operation and maintenance through the suppliers/other teams, where necessary.
f) Make available shop drawings as well as as-built drawings for the building and services.
g) Arrange all maintenance and operation manual from the concerned suppliers/manufacturers.

6.3 The team of professionals (*see* **4.1.2**) shall work and monitor the project activities for successful construction/execution of the project with regard to various construction project management functions, particularly, time, cost, quality and safety.

7 OPERATION, MAINTENANCE, DECOMMISSIONING AND DECONSTRUCTION

7.1 The team of professionals (*see* **4.1.3**) shall set up a system of periodic maintenance and upkeep of constructed buildings.

7.2 The operation and maintenance team shall be responsible for preparation/application of operation and maintenance manual, and draw maintenance schedule/frequencies and guidelines for maintenance personnel. Apart from the specific provisions laid down in concerned Parts/Sections of the Code, the following, as may be applicable to the project concerned, shall additionally be taken into account:

a) Periodic validation of buildings by competent professionals through inspection of the buildings in respect of structural safety and safety of electrical and other installations and ensuring that all fire safety equipment/systems are in proper working condition.
b) Periodic accessibility audits to ensure that the buildings remain universally accessible and barrier free for persons with disabilities.
c) Preparation of predictive/preventive maintenance schedules for all installations in the building and strictly following the same; the record of the preventive maintenance to be properly kept.
d) Ensuring inter-disciplinary coordination during operation and maintenance, and repairs; deployment of trained personnel with multi-disciplinary skills to be encouraged.
e) Condition survey of structures and installations, identification of distress of various elements and initiating plans for rehabilitation/retrofitting well in time. Post-disaster investigations by competent engineer/specialist.

7.3 The proposals for rehabilitation/retrofitting should be prepared after detailed investigations through visual inspection, maintenance records and testing as required and got executed through specialized agencies under the guidance and supervision of competent professionals. For further details and good practices regarding the same, reference shall be made to Part 7 'Construction Management, Practices and Safety' of the Code.

7.4 After the useful service life of a building is over, or for other reasons such as redevelopment and proposed change in use of the land and built facility, it may be required to deconstruct a building. Such a deconstruction is preceded by an organized decommissioning. The decommissioning and deconstruction needs to be well planned and coordinated among concerned building professionals so as to ensure safety during such operations, as also retrieval of appropriate products, components and systems, for their possible reuse or recycling, or disposal as may be appropriate. This may in turn require a comprehensive decommissioning and deconstruction (including demolition) plan, which may be prepared during the initial stages of the project and kept available for use at the end of life cycle of the same.

ANNEX A

(*Clause* 3.2)

BRIEF DETAILS OF THE COVERAGE OF VARIOUS PROVISIONS UNDER DIFFERENT PARTS/SECTIONS OF THE CODE

A-1 PART 1 DEFINITIONS

It lists the terms appearing in all the Parts/Sections of the National Building Code of India. However, some common definitions are reproduced in this Part also.

A-2 PART 2 ADMINISTRATION

It covers the administrative aspects of the Code, such as applicability of the Code, organization of building department for enforcement of the Code, procedure for obtaining development and building permits, and responsibility of the owner and all professionals involved in the planning, design and construction of the building.

A-3 PART 3 DEVELOPMENT CONTROL RULES AND GENERAL BUILDING REQUIREMENTS

It covers the development control rules and general building requirements for proper planning and design at the layout and building level to ensure health safety, public safety and desired quality of life. It also covers requirements for accessibility in buildings and built environment for elders and persons with disabilities.

A-4 PART 4 FIRE AND LIFE SAFETY

It covers the requirements for fire prevention, life safety in relation to fire, and fire protection of buildings. It also specifies occupancy-wise classification, constructional aspects, egress requirements and protection features that are necessary to minimise danger to life and property from fire.

A-5 PART 5 BUILDING MATERIALS

It covers the requirements of building materials and components, and criteria for accepting new or alternative building materials and components.

A-6 PART 6 STRUCTURAL DESIGN

This Part through its eight Sections provides for structural adequacy of buildings to deal with both internal and external environment, and provides guidance to engineers/structural engineers for varied usage of material/technology types for building design.

A-6.1 Section 1 Loads, Forces and Effects

It covers basic design loads to be assumed in the design of buildings. The imposed loads, wind loads, seismic forces, snow loads and other loads, which are specified therein, are minimum working loads which should be taken into consideration for purposes of design.

A-6.2 Section 2 Soils and Foundations

It covers geotechnical design (principles) of building foundations, such as shallow foundations, like, continuous strip footings, combined footings, raft foundations, deep foundations like pile foundations and other foundation systems to ensure safety and serviceability without exceeding the permissible stresses of the materials of foundations and the bearing capacity of the supporting soil/rock. It also covers provisions relating to preliminary work required for

construction of foundations and protection of excavation.

A-6.3 Section 3 Timber and Bamboo

A-6.3.1 *Section 3A Timber*

It covers the general principles involved in the design of structural timber in buildings, including elements of structures connected together by fasteners/fastening techniques.

A-6.3.2 *Section 3B Bamboo*

It covers the general principles involved in the design of structural bamboo in buildings with regard to mechanical resistance and durability of structures. It also covers design of both bamboo (round bamboo, split bamboo, glued laminated bamboo) and bamboo-based panels joined together with adhesives or mechanical fasteners. It also covers minimum strength data, dimensional stability, grading requirements and traditional bamboo joints for quality assurance. Constructional aspects using bamboo, such as, work on site, fabrication of components off-site and their erection on site are also covered to the extent necessary to indicate and ensure the quality of material and standard of workmanship to comply with the assumptions of the design rules and the limitations.

A-6.4 Section 4 Masonry

It covers the structural design aspects of unreinforced load bearing and non-load bearing walls, constructed with masonry units permitted therein. It also deals with the selection of materials, special features of design and construction for masonry construction using rectangular masonry units and covers guidelines regarding earthquake resistant buildings constructed using masonry of low strength. It also covers provisions for design of reinforced brick and reinforced brick concrete floors and roofs. It also gives the recommendations for structural design aspects of reinforced load bearing and non-load bearing walls, constructed with different types of bricks and blocks.

A-6.5 Section 5 Concrete

A-6.5.1 *Section 5A Plain and Reinforced Concrete*

It covers the general structural use of plain and reinforced concrete.

A-6.5.2 *Section 5B Prestressed Concrete*

It covers the general structural use of prestressed concrete. It covers both work carried out on site and the manufacture of precast prestressed concrete units.

A-6.6 Section 6 Steel

It covers the structural design aspects of steel structures in buildings. It applies to general construction using hot rolled steel sections and steel tubes, joined using riveting, bolting and welding.

A-6.7 Section 7 Prefabrication, Systems Building and Mixed/Composite Construction

A-6.7.1 *Section 7A Prefabricated Concrete*

It covers recommendations regarding modular planning, component sizes, prefabrication systems, design considerations, joints and manufacture, storage, transport and erection of prefabricated concrete elements for use in buildings and such related requirements for prefabricated concrete

A-6.7.2 *Section 7B Systems Building and Mixed/ Composite Construction*

It covers recommendations regarding modular planning, component sizes, joints, manufacture, storage, transport and erection of prefabricated elements for use in buildings and such related requirements for systems building and mixed/composite construction.

A-6.8 Section 8 Glass and Glazing

It covers the following:

a) Selection and application of glass in buildings, different types of glass, their requirements and associated glazing materials.
b) Guiding provision for glazing in buildings with respect to their effect on energy, visual (light) and solar environments in the building.
c) Selection of glass in buildings, subject to wind loading, seismic loading and special considerations for fire rated glass and related materials.
d) Provisions for the selection of and manifestation on glass used in buildings, subject to safety with respect to human impact on the occupants.
e) Provisions relating to glazing systems such as selection, design, fabrication, installation, testing and maintenance.

A-7 PART 7 CONSTRUCTION MANAGEMENT, PRACTICES AND SAFETY

It covers construction project management; construction planning, site management and building construction practices; storage, stacking and handling of materials; and safety of personnel during construction operations for all elements of a building and demolition of buildings; and habitat and welfare

requirements for workers. It also covers guidelines relating to repairs, retrofitting and strengthening of buildings.

A-8 PART 8 BUILDING SERVICES

This Part through its six elaborate Sections on utilities provides detailed guidance to concerned professionals/ utility engineers for meeting necessary functional requirements in buildings.

A-8.1 Section 1 Lighting and Natural Ventilation

It covers requirements and methods for lighting and natural ventilation of buildings.

A-8.2 Section 2 Electrical and Allied Installations

It covers the essential requirements for electrical installations in buildings to ensure efficient use of electricity including safety from fire and shock. It also includes general requirements relating to lightning protection of buildings and brief provisions on certain allied installations.

A-8.3 Section 3 Air Conditioning, Heating and Mechanical Ventilation

It covers the planning, design considerations, installation, testing, commissioning and handing over and also operation and maintenance of air conditioning, heating and mechanical ventilation systems for buildings. It also covers refrigeration for cold storages.

A-8.4 Section 4 Acoustics, Sound Insulation and Noise Control

It covers requirements and guidelines regarding planning against noise, acceptable noise levels and the requirements for sound insulation in buildings with different occupancies.

A-8.5 Section 5 Installation of Lifts, Escalators and Moving Walks

A-8.5.1 *Section 5A Lifts*

It covers the requirements for planning, design, installation, operation, maintenance and inspection of lifts (passenger lifts, goods lifts, hospital lifts, service lifts and dumb waiter) so as to ensure safe movement of people with satisfactory performance.

It also gives information that should be exchanged among the architect/engineer, the consulting engineer and the lift manufacturer from the stage of planning to installation including maintenance.

A-8.5.2 *Section 5B Escalators and Moving Walks*

It covers the essential requirements for planning, installation, operation, maintenance and inspection of escalators and moving walks so as to ensure safe movement of people with satisfactory performance, while using these.

It also gives information that should be exchanged among the architect/engineer, the consulting engineer and the escalator/moving walk manufacturer from the stage of planning to installation including maintenance.

A-8.6 Section 6 Information and Communication Enabled Installations

It covers the essential requirements for information and communication enabled installations, technology systems and related cabling installations in a building. It also covers the basic design and integration requirements for telecommunication spaces within the building/buildings along with their cabling infrastructure, their pathway components and passive connectivity hardware.

It also includes general requirements relating to installation of different communication equipment, cable terminations, power connections and general guidelines required for planning and providing information and communication technology (ICT) services in the building at the planning and execution stages. The provisions given herein are basic requirements applicable to all residential and other buildings.

A-9 PART 9 PLUMBING SERVICES (INCLUDING SOLID WASTE MANAGEMENT)

This Part through its four Sections gives detailed guidance to concerned professionals/plumbing engineers with regard to plumbing and other related requirements in buildings including solid waste management.

A-9.1 Section 1 Water Supply

It covers the basic requirements of water supply for residential, business and other types of buildings, including traffic terminal stations. It also deals with general requirements of plumbing connected to public water supply and design of water supply systems along with general guidelines about expansion in piping systems, and swimming pools.

A-9.2 Section 2 Drainage and Sanitation

It covers the design, layout, construction and maintenance of drains for foul water, surface water, subsoil water and sewage; together with all ancillary works, such as connections, manholes and inspection chambers used within the building and from building to the connection to a public sewer, private sewer, individual sewage-disposal system, cesspool, soakaway or to other approved point of disposal/ treatment work.

A-9.3 Section 3 Solid Waste Management

It covers the provisions relating to solid waste management systems, assessment of per capita solid waste quantities and treatment of solid waste quantities and treatment of solid waste within the building, building complexes and their built environment.

A-9.4 Section 4 Gas Supply

It covers the requirements regarding the safety of persons and property for all piping uses and for all types of gases for purposes like fuel, lighting and medical in buildings.

A-10 PART 10 LANDSCAPE DEVELOPMENT, SIGNS AND OUTDOOR DISPLAY STRUCTURES

A-10.1 Section 1 Landscape Planning, Design and Development

It covers requirements of landscape planning, design and development with the view to promoting quality of outdoor built and natural environments and the protection of land and its resources.

A-10.2 Section 2 Signs and Outdoor Display Structures

It covers the requirements with regard to public safety, structural safety and fire safety of all signs and outdoor display structures.

A-11 PART 11 APPROACH TO SUSTAINABILITY

It covers the parameters required to be considered for planning, design, construction, operation and maintenance of buildings and those relating to land development, from sustainability point of view. It is a supplement to all other Parts/Sections of the Code and shall be read along with them.

A-12 PART 12 ASSET AND FACILITY MANAGEMENT

It covers provisions relating to management of building assets and associated facilities and includes various aspects relating to maintenance of all types of facilities and fixed assets, such as buildings and building services. It does not cover assets other than physical assets.

NATIONAL BUILDING CODE OF INDIA

PART 1 DEFINITIONS

BUREAU OF INDIAN STANDARDS

FOREWORD

Each Part or Section of the National Building Code of India gives the definitions of the special terms used in it. These definitions may be found in the clause 'Terminology' normally placed immediately after the 'Scope' in each Part/Section. However, users may find this Part very convenient for reference as it gives the alphabetically arranged list of terms defined in all the Parts/Sections, along with the location of the definition. It may also be noted that in some cases like in Part 3 'Development Control Rules and General Building Requirements' and Part 7 'Construction Management, Practices and Safety' of the Code, these have been placed in other appropriate clauses rather than after 'Scope' considering the suitability and convenience afforded therefrom.

In this revision, this Part has been updated to cover the various terms actually covered in different Parts/Sections in this revision of the Code.

NATIONAL BUILDING CODE OF INDIA

PART 1 DEFINITIONS

1 SCOPE

This Part lists the terms which are appearing in all the Parts/Sections of the National Building Code of India, along with their definitions. The terms have been arranged in their alphabetical order. The Part(s)/ Section(s) in which these terms are appearing, have been indicated against the terms.

However, some common definitions are reproduced in this Part also, the definitions being placed immediately below the term concerned.

A

*A*95 — Part 8/Section 5A
Abandoned Sign — Part 10/Section 2
Ability — Part 3
Acceleration — Part 8/Section 5A, Part 8/Section 5B
**Access* — Part 3, Part 12
Access Aisle — Part 3
Access Panel — Part 9/Section 1
Access Point — Part 8/Section 6
Accessible Site, Building, Facility or Portions — Part 3
Accessible Route — Part 3
Accessible Toilet — Part 3
Accessory — Part 8/Section 2
Accessory Use — Part 2, Part 3

Any use of the premises subordinate to the principal use and customarily incidental to the principal use.

Accidental Loads — Part 6/Section 6
*Accompanying Loa*d — Part 6/Section 6
Action — Part 6/Section 6
Action Effect or Load Effect — Part 6/Section 6
Actual Length — Part 6/Section 6
Adaptive Thermal Comfort — Part 11
Advertising Sign — Part 10/Section 2
**Ageing* — Part 3, Part 12
Air Admittance Valve — Part 9/Section 2
*Air Breа*k — Part 9/Section 2
Air Change per Hour — Part 8/Section 1
Air Circuit Breaker (*ACB*) — Part 8/Section 2
Air Conditioning — Part 8/Section 3
Air Gap, Drainage — Part 9/Section 2

* Definitions are different.

Air Gap, Water Distribution — Part 9/Section 1
Air System Balancing — Part 8/Section 3
Air Valve — Part 9/Section 1
Allowable Load — Part 6/Section 2
Alteration — Part 2, Part 3

A change from one type of occupancy to another, or a structural change, such as an addition to the area or height, or the removal of part of a building, or any change to the structure, such as the construction of, cutting into or 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 fixtures or equipment.

Alternating Current Variable Voltage (ACVV) Control — Part 8/Section 5A
Alternating Current Variable Voltage Variable Frequency (ACVVVF) Control — Part 8/Section 5A
Altitude — Part 8/Section 1
Ambient Noise — Part 8/Section 4
*Anaerobic Diges*tion — Part 9/Section 3
Anchor Pile — Part 6/Section 2
Anchorage Device — Part 6/Section 5B
Angle of Attack — Part 6/Section 1
Angle of Inclination — Part 8/Section 5B
Animated Sign — Part 10/Section 2
Annealed Fire Resistant Glass — Part 6/Section 8
Annealed Glass (see Glass) — Part 6/Section 8
Antenna — Part 8/Section 6
Anti-siphon — Part 9/Section 1
Apparatus — Part 8/Section 2
Appliance — Part 8/Section 2
Appliance Valve — Part 9/Section 4
Approved — Part 2, Part 3, Part 10/Section 2

Approved by the Authority having jurisdiction.

Approved Agency — Part 9/Section 4
Appurtenance — Part 9/Section 1
Area of Rescue Assistance — Part 3
Area of Special Control — Part 10/Section 2
As-built Information — Part 12
As-cut Finished Sizes — Part 6/Section 8
Aspect Ratio — Part 6/Section 8
Assembly Buildings — Part 6/Section 1

Asset — Part 12
Asset Life — Part 12
Asset Register — Part 12
Asset Type — Part 12
Asset/Facility Management — Part 12
Assisted Evacuation — Part 3, Part 4
Assistive Product/Device — Part 3
Atmospheric Pressure — Part 8/Section 3
Atrium — Part 4
Attenuation — Part 8/Section 6
Audible Frequency Range — Part 8/Section 4
Authorities Concerned — Part 4

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving or accepting equipment, materials, an installation, or a procedure.

Authority Having Jurisdiction — Part 0, Part 2, Part 3, Part 6/Section 7A, Part 6/Section 7B, Part 7, Part 9/Section 1, Part 9/Section 4, Part 10/Section 2, Part 11

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'.

Authorization — Part 9/Section 3
Automatic Door — Part 3
Automatic Fire Detection and Alarm System — Part 4
Automatic Operation — Part 8/Section 5A
Automatic Rescue Device — Part 8/Section 5A
Automatic Sprinkler System — Part 4
Automatic Water Spray Systems — Part 4
Auxiliary Brake — Part 8/Section 5B
Available Head — Part 9/Section 1
Avenue — Part 10/Section 1
A-Weighted Sound Pressure — Part 8/Section 4
A-Weighted Sound Pressure Level — Part 8/Section 4
Axial Flow Fan — Part 8/Section 1
Axis of Measurement — Part 8/Section 5A
Azimuth — Part 8/Section 1

B

Backbone — Part 8/Section 6
Backbone Cabling Media Distribution and Building Pathway — Part 8/Section 6
Back Fill — Part 6/Section 2
Back Pressure Backflow — Part 9/Section 1
Back Siphonage — Part 9/Section 1
Back to Back Cluster — Part 3
Back Up — Part 9/Section 2
Back-up Protection — Part 8/Section 2
Back Water Valve — Part 9/Section 2
Backflow — Part 9/Section 1
Backflow Prevention Device — Part 9/Section 1
Background noise — Part 8/Section 4
Background Noise Correction — Part 8/Section 5B
Balcony — Part 3
Balustrade — Part 6/Section 8, Part 8/Section 5B
Balustrade Decking — Part 8/Section 5B
Bamboo — Part 6/Section 3B
Bamboo Clump — Part 6/Section 3B
Bamboo Culm — Part 6/Section 3B
Bamboo Mat Board — Part 6/Section 3B
Bamboo Mat Corrugated Sheet — Part 6/Section 3B
*Bamboo Mat Veneer Composi*te — Part 6/Section 3B
Band — Part 6/Section 4
Banner — Part 10/Section 2
Banner Sign– Part 10/Section 2
Barrel — Part 9/Section 1
Barrier — Part 8/Section 2
Base — Part 9/Section 1
Basement or Cellar — Part 3
Basic Protection — Part 8/Section 2
Basic Module — Part 6/Section 7A, Part 6/Section 7B
Bath Room Group — Part 9/Section 1, Part 9/Section 2
Bather Load — Part 9/Section 1
Batter Pile (Raker Pile) — Part 6/Section 2
Battery of Fixtures — Part 9/Section 2
Beads or Glazing Beads — Part 6/Section 8
Beam — Part 6/Section 3B, Part 6/Section 6
Beam, Built-Up-Laminated — Part 6/Section 3A
Beam, Glued-Laminated — Part 6/Section 3A
Bearing Capacity, Safe — Part 6/Section 2
Bearing Capacity, Ultimate — Part 6/Section 2
Bearing Pressure, Allowable (Gross or Net) — Part 6/Section 2
Bearing Type Connection — Part 6/Section 6
Bed Block — Part 6/Section 4
Bed Pan Washer — Part 9/Section 2
Bedding — Part 9/Section 1
Benching — Part 9/Section 2
Benchmarking — Part 12
*Biodegradable Wa*ste — Part 12
Biodiversity — Part 11
Bite — Part 6/Section 8
Biodegradable Substance — Part 9/Section 3

Biomethanation — Part 9/Section 3
Block (Setting Block) — Part 6/Section 8
Bond — Part 6/Section 4
Bonded Member — Part 6/Section 5B
Bonded Post-tensioning — Part 6/Section 5B
Bonding Conductor — Part 8/Section 2
Bonding Ring Conductor (*BRC*) — Part 8/Section 2
Bored Cast In-situ Pile — Part 6/Section 2
Bored Compaction Pile — Part 6/Section 2
Bored Pile — Part 6/Section 2
Bottom Car Clearance — Part 8/Section 5A
Bottom Car Run-by — Part 8/Section 5A
Bottom Counterweight Run-by — Part 8/Section 5A
Box System — Part 6/Section 4
Braced Member — Part 6/Section 6
Brake Load — Part 8/Section 5B
Branch — Part 9/Section 2
Branch Soil Pipe (BSP) — Part 9/Section 2
Branch Soil Waste Pipe (BSWP) — Part 9/Section 2
Branch Vent Pipe (BVP) — Part 9/Section 2
Branch Waste Pipe (BWP) — Part 9/Section 2
Breadth — Part 6/Section 1
Break-In — Part 8/Section 4
Break-Out — Part 8/Section 4
Breaking Strength — Part 6/Section 3B
Bresummer — Part 6/Section 3A
Briefing — Part 12
Brightness Ratio or Contrast — Part 8/Section 1
Brittle Cladding — Part 6/Section 6
Broad Band Noise — Part 8/Section 4
Buckling Load — Part 6/Section 6
*Buckling Strength or Resist*ance — Part 6/Section 6
**Buffer* — Part 8/Section 5A, Part 10/Section 1
Buffer Zone — Part 12
Building — Part 0, Part 2, Part 3, Part 4

Any structure for whatsoever purpose and of whatsoever materials constructed and every part thereof whether used as human habitation or not and includes foundation, plinth, walls, floors, roofs, chimneys, plumbing and building services, fixed platforms, verandah, balcony, cornice or projection, part of a building or anything affixed thereto or any wall enclosing or intended to enclose any land or space and signs and outdoor display structures. Tents/ *Shamianahs*, tarpaulin shelters, etc, erected for temporary and ceremonial occasions with the permission of the Authority shall not be considered as building.

* Definitions are different.

Building, Height of — Part 2, Part 3, Part 4

The vertical distance measured, in the case of flat roofs from the average level of the ground around and contiguous to the building or as decided by the Authority to the terrace of last livable floor of the building adjacent to the external walls; and 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 the case of gables facing the road, the midpoint between the eaves level and the ridge. Architectural features serving no other function except that of decoration shall be excluded for the purpose of measuring heights.

Building Drain-Combined — Part 9/Section 2
Building Drain-Sanitary — Part 9/Section 2
Building Drain-Storm — Part 9/Section 2
Building Sewer — Part 9/Section 2
Building Sub-Drain — Part 9/Section 2
Building Trap — Part 9/Section 2
Building Energy Simulation (*BES*) — Part 8/Section 3
Building Environment — Part 11
Building Fabric — Part 12
Building Information Model (*BIM*) — Part 12
Building Integrated Renewable Energy — Part 8/ Section 3
Building Line — Part 2, Part 3, Part 10/Section 2

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 prescribed, if any, in any scheme. The building line may change from time to time as decided by the Authority.

Building Maintenance — Part 12
Building Management System (BMS) — Part 8/ Section 3, Part 8/Section 6, Part 12
Building Performance — Part 11
Buildings Related Illnesses (*BRI*) — Part 8/Section 3
Built-up Section — Part 6/Section 6
Built Environment — Part 11
Bunched — Part 8/Section 2
Bundle-Column — Part 6/Section 3B
Buried Direct — Part 8/Section 2
Bus Bar — Part 8/Section 6
Busbar Trunking System — Part 8/Section 2
Business Buildings — Part 6/Section 1
Business Continuity Management (*BCM*) — Part 12
Buttress — Part 6/Section 4
Bypass Equipotential Bonding Conductor — Part 8/ Section 2

C

Cabin — Part 3
Cable — Part 6/Section 5B, Part 8/Section 2
Cable, Circuit Integrity — Part 8/Section 2
Cable, Flame Retardant (FR) — Part 8/Section 2
Cable, Flame Retardant Low Smoke Halogen Free (FR-LSH) — Part 8/Section 2
Cable, Flexible — Part 8/Section 2
Cable, Metal-Sheathed — Part 8/Section 2
Cable, PVC Sheathed-Insulated — Part 8/Section 2
Cable, Weatherproof — Part 8/Section 2
Cable, XLPE — Part 8/Section 2
Cable Armoured — Part 8/Section 2
Cable Bracket — Part 8/Section 2
Cable Channel — Part 8/Section 2
Cable Cleat — Part 8/Section 2
Cable Coupler — Part 8/Section 2
Cable Ducting — Part 8/Section 2
Cable Ladder — Part 8/Section 2
Cable Raceways — Part 8/Section 2
Cable Tray — Part 8/Section 2
Cable Trunking — Part 8/Section 2
Cable Tunnel — Part 8/Section 2
Call Indicator — Part 8/Section 5A
Camber — Part 6/Section 6
Candela (cd) — Part 8/Section 1
Canopy — Part 3
Canopy/Tree Canopy — Part 10/Section 1
Canopy Sign — Part 10/Section 2
Car Bodywork — Part 8/Section 5A
Car Door Electric Contact — Part 8/Section 5A
Car Frame — Part 8/Section 5A
Car Platform — Part 8/Section 5A
Car Switch Operation — Part 8/Section 5A
Carbon Emissions — Part 12
Carbon Footprint — Part 12
Cartridge Fuse Link — Part 8/Section 2
Carpet Area — Part 3
Ceiling Rose — Part 8/Section 2
Cell — Part 6/Section 3B
Cellular Concrete — Part 6/Section 7A, Part 6/Section 7B
Cellulose — Part 6/Section 3B
Central Field — Part 8/Section 1
Centre Internode — Part 6/Section 3B
Centre of Rigidity — Part 6/Section 4
Centrifugal Fan — Part 8/Section 1
Cesspool — Part 9/Section 2
Chair — Part 9/Section 1
Chair Rail — Part 6/Section 8
Channel — Part 9/Section 1
Characteristic Load — Part 6/Section 3B, Part 6/Section 5B, Part 6/Section 6
Characteristic Strength — Part 6/Section 3B, Part 6/Section 5B
Characteristic Yield/Ultimate Stress — Part 6/Section 6
Check — Part 6/Section 3A
Chhajja — Part 3
Chimney — Part 3
Chowk or Courtyard — Part 3
Chowk, Inner — Part 3
Chowk, Outer — Part 3
Circuit — Part 8/Section 2
Circuit, Final Sub — Part 8/Section 2
Circuit Breaker — Part 8/Section 2
Circuit Breaker, *Linked* — Part 8/Section 2
Circuit Integrity Cable Support and Fixing Materials — Part 8/Section 2
Circulation Path — Part 3
Circulation Space — Part 3
Clay — Part 6/Section 2
Clay, Firm — Part 6/Section 2
Clay, Soft — Part 6/Section 2
Clay, Stiff — Part 6/Section 2
Cleaning — Part 12
Cleaning Eye — Part 9/Section 2
Cleaning Services — Part 12
Clear — Part 3
Clear Design Sky — Part 8/Section 1
Clear Glass — Part 6/Section 8
Clear Waste Water– Part 9/Section 2
Clearance– Part 8/Section 5A
Cleat — Part 8/Section 2
Cleavability — Part 6/Section 3B
Climber (Creeper/Vine) — Part 10/Section 1
Closed Clusters — Part 3
Closed Sign — Part 10/Section 2
Closely-Spaced Modules — Part 6/Section 1
Cluster — Part 3
Cluster Court Town House — Part 3
Cluster Plot — Part 3
Coaxial Cable — Part 8/Section 6
Coincidence Factor — Part 8/Section 2
Collapse — Part 6/Section 3B
Collection — Part 9/Section 3
Collection Chamber — Part 9/Section 2

Colour Contrast — Part 3
Colour Rendering Index (CRI) — Part 8/Section 1
**Column* — Part 6/Section 3B, Part 6/Section 6
Column or Strut — Part 6/Section 5B
Column — Part 6/Section 4
Columnar — Part 10/Section 1
Coefficient of Linear Expansion — Part 6/Section 8
Coefficient of Performance, Compressor, Heat Pump — Part 8/Section 3
Coefficient of Performance, Compressor, Refrigerating — Part 8/Section 3
Coefficient of Performance (*Heat Pump*) — Part 8/Section 3
Coefficient of Performance (*Refrigerating*) — Part 8/Section 3
Comb — Part 8/Section 5B
Comb Lighting — Part 8/Section 5B
Comb Plate — Part 8/Section 5B
Comb Plate Switch — Part 8/Section 5B
Comb Teeth — Part 8/Section 5B
Combination Sign– Part 10/Section 2
Combustible Material — Part 4, Part 6/Section 8, Part 10/Section 2

A material that, in the form in which it is used and under the conditions anticipated, will ignite and burn; a material that does not meet the definition of noncombustible or limited combustible.

Common Path of Travel — Part 4
Common Rafter — Part 6/Section 3B
Communication Pipe — Part 9/Section 1
Compact Section — Part 6/Section 6
Compact Substation or Prefabricated Substation — Part 8/Section 2
Competent Authority — Part 9/Section 4
Competent Maintenance Person — Part 8/Section 5A
Competent Person — Part 12
Component — Part 6/Section 7A, Part 6/Section 7B
Composite Members — Part 6/Section 7A, Part 6/Section 7B
Composite Station — Part 4
Composting — Part 9/Section 3
Compression Wood — Part 6/Section 3A
Computer Aided Facilities Management (CAFM) — Part 12
Computer Aided Maintenance Management System (CMMS) — Part 12
Concrete Grades — Part 6/Section 4

* Definitions are different.

Concourse — Part 4
Condition Monitoring — Part 12
Conductor of a Cable or Core — Part 8/Section 2
Conductor, Aerial — Part 8/Section 2
Conductor, Bare — Part 8/Section 2
Conductor, Earthed — Part 8/Section 2
Conductor, Insulated — Part 8/Section 2
Conduit — Part 8/Section 2
Confined Space — Part 12
Connection — Part 9/Section 2
Connector — Part 8/Section 2
Connector Box or Joint Box — Part 8/Section 2
Connector for Portable Appliances — Part 8/Section 2
Consolidation Point (CP) — Part 8/Section 6
Constant Stress Range — Part 6/Section 6
Construction and Demolition Waste — Part 9/Section 3
*Construction Equipmen*t — Part 7
**Consumer* — Part 9/Section 1, Part 9/Section 2
Consumer's Pipe– Part 9/Section 1
Consumer's Terminals — Part 8/Section 2
Contaminants — Part 8/Section 1
Continuous Operating Voltage (U_c) — Part 8/Section 2
Contour — Part 10/Section 1
*Contour Interv*al — Part 10/Section 1
Control — Part 8/Section 5A
Conversion — Part 2
Cooking Alcove — Part 3
Cooling Load — Part 8/Section 3
Cooling Tower — Part 8/Section 3
Cord, Flexible — Part 8/Section 2
Core of a Cable — Part 8/Section 2
Corrective Maintenance — Part 12
Correlated Colour Temperature (CCT) — Part 8/Section 1
Corridor — Part 6/Section 8
Corrosion — Part 6/Section 6
Counterweight — Part 8/Section 5A
Cover — Part 9/Section 1
Covered Area — Part 3, Part 4

Ground area covered by the building immediately above the plinth level. The area covered by the following in the open spaces is excluded from covered area (*see* Table 2 of Part 4 'Fire and Life Safety' of the Code):

a) Garden, rockery, well and well structures, plant nursery, waterpool, swimming pool (if uncovered), platform round a tree, tank,

* Definitions are different.

fountain, bench, *Chabutara* with open top and unenclosed on sides by walls and the like;

b) Drainage culvert, conduit, catch–pit, gully pit, chamber, gutter and the like;

c) Compound wall, gate, unstoreyed porch and portico, slide, swing, uncovered staircases, ramp areas covered by *Chhajja* and the like; and

d) Watchman's booth, pumphouse, garbage shaft, electric cabin or sub-stations, and such other utility structures meant for the services of the building under consideration.

NOTE — For the purpose of this part, covered area equals the plot area minus the area due for open spaces in the plot.

Coupled Glazing (*Secondary Glazing*) — Part 6/Section 8

Crane Load — Part 6/Section 6

Creep — Part 6/Section 5B

Creep Coefficient — Part 6/Section 5B

Crime Prevention through Environmental Design (CPTED) — Part 12

Critical Activities — Part 12

Critical Asset — Part 12

Critical Damping — Part 6/Section 1

Crookedness — Part 6/Section 3B

Cross Wall — Part 6/Section 3B

Cross-Connect — Part 8/Section 6

Cross-Connection — Part 9/Section 1

Cross-Sectional Area of Masonry Unit — Part 6/Section 4

Cross-Talk — Part 8/Section 4

Crown of Trap — Part 9/Section 2

Crumple Section — Part 6/Section 4

Crush Train Load — Part 4

'Cul-de-Sac' Cluster — Part 3

Cumulative Figure — Part 6/Section 6

Current Carrying Capacity of a Conductor — Part 8/Section 2

Current Using Equipment — Part 8/Section 2

Curtain Wall — Part 6/Section 4, Part 6/Section 8

Curvature — Part 6/Section 3B

Customer's/Consumer's Connection — Part 9/Section 4

Cut-Out — Part 8/Section 2

Cut-Off Level — Part 6/Section 2

Cut-Off Limit — Part 6/Section 6

D

Damp Situation — Part 8/Section 2

Damping — Part 6/Section 1

Danger — Part 8/Section 2

Daylight Area — Part 8/Section 1

Daylight Factor — Part 8/Section 1

Daylight Penetration — Part 8/Section 1

Deconstruction — Part 12

De-Structured Bamboo — Part 6/Section 3B

Dead — Part 8/Section 2

Dead Knot — Part 6/Section 3A

Dead Loads — Part 6/Section 6

Decay or Rot — Part 6/Section 3A

Decayed Knot — Part 6/Section 3A

Decibel — Part 8/Section 4

Deciduous Tree — Part 10/Section 1

Dedicated Outdoor Air System (*DOAS*) — Part 8/Section 3

Deep Area — Part 9/Section 1

Deep Manhole — Part 9/Section 2

Deflection — Part 6/Section 6

Deflector Sheave– Part 8/Section 5A

Delamination — Part 6/Section 3B

Deliverable — Part 12

Demand Based Ventilation — Part 8/Section 3

Density — Part 3

Depth — Part 6/Section 1

Depth of Manhole — Part 9/Section 2

Design Acceleration — Part 8/Section 5A

Design Acceleration Spectrum — Part 6/Section 1

Design Current (of a Circuit) — Part 8/Section 2

Design Development — Part 12

Design Horizontal Seismic Coefficient — Part 6/Section 4

**Design Life* — Part 6/Section 6, Part 12

Design Load/Factored Load — Part 6/Section 6

Design Pressure Difference — Part 8/Section 3

Design Spectrum — Part 6/Section 6

Design Horizontal Acceleration Coefficient — Part 6/Section 1

Design Horizontal Force — Part 6/Section 1

Detached Building — Part 3

Detail Category — Part 6/Section 6

Developed Height — Part 6/Section 1

Developed Length — Part 9/Section 2

Development — Part 2, Part 3

'Development' with grammatical variations means the carrying out of building, engineering, mining or other

* Definitions are different.

operations in, or over, or under land or water, or in the use of any building or land, and includes redevelopment and layout and subdivision of any land; and `to develop' shall be construed accordingly.

Dew Point Temperature — Part 8/Section 3
Diameter — Part 9/Section 2

The nominal internal diameter of pipes and fittings.

Diameter of Knot — Part 6/Section 3A
Diaphragm — Part 6/Section 7A
Diaphragm, Structural — Part 6/Section 3A
Dilution Ventilation — Part 8/Section 1
Direct Contact — Part 8/Section 2
Direct to Home (DTH) — Part 8/Section 6
Direct Earthing System — Part 8/Section 2
Direct Solar Illuminance — Part 8/Section 1
Direct Tap — Part 9/Section 1
Direction Sign — Part 10/Section 2
Disability — Part 3
Disaster — Part 11
Discolouration — Part 6/Section 3A, Part 6/Section 3B
Disconnector — Part 8/Section 2
Discontinuity — Part 6/Section 6
Discrimination (Over-Current Discrimination) — Part 8/Section 2
Disposal — Part 9/Section 3
Distance Piece — Part 6/Section 8
Distance Area or Resistance Area (for an Earth Electrode only) — Part 8/Section 2
Distribution/Distributing Company — Part 9/Section 4
Diversity Factor — Part 8/Section 2
Diving Pool — Part 9/Section 1
Documented Information — Part 12
Domestic Hazardous Waste — Part 12
Door — Part 8/Section 5A
Door-to-Door Time — Part 8/Section 5A
Door and Shutter Assembly Door-Set — Part 6/Section 8
Door Closer — Part 8/Section 5A
Door Closing Time — Part 8/Section 5A
Door Opening Time — Part 8/Section 5A
Door Operator — Part 8/Section 5A
Door, Centre Opening Sliding — Part 8/Section 5A
Door, Mid-Bar Collapsible — Part 8/Section 5A
Door, Multi-Panel — Part 8/Section 5A
Door, Single Slide — Part 8/Section 5A
Door, Swing — Part 8/Section 5A
Door, Two Speed Siding — Part 8/Section 5A
Door, Vertical Bi-parting — Part 8/Section 5A
Door, Vertical Lifting — Part 8/Section 5A
Double Button (Continuous Pressure) Operation — Part 8/Section 5A
Double Glazed Fire Resistant Glass — Part 6/Section 8
Double Glazing — Part 6/Section 8
Down-Comer — Part 4
Down Take Tap — Part 9/Section 1
Drain — Part 2, Part 3, Part 9/Section 2

A conduit, channel or pipe for the carriage of storm water, sewage, waste water or other water-borne wastes in a building drainage system.

Drain Vent Pipe (DVP) — Part 9/Section 2
**Drainage* — Part 2, Part 3, Part 9/Section 2, Part 10/Section 1
Drainage Fixture Unit (DFU) — Part 9/Section 2
Drainage Work — Part 9/Section 2
Driven Cast In-situ Pile — Part 6/Section 2
Drop Connection — Part 9/Section 2
Drop Manhole — Part 9/Section 2
Dry Riser — Part 4
Dry Waste — Part 12
Dry Bulb Temperature — Part 8/Section 1, Part 8/Section 3
Duct — Part 8/Section 2
Ducting — Part 8/Section 2
Duct System — Part 8/Section 3
Ductility — Part 6/Section 1, Part 6/Section 6
Dumb Waiter — Part 8/Section 5A
Dump Sites — Part 12
**Durability* — Part 6/Section 6, Part 12
Duration of Load — Part 6/Section 3A
Duress Alarms — Part 12
Dwelling Unit/Tenement — Part 3
Dwellings — Part 6/Section 1

E

Earth — Part 8/Section 2
Earth Continuity Conductor — Part 8/Section 2
Earthed Concentric Wiring — Part 8/Section 2
Earth Electrode — Part 8/Section 2
Earth Electrode Network — Part 8/Section 2
Earth Electrode Resistance — Part 8/Section 2
Earth Fault — Part 8/Section 2
Earth Fault Current — Part 8/Section 2

* Definitions are different.

Earth Leakage Current — Part 8/Section 2
Earthing — Part 8/Section 2
Earthing Conductor — Part 8/Section 2
Earthing Lead — Part 8/Section 2
Earthing Resistance, Total — Part 8/Section 2
Earthquake Loads — Part 6/Section 6
Ecological Footprint — Part 11
Ecosystem — Part 11
Economizer, Air — Part 8/Section 3
Economizer, Water — Part 8/Section 3
**Edge Distance* — Part 6/Section 3A, Part 6/Section 6
Edge Deterioration — Part 6/Section 8
Edge Faults — Part 6/Section 8
Edge Polished — Part 6/Section 8
Edging — Part 6/Section 8
Educational Buildings — Part 6/Section 1
Effective Frontal Area — Part 6/Section 1
Effective Height — Part 6/Section 4
Effective Lateral Restraint — Part 6/Section 6
**Effective Length* — Part 6/Section 4, Part 6/Section 6
Effective Opening — Part 9/Section 1
Effective Perceived Noise Level in Decibel (EPN dB) — Part 8/Section 4
**Effective Temperature (ET)* — Part 8/Section 1, Part 8/Section 3
Effective Thickness — Part 6/Section 4
Efficiency of a Pile Group — Part 6/Section 2
Egress — Part 10/Section 1
Elastic Cladding — Part 6/Section 6
Elastic Critical Moment — Part 6/Section 6
Elastic Design — Part 6/Section 6
Elastic Limit — Part 6/Section 6
Electric Shock — Part 8/Section 2
Electric Sign — Part 10/Section 2
Electrical and Mechanical Interlock — Part 8/Section 5A
Electrical Equipment (abb: Equipment) — Part 8/Section 2
Electrically Independent Earth Electrode — Part 8/Section 2
Electrical Supply System for Life and Safety Services — Part 8/Section 2
Electro-Mechanical Lock — Part 8/Section 5A
Electronic Devices — Part 8/Section 5A
Element of Surface Area — Part 6/Section 1
Elevation — Part 10/Section 1
Embodied Energy — Part 11
Emergency Brake — Part 8/Section 5B
Emergency Lighting — Part 4
Emergency Lighting System — Part 4
Emergency Stop Switch — Part 8/Section 5B
Emergency Switching — Part 8/Section 2
Emission Sound Pressure Level (L_{pA}) — Part 8/Section 5B
Emissivity (E) — Part 11
Emulative Detailing System — Part 6/Section 7A
Enclosed Station — Part 4
Enclosed Distribution Board — Part 8/Section 2
Enclosure — Part 8/Section 2
*End Dist*ance — Part 6/Section 3A, Part 6/Section 3B, Part 6/Section 6
End Splitting — Part 6/Section 3B
End-User — Part 12
Endemic Plant — Part 10/Section 1
Energy Efficiency Ratio (*EER*) — Part 8/Section 3
Energy Recovery Unit — Part 8/Section 3
Entraining Load — Part 4
Environmental Impact — Part 11
Environmental Indicator (K_{2A}) — Part 8/Section 5B
Epicenter — Part 6/Section 1
Equipotential Bonding — Part 8/Section 2
Equivalent Continuous A-Weighted Sound Pressure Level, $L_{Aeq.T}$ — Part 8/Section 4
Equivalent Sound Absorption Area of a Room, A — Part 8/Section 4
Equivalent Sound Pressure Level (L_{Aeq}) — Part 8/Section 5A, Part 8/Section 5B
Erection Loads — Part 6/Section 6
Erection Tolerance — Part 6/Section 6
Erosion — Part 10/Section 1
Escalator — Part 3, Part 8/Section 5B
Escape Lighting — Part 4
Estimated Service Life (ESL) — Part 12
Evacuation Lift — Part 4
Evaporative Cooling — Part 8/Section 3
Evergreen Tree — Part 10/Section 1
Exhaust of Air — Part 8/Section 1
Exit — Part 3, Part 4
Exit Access — Part 4
Exit Access Corridor — Part 4
Exit Discharge — Part 4
Exotic — Part 10/Section 1
Exposed Conductive Part — Part 8/Section 2

* Definitions are different.

Exposed Edge — Part 6/Section 8
Exposed Metal — Part 8/Section 2
Exposed Surface Area to Mass Ratio — Part 6/Section 6
Exterior Panel — Part 8/Section 5B
Exterior Property — Part 12
Exterior Sign — Part 10/Section 2
External Envelope — Part 12
External Faces of Cluster — Part 3
External Influence — Part 8/Section 2
External Lightning Protection System — Part 8/Section 2
External Reflected Component (ERC) — Part 8/Section 1
Extraneous Conductive Part — Part 8/Section 2

F

Fabrication Tolerance — Part 6/Section 6
Facade — Part 6/Section 8
Facade Level — Part 8/Section 4
Faced Wall — Part 6/Section 4
Faceted Glazing — Part 6/Section 8
Factor of Safety — Part 6/Section 6
Factor of Safety (with Respect to Bearing Capacity) — Part 6/Section 2
*Facilities Maintena*nce — Part 12
Facility — Part 12
Facility Asset Maintenance — Part 12
Fatigue — Part 6/Section 6
Fatigue Loading — Part 6/Section 6
Fatigue Strength — Part 6/Section 6
Fault — Part 8/Section 2
Fault Current — Part 8/Section 2
Fault Protection — Part 8/Section 2
Feed Cistern — Part 9/Section 1
Fence — Part 10/Section 1
Fenestration — Part 6/Section 8
Fetch Length — Part 6/Section 1
Fin — Part 6/Section 8
Final Circuit — Part 8/Section 2
Final Prestress — Part 6/Section 5B
Final Tension — Part 6/Section 5B
Finger Joint — Part 6/Section 3A
Finger Jointed Timber — Part 6/Section 3A
Fire Barrier (or Fire Resisting Barrier) — Part 4
Fire Compartment — Part 4
Fire Damper — Part 8/Section 3
Fire Door and Fire Door Assembly — Part 4
Fire Exit — Part 4
Fire Exit Hardware — Part 4
Fire Exposure Condition — Part 6/Section 6
Fireman's Lift — Part 4
Fire Load — Part 4
Fire Load Density — Part 4
Fire Protection System — Part 6/Section 6
**Fire Resistance* — Part 4; Part 6/Section 6
Fire Resistance Level — Part 6/Section 6
Fire Resistance Rating — Part 4
Fire Resistant Wall — Part 4
Fire Separation — Part 3, Part 4, Part 6/Section 8

The distance, in metre, measured from the external wall of the building concerned to the external wall of any other building on the site, or from other site, or from the opposite side of a street or other public space for the purpose of preventing the spread of fire.

Fire Stop — Part 4
Fire Suppression Systems — Part 4
Fire Survival Distribution Board — Part 8/Section 2
Fire Wall or Fire Separating Wall — Part 4
Firefighting Shaft (Fire Tower) — Part 4
Fitting, Lighting — Part 8/Section 2
Fittings — Part 9/Section 1, Part 9/Section 2

The appurtenances such as coupling, flange, branch, bend, tees, elbows, unions, waste (with or without plug), P or S trap (with or without vent), stop ferrule, bib tap, pillar tap, bath faucet, water meter, garden hydrant, valves and any other article used in connection with water supply, drainage and sanitation.

Fixed Equipment — Part 8/Section 2
Fixture Unit — Part 9/Section 1, Part 9/Section 2
Flameproof Enclosure– Part 8/Section 2
Flattened Bamboo — Part 6/Section 3B
Flexural Stiffness — Part 6/Section 6
Float Glass — Part 6/Section 8
Float Operated Valve — Part 9/Section 1
Floor — Part 3

The lower surface in a storey on which one normally walks in a building. The general term 'floor' unless specifically mentioned otherwise shall not refer to a 'mezzanine floor'.

Floor Area (Gross) — Part 4
Floor Area Ratio (FAR) — Part 3, Part 4

The quotient obtained by dividing the total covered area (plinth area) on all floors by the area of the plot.

* Definitions are different.

Floor Hole — Part 7
Floor Opening — Part 7
Floor Response Spectrum — Part 6/Section 1
Floor Selector — Part 8/Section 5A
Floor Stopping Switch — Part 8/Section 5A
Flush Over Panel — Part 6/Section 8
Flushing Cistern — Part 9/Section 1
Flushometer Tank — Part 9/Section 1
Foam Protection System — Part 4
Foliage — Part 10/Section 1
Footing — Part 6/Section 2
Force Coefficient — Part 6/Section 1
Formation — Part 9/Section 1, Part 9/Section 2
Foundation — Part 6/Section 2
Foundation, Raft — Part 6/Section 2
Frame — Part 6/Section 8
Frameless Glazing — Part 6/Section 8
Free-Field Level — Part 8/Section 4
Freestanding Sign– Part 10/Section 2
French Drain or Rubble Drain — Part 9/Section 2
**Frequency* — Part 8/Section 4, Part 8/Section 6
Fresh Air or Outside Air — Part 8/Section 1
Friction Type Connection — Part 6/Section 6
Front Putty — Part 6/Section 8
Frost Line — Part 9/Section 1, Part 9/Section 2
Full Culm — Part 6/Section 3B
Fully Framed Glazing — Part 6/Section 8
Functional Earthing — Part 8/Section 2
Fundamental or Ultimate Stress — Part 6/Section 3A, Part 6/Section 3B
Fuse — Part 8/Section 2
Fuse Carrier — Part 8/Section 2
Fuse Element — Part 8/Section 2
Fuse Link — Part 8/Section 2

G

Gallery — Part 3
Gap — Part 6/Section 8
Garage, Private — Part 3
Garage, Public — Part 3
Gas Fitter — Part 9/Section 4
Gauge — Part 6/Section 6
Geared Machine — Part 8/Section 5A
Gearless Machine — Part 8/Section 5A
General Ventilation — Part 8/Section 1
General Washing Place — Part 9/Section 1
Generator of Wastes — Part 9/Section 3
Geogrid — Part 10/Section 1
Geo-textile — Part 10/Section 1
Geothermal Heat Pump — Part 8/Section 3
Geyser — Part 9/Section 1
Girth of Tree — Part 10/Section 1
Glare — Part 8/Section 1
Glass — Part 6/Section 8
Glazing-Bite — Part 6/Section 8
Global Warming Potential (GWP) — Part 8/Section 3
Globe Temperature — Part 8/Section 1
Glue — Part 6/Section 3A
Glued Laminated (Glulam) — Part 6/Section 3A
Glued Laminated, horizontally — Part 6/Section 3A
Glued Laminated, vertically — Part 6/Section 3A
Goods Lift — Part 8/Section 5A
Grab Bars — Part 3
Grade — Part 10/Section 1
Gradient Height — Part 6/Section 1
Gradient — Part 10/Section 1
Grading — Part 10/Section 1
Grass Paver — Part 10/Section 1
Grasses — Part 10/Section 1
Gravel — Part 6/Section 2
Gravity Load — Part 6/Section 6
Grease Interceptor (*or Grease Trap*) — Part 9/Section 2
Green Roof — Part 10/Section 1
Green Roof System — Part 11
Green Walls — Part 10/Section 1
Ground Improvement — Part 6/Section 2
Ground Roughness — Part 6/Section 1
Ground Sign — Part 10/Section 2
Ground-Borne Noise — Part 8/Section 4
Groundcover — Part 10/Section 1
Group Automatic Operation — Part 8/Section 5A
Group Housing — Part 3
Group Open Space– Part 3
Grout — Part 6/Section 4
Grouted Cavity Reinforced Masonry — Part 6/Section 4
Grouted Hollow-Unit Masonry — Part 6/Section 4
Grouted Masonry — Part 6/Section 4
Grouted Multi-Wythe Masonry — Part 6/Section 4
Guard Railing — Part 7
Guard Rail — Part 6/Section 8
Guide Rails — Part 8/Section 5A
Guide Rails Fixing– Part 8/Section 5A
Guide Shoe — Part 8/Section 5A
Gully Chamber– Part 9/Section 2

* Definitions are different.

Gully Trap– Part 9/Section 2
Gusset Plate — Part 6/Section 6
Gust — Part 6/Section 1

H

Habitable Room — Part 3
Hairline Scratch — Part 6/Section 8
Halo — Part 6/Section 8
Hand-Held Equipment — Part 8/Section 2
Handling Capacity (HC) — Part 8/Section 5A
* *Handrail* — Part 3, Part 8/Section 5B
Hard Landscape — Part 10/Section 1
Hardy Plant — Part 10/Section 1
Harmonics (Current and Voltage) — Part 8/Section 2
Haunching — Part 9/Section 1
Hazardous Live-Part — Part 8/Section 2
Hazardous Waste — Part 12
Headway — Part 4
Heat Island Effect — Part 10/Section 1, Part 11
Heat Pump — Part 8/Section 3
Heat Recovery — Part 8/Section 3
Heat Soaking — Part 6/Section 8
Heat Strengthened Glass — Part 6/Section 8
Heating Load — Part 8/Section 3
Hedge — Part 10/Section 1
Heel Rest Bend or Duck-Foot Bend — Part 9/Section 1
*Hemi Cellulos*e — Part 6/Section 3B
Herb — Part 10/Section 1
Hermetic Seal — Part 6/Section 8
High Activity Area — Part 6/Section 8
High Altitudes — Part 9/Section 1, Part 9/Section 2
High Rise Building — Part 4
High Risk Area — Part 6/Section 8
High Shear — Part 6/Section 6
Highway Authority — Part 9/Section 1, Part 9/Section 2
Hoisting Beam — Part 8/Section 5A
Hollow Unit — Part 6/Section 4
Horizontal Cabling — Part 8/Section 6
Horizontal Cabling Media Distribution and Building Pathway — Part 8/Section 6
Horizontal Cross-Connect (HC) — Part 8/Section 6
Horizontal Exit — Part 4
Horizontal Pipe — Part 9/Section 1, Part 9/Section 2
Horizontal Sun Angle (HSA) — Part 11
Hospital Lift — Part 8/Section 5A
Hot Water Tank — Part 9/Section 1
House Keeping — Part 12

* Definitions are different.

Hue — Part 3
Humidification — Part 8/Section 1
Humidity, Absolute — Part 8/Section 1
Humidity, Relative — Part 8/Section 1
Hybrid Building — Part 8/Section 3
Hydrant System — Part 4
Hydro-pneumatic Systems — Part 9/Section 1
Hydronic Systems — Part 8/Section 3
Hydronic System Balancing — Part 8/Section 3

I

Identification Sign — Part 10/Section 2
Illuminance — Part 8/Section 1
Illuminated Sign — Part 10/Section 2
Impact Sound Pressure Level, L_i — Part 8/Section 4
Impairment — Part 3
Importance Factor — Part 6/Section 1
**Imposed Load (Live Load)* — Part 6/Section 1, Part 6/Section 6
Impulse Current — Part 8/Section 2
Impulse Withstood Voltage — Part 8/Section 2
Increments — Part 6/Section 7A, Part 6/Section 7B
Independent Cluster– Part 3
Indirect Contact — Part 8/Section 2
Indirect-Direct Cooling — Part 8/Section 3
Indirect Waste Pipe — Part 9/Section 2
Indoor Air Quality (IAQ) — Part 8/Section 3, Part 11
Indoor Ambient Noise — Part 8/Section 4
Indoor Environment Quality (IEQ) — Part 11
Industrial Buildings — Part 6/Section 1
Industrial Plugs and Sockets — Part 8/Section 2
Infill Balustrades — Part 6/Section 8
Infiltration/Exfiltration — Part 8/Section 3
Inflammable Material — Part 8/Section 2
Information Management — Part 12
Informational Sign — Part 10/Section 2
Ingress — Part 10/Section 1
Initial Load Test — Part 6/Section 5B
Initial Prestress — Part 6/Section 5B
Initial Tension — Part 6/Section 5B
Injection — Part 6/Section 2
Inlet — Part 9/Section 1
Inlet Fittings — Part 9/Section 2
Inlet Hopper — Part 9/Section 2
Inner Diameter — Part 6/Section 3B
Insanitary — Part 9/Section 2
Insertion Loss — Part 8/Section 4

* Definitions are different.

Inside Location — Part 6/Section 3A, Part 6/Section 3B
Inside Plant (ISP) — Part 8/Section 6
Inspection Chamber — Part 9/Section 2
Inspection Door — Part 8/Section 5B
Instability — Part 6/Section 6
**Installation* — Part 8/Section 5A, Part 9/Section 4
Installation (Electrical) — Part 8/Section 2
Installer — Part 8/Section 5A
Institutional Buildings — Part 6/Section 1
Insulated — Part 8/Section 2
Insulating Glass Unit (IGU) — Part 6/Section 8
Insulation — Part 8/Section 2
Insulation, Basic — Part 8/Section 2
Insulation, Double — Part 8/Section 2
Insulation, Reinforced — Part 8/Section 2
Insulation, Supplementary — Part 8/Section 2
Intensity of Earthquake — Part 6/Section 1
Interceptor — Part 9/Section 2
Interceptor Manhole or Interceptor Chamber — Part 9/Section 2
Interior Panel — Part 8/Section 5B
Interlayer — Part 6/Section 8
Interlocking Cluster — Part 3
Intermediate Cross-Connect — Part 8/Section 6
Internal Faces of Cluster– Part 3
Internal Lightning Protection System — Part 8/Section 2
Internal Partition — Part 6/Section 8
Internal Reflected Component (IRC) — Part 8/Section 1
International Symbol of Accessibility — Part 3, Part 10/Section 2
Interval — Part 8/Section 5A
Intrusion Detection Systems — Part 12
Invasive Plant — Part 10/Section 1
Invert — Part 9/Section 2, Part 10/Section 1
Internet of Things — Part 8/Section 6
Irrigation — Part 10/Section 1
Isolation — Part 8/Section 2
Isolator — Part 8/Section 2
Isoptera — Part 6/Section 3A

J

Jerk — Part 8/Section 5A
Joint — Part 6/Section 3B, Part 6/Section 4
Joist — Part 6/Section 3B
Jointed Detailing System — Part 6/Section 7A
Joint Reinforcement — Part 6/Section 4
Junction Box — Part 8/Section 2
Junction Pipe — Part 9/Section 1, Part 9/Section 2

K

**Kerb* — Part 3, Part 10/Section 1
Kerb Ramp — Part 3
Knot — Part 6/Section 3A
Knot Hole– Part 6/Section 3A
Knurled Surface — Part 3

L

Lagging — Part 9/Section 1, Part 9/Section 2
Lamella Roof — Part 6/Section 3A
Laminated Safety Glass — Part 6/Section 8
*Laminated Veneer Lumbe*r — Part 6/Section 3A
Laminations — Part 6/Section 3A
Landfilling — Part 9/Section 3
Landing — Part 3
Landing Call Push — Part 8/Section 5A
Landing Door — Part 8/Section 5A
Landing Zone — Part 8/Section 5A
Large Lobby — Part 8
Latent Heat — Part 8/Section 3
Latent Heat Load — Part 8/Section 3
Lateral Restraint for a Beam — Part 6/Section 6
Lateral Support — Part 6/Section 4
Latewood — Part 6/Section 3A
Leachate — Part 9/Section 3
Leading Imposed Load — Part 6/Section 6
Leaf — Part 6/Section 4
Leakage Current — Part 8/Section 2
Ledge or Tand — Part 3
Length of Internode — Part 6/Section 3B
Levelling Device, Lift Car — Part 8/Section 5A
Levelling Device, One Way Automatic — Part 8/Section 5A
Levelling Device, Two-Way Automatic Maintaining — Part 8/Section 5A
Levelling Devices — Part 8/Section 5A
Levelling Zone — Part 8/Section 5A
LEMP Protection Measures (SPM) — Part 8/Section 2
Licensed (or Registered) Plumber — Part 9/Section 1, Part 9/Section 2
Life Cycle — Part 12
Life Cycle Assessment (LCA) — Part 11
Lift — Part 3, Part 8/Section 5A

* Definitions are different.

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An appliance designed to transport persons or materials between two or more levels in a vertical or substantially vertical direction by means of a guided car or platform. The word 'elevator' is also synonymously used for 'lift'.

Lift Car — Part 8/Section 5A
Lift Landing — Part 8/Section 5A
Lift Lobby — Part 4
Lift Machine — Part 8/Section 5A
Lift Pit — Part 8/Section 5A
Lift Ride Quality — Part 8/Section 5A
Lift Well — Part 8/Section 5A
Lift Well Enclosure — Part 8/Section 5A
Light Output Ratio (LOR) or Efficiency — Part 8/Section 1
Light Pipe — Part 8/Section 1
Light Reflectance Value (LRV) — Part 3
Light Shelf — Part 8/Section 1/, Part 11
Light Transmission — Part 6/Section 8
Light Transmittance — Part 6/Section 8
Light-Weight Concrete — Part 6/Section 7A
Lighting — Part 8/Section 1
Lightning Electromagnetic Impulse — Part 8/Section 2
Lightning Protection — Part 8/Section 2
Lightning Protection Level (LPL) — Part 8/Section 2
Lightning Protection System (LPS) — Part 8/Section 2
Lightning Protection Zone — Part 8/Section 2
Lignin — Part 6/Section 3B
Line Conductor — Part 8/Section 2
Linear Defects — Part 6/Section 8
Limit State — Part 6/Section 6
Liquefaction — Part 6/Section 1
Lithological Features — Part 6/Section 1
Live Knot — Part 6/Section 3A
Live or Alive — Part 8/Section 2
Live Load — Part 6/Section 6
Live Part — Part 8/Section 2
Load — Part 6/Section 6
Load Bearing Wall — Part 6/Section 4
Load Carrying Unit — Part 8/Section 5B
Loaded Edge Distance — Part 6/Section 3A
Loaded End or Compression End Distance — Part 6/Section 3B
Local Area Network (LAN) — Part 8/Section 6
Local Exhaust Ventilation– Part 8/Section 1
Local Multipoint Distribution System (LMDS) — Part 8/Section 6
Location — Part 6/Section 3A
Locations, Industrial– Part 8/Section 2
Locations, Non-Industrial — Part 8/Section 2
Loft — Part 3
Loose Grain (Loosened Grain) — Part 6/Section 3A
Loose Knot — Part 6/Section 3A
Lower Inner Decking — Part 8/Section 5B
Lower Outer Decking — Part 8/Section 5B
Low Rise Building — Part 6/Section 1
Low-Voltage Switchgear and Controlgear Assembly — Part 8/Section 2
Lumen — Part 8/Section 1
Luminaire — Part 8/Section 2
Luminance (at a Point of a Surface in a Given Direction) (Brightness) — Part 8/Section 1
Luminous Flux — Part 8/Section 1

M

M2M — Part 8/Section 6
Machete — Part 6/Section 3B
Machinery — Part 8/Section 5B
Machinery Spaces — Part 8/Section 5B
Maximum Capacity — Part 8/Section 5B
Made-Up Ground — Part 6/Section 2
Main Cross-connect — Part 8/Section 6
Main Distribution Frame (MDF) — Part 8/Section 6
Main Drain — Part 9/Section 1
Main Earthing Terminal — Part 8/Section 2
Main Member — Part 6/Section 6
Main Soil Pipe (MSP) — Part 9/Section 2
Main Soil and Waste Pipe (MSWP) — Part 9/Section 2
Main Vent Pipe (MVP) — Part 9/Section 2
Main Waste Pipe (MWP) — Part 9/Section 2
Maintenance — Part 12
Maintenance Factor — Part 8/Section 1
Maintenance Management — Part 12
Maintenance Manual — Part 12
Maintenance Organization — Part 8/Section 5A
Maintenance Plan — Part 12
Maintenance Policy — Part 12
Maintenance Programme — Part 12
Maintenance Strategy — Part 12
Make-Up Air — Part 8/Section 1
Make-Up Water — Part 9/Section 1
Management System — Part 12
Manhole — Part 9/Section 2
Manhole Chamber — Part 9/Section 2
Manifestation — Part 6/Section 8
Manifold — Part 9/Section 4
Manoeuvring Zone — Part 3
Mansard — Part 10/Section 2

Mantrap — Part 12
Marquee Sign– Part 10/Section 2
Masonry — Part 6/Section 4
Masonry Unit — Part 6/Section 4
Mass Rapid Transit — Part 4
Master Plan — Part 3
Mat — Part 6/Section 3B
Material Handling Hoists — Part 7
Maximum Thickness — Part 6/Section 8
Mean Ground Level — Part 6/Section 1
Mean Outer Diameter — Part 6/Section 3B
Mean Radiant Temperature — Part 8/Section 3
Mean Wall Thickness — Part 6/Section 3B
Means of Egress — Part 4
Means of Escape — Part 4
Measured Speed — Part 8/Section 5B
Mechanical Ventilation — Part 8/Section 1
Mechanically Laminated — Part 6/Section 3A
Mercantile Buildings — Part 6/Section 1
Meridian — Part 8/Section 1
Meshed Bonding Network (MESH-BN) — Part 8/Section 2
Metropolitan Area Network (MAN) — Part 8/Section 6
Mezzanine Floor — Part 3
Metro-station — Part 4
Microclimate — Part 10/Section 1
Mill Tolerance — Part 6/Section 6
Miniature Circuit Breaker (MCB) — Part 8/Section 2
Minimum Thickness — Part 6/Section 8
Mixed Mode Building — Part 8/Section 3
Mixed Occupancy — Part 4
Mobile Equipment — Part 8/Section 2
Modal Mass in Mode of a Structure — Part 6/Section 1
Modal Participation Factor — Part 6/Section 1
Modes of Oscillation — Part 6/Section 1
Modular Co-ordination — Part 6/Section 7A, Part 6/Section 7B
Modular Grid — Part 6/Section 7A, Part 6/Section 7B
Module — Part 6/Section 7A, Part 6/Section 7B
Modulus of Elasticity (Young's Modulus) — Part 6/Section 8
Moment Resistant Frame — Part 6/Section 4
Moment Resistant Frame with Shear Walls — Part 6/Section 4
Monitoring — Part 8/Section 2
Monolithic Glass — Part 6/Section 8
Mortise and Tenon — Part 6/Section 3B
Mould — Part 6/Section 3A
Moulded Case Circuit Breaker (MCCB) — Part 8/Section 2
Mound — Part 10/Section 1
Moving Walk — Part 8/Section 5B
Mulching — Part 10/Section 1
Mullion — Part 6/Section 8
Multichannel Multipoint Distribution System (MMDS) — Part 8/Section 6
Multimodule — Part 6/Section 7A, Part 6/Section 7B
Multiple Earthed Neutral System — Part 8/Section 2
*Multiple Occupa*ncy — Part 4
Multi-User Telecommunications Outlet Assembly (MUTOA) — Part 8/Section 6
Municipal Authority — Part 9/Section 3
Municipal Solid Waste — Part 9/Section 3

N

Native Plant — Part 10/Section 1
Natural Period in Mode of Oscillation — Part 6/Section 1
Natural Ventilation — Part 8/Section 1
Naturalised Plant — Part 10/Section 1
Naturally Conditioned Building — Part 8/Section 3
Negative Skin Friction — Part 6/Section 2
Net Section — Part 6/Section 3B
Neutral Conductor — Part 8/Section 2
Newel — Part 8/Section 5B
Node — Part 6/Section 3B
Noise — Part 8/Section 4
Noise Exposure Forecast (NEF) — Part 8/Section 4
Noise Criteria — Part 8/Section 4
Noise Rating (NR) — Part 8/Section 4
Noise Reduction Co-efficient (NRC) — Part 8/Section 4
Nominal/Rated Speed — Part 8/Section 5B
Nominal Thickness — Part 6/Section 8
Nominal Travel Time — Part 8/Section 5A
Non-Combustible Material — Part 6/Section 8
Non-Renewable Resource — Part 11
Non-Selective Collective Automatic Operation — Part 8/Section 5A
Non-transit Occupancy — Part 4
Normal Mode of Oscillation — Part 6/Section 1
Normal Operation — Part 8/Section 5A
Normal Stress — Part 6/Section 6
Normalized Impact Sound Pressure Level — Part 8/Section 4
North and South Points — Part 8/Section 1

O

Occupancy or Use Group — Part 2, Part 3, Part 4

The principal occupancy for which a building or a part of a building is used or intended to be used; for the purposes of classification of a building according to occupancy, an occupancy shall be deemed to include the subsidiary occupancies which are contingent upon it.

Occupant Load — Part 4
Occupants — Part 12
Occupier — Part 2
Octave Band — Part 8/Section 4
Office Buildings — Part 6/Section 1

**Offset* — Part 6/Section 2, Part 9/Section 1, Part 9/Section 2
Oil Buffer — Part 8/Section 5A
Oil Buffer Stroke — Part 8/Section 5A
Open Clusters — Part 3
Open Sign — Part 10/Section 2
Open Space — Part 3
Open Space, Front — Part 3
Open Space, Rear — Part 3
Open Space, Side — Part 3
Open Station — Part 4
Operable Parts — Part 3
Operating Device — Part 8/Section 5A
Operation — Part 8/Section 5A
Operational Construction/Installation — Part 2
Operational Plan — Part 12
Operational Strategy — Part 12
Operative Temperature — Part 8/Section 3
Operator of a Facility — Part 9/Section 3
Optical Distribution Frame — Part 8/Section 6
Optical Fibre — Part 8/Section 6
Orientation of Buildings — Part 8/Section 1
Organic Coated Glass — Part 6/Section 8
Origin of an Electrical Installation — Part 8/Section 2
Outer Diameter — Part 6/Section 3B
Outside Location — Part 6/Section 3A, Part 6/Section 3B
Outside Plant (OSP) — Part 8/Section 6
Overcurrent — Part 8/Section 2
Overload Current (of a Circuit) — Part 8/Section 2
Over Speed Governor — Part 8/Section 5A
Overhead Beams — Part 8/Section 5A
Owner — Part 0, Part 2, Part 3, Part 10/Section 2

A person, a group of persons or a body having a legal interest in land and/or building thereon. This includes freeholders, leaseholders or those holding a sub-lease who will have legal right to occupation and have liabilities in respect of safety or building condition.

In case of lease or sub-lease holders, as far as ownership with respect to the structure is concerned, the structure of a flat or structure on a plot belongs to the allottee/lessee till the allotment/lease subsists.

Ozone Depletion Potential (ODP) — Part 8/Section 3

P

Pane — Part 6/Section 8
Panel — Part 6/Section 8
Panel Wall — Part 6/Section 4
Parapet — Part 3, Part 10/Section 2
Parking Space — Part 3
Partial Safety Factor — Part 6/Section 6
Partition — Part 3, Part 6/Section 8
Partition Wall — Part 6/Section 4
Partly Framed or Unframed Glazing — Part 6/Section 8
Passenger Arrival Rate — Part 8/Section 5A
Passenger Average Transfer — Part 8/Section 5A
Passenger Average Waiting Time (AWT) — Part 8/Section 5A
Passenger Lift — Part 8/Section 5A
Passive Cooling — Part 8/Section 3
Passive Heating — Part 8/Section 3
Passive Solar Gain — Part 6/Section 8
Patterned Glass — Part 6/Section 8
Peak Ground Acceleration — Part 6/Section 1
Peak Gust — Part 6/Section 1
Peak to Peak Vibration Levels — Part 8/Section 5A
Peat — Part 6/Section 2
Pelletization — Part 9/Section 3
Percentile Level — Part 8/Section 4
Perimeter Intrusion Detection and Assessment System (PIDAS) — Part 12
Perimeter Security — Part 12
Period of Structural Adequacy under Fire — Part 6/Section 6
Period of Supply — Part 9/Section 1
Peripheral Field — Part 8/Section 1
Permanent Load — Part 6/Section 2
Permeable Paving– Part 10/Section 1
Permissible Stress — Part 6/Section 3A, Part 6/Section 3B, Part 6/Section 6
Permit — Part 2

* Definitions are different.

Persons with Disabilities — Part 3
PEN Conductor — Part 8/Section 2
Phase Conductor — Part 8/Section 2
Physical Asset — Part 12
Pier — Part 6/Section 4
Pile Foundation — Part 6/Section 2
Pile Rig — Part 7
Pile Spacing — Part 6/Section 2
Pilot — Part 9/Section 4
Pink Noise — Part 8/Section 4
Pipe System — Part 9/Section 2
Pipe Work — Part 9/Section 1
Pit — Part 8/Section 5B
Pitch — Part 6/Section 6
Pitch Pocket — Part 6/Section 3A
Place of Comparative Safety — Part 4
Planned Preventive Maintenance — Part 12
Platform — Part 7
Plastic Collapse — Part 6/Section 6
Plastic Design — Part 6/Section 6
Plastic Hinge — Part 6/Section 6
Plastic Moment — Part 6/Section 6
Plastic Section — Part 6/Section 6
Plenum — Part 8/Section 3
Plinth — Part 3

The portion of a structure between the surface of the surrounding ground and surface of the floor, immediately above the ground.

Plinth Area — Part 3

The built up covered area measured at the floor level of the basement or of any storey.

Plug — Part 8/Section 2
Plumbing — Part 9/Section 1, Part 9/Section 2
Plumbing System — Part 9/Section 1, Part 9/Section 2
Pocket Type Reinforced Masonry — Part 6/Section 4
Point of Safety — Part 4
Point (in Wiring) — Part 8/Section 2
Poisson's Ratio — Part 6/Section 6
Pool — Part 9/Section 1
Pool Depth — Part 9/Section 1
Porch — Part 3
Portable Equipment — Part 8/Section 2
*Portable S*ign– Part 10/Section 2
Position and/or Direction Indicator — Part 8/Section 5A
Positive Ventilation — Part 8/Section 1, Part 8/Section 3
Post-Tensioning — Part 6/Section 5B
Potable Water — Part 9/Section 1
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Roof Exits — Part 4
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Room Height — Part 2, Part 3

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.

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Safe Load — Part 6/Section 2
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Sand, Medium — Part 6/Section 2
Sandwich Concrete Panels — Part 6/Section 7A, Part 6/Section 7B
Sandwich, Structural — Part 6/Section 3A
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Sanitary Land Filling — Part 12
Sanitary Waste — Part 12
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Sapwood — Part 6/Section 3A
Scaffold — Part 7
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Semi-Detached Building — Part 3
Separation Section — Part 6/Section 4
Sensible Cooling — Part 8/Section 3
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Server — Part 8/Section 6
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Service Life — Part 12
Service Lift — Part 8/Section 5A
**Service Pipe* — Part 9/Section 1, Part 9/Section 4
Service Road — Part 2, Part 3
Service Shut-Off Valve (Isolation Valve) — Part 9/Section 4
Serviceability Limit State — Part 6/Section 6

* Definitions are different.

Set-Back Line — Part 2, Part 3

A line usually parallel to the plot boundaries and laid down in each case by the Authority, beyond which nothing can be constructed towards the site boundaries.

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Shade Factor — Part 8/Section 3
Shading Coefficient — Part 6/Section 8
Shake — Part 6/Section 3A
Shallow Area — Part 9/Section 1
Shallow Foundation — Part 6/Section 2
Shear Connectors — Part 6/Section 7A, Part 6/Section 7B
Shear Force — Part 6/Section 6
Shear Lag — Part 6/Section 6
Shear Stress — Part 6/Section 6
Shear Wall — Part 6/Section 4
Sheathing — Part 6/Section 5B
Sheave — Part 8/Section 5A
Sheet Glass — Part 6/Section 8
Shelterbelt — Part 10/Section 1
Shielding Effect — Part 8/Section 2
Shock Current — Part 8/Section 2
Short-Circuit Current — Part 8/Section 2
Short Column — Part 6/Section 5B
Shrinkage Loss — Part 6/Section 5B
Shrub — Part 10/Section 1
Shutdown/Outage — Part 12
Sick Building Syndrome (SBS) — Part 8/Section 3
Sign — Part 10/Section 2
Sign Area — Part 10/Section 2
Sign Copy — Part 10/Section 2
Sign Face — Part 10/Section 2
Sign Structure — Part 10/Section 2
Signal Operation — Part 8/Section 5A
Silt — Part 6/Section 2
Silver — Part 6/Section 3B
Single Automatic Operation — Part 8/Section 5A
Single Floor Flight Time — Part 8/Section 5A
Single Floor Transit Time — Part 8/Section 5A
Single-Speed Alternating Current Control– Part 8/Section 5A
Site (Plot) — Part 2, Part 3, Part 4

A parcel (piece) of land enclosed by definite boundaries.

Site, Corner — Part 3
Site, Depth of — Part 3

Site, Double Frontage — Part 3
Site, Interior or Tandem — Part 3
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Slack Rope Switch — Part 8/Section 5A
Slender Column — Part 6/Section 5B
Slender Section — Part 6/Section 6
Slenderness Ratio — Part 6/Section 3B, Part 6/Section 4, Part 6/Section 6
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Soft Landscape– Part 10/Section 1
Soft Rock — Part 6/Section 2
Soil Appliances — Part 9/Section 2
Soil Densification — Part 6/Section 2
Soil, Highly Organic and Other Miscellaneous Soil — Part 6/Section 2
Soil Pipe — Part 9/Section 2
*Soil Reinforc*ement — Part 6/Section 2
Soil Waste — Part 9/Section 2
Soil, Black Cotton — Part 6/Section 2
Soil, Coarse Grained — Part 6/Section 2
Soil, Fine Grained — Part 6/Section 2
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Solar Energy Transmittance (Direct) — Part 6/Section 8
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Sound Knot — Part 6/Section 3A
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Sound Power Level — Part 8/Section 4
Sound Pressure Level, L_p — Part 8/Section 4, Part 8/Section 5B
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Spot Elevation — Part 10/Section 1
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Spread (or Isolated or Pad) Foundation/Footing — Part 6/Section 2
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Spring Buffer Load Rating– Part 8/Section 5A
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* Definitions are different.

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Standby Supply System — Part 8/Section 2
Standardized Level Difference — Part 8/Section 4
Static Pressure — Part 8/Section 3, Part 9/Section 1
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Station Platform — Part 4
Step Voltage — Part 8/Section 2
Stickability — Part 6/Section 6
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*Stock/Standard Size*s — Part 6/Section 8
Stop Tap — Part 9/Section 1
Stop-Cock — Part 9/Section 1
Storage — Part 9/Section 3
Storage Buildings — Part 6/Section 1
Storage Tank — Part 9/Section 1
Storey — Part 3

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.

Storey, Topmost — Part 3
Street — Part 2, Part 3

Any means of access, namely, highway, street, lane, pathway, alley, stairway, passageway, carriageway, footway, square, place or bridge, whether a thoroughfare or not, over which the public have a right of passage or access or have passed and had access uninterruptedly for a specified period, whether existing or proposed in any scheme and includes all bunds, channels, ditches, storm-water drains, culverts, sidewalks, traffic islands, roadside trees and hedges, retaining walls, fences, barriers and railings within the street lines.

Street/Outdoor Furniture — Part 10/Section 1
Street Level or Grade — Part 2, Part 3

The officially established elevation or grade of the centre line of the street upon which a plot fronts and if there is no officially established grade, the existing grade of the street at its mid-point.

Street Line — Part 2, Part 3, Part 10/Section 2

The line defining the side limits of a street.

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Strain Hardening — Part 6/Section 6
Strength — Part 6/Section 6
Strength Limit State — Part 6/Section 6
Stress — Part 6/Section 6
Stress Analysis — Part 6/Section 6
Stress at Transfer — Part 6/Section 5B
Stress Cycle Counting — Part 6/Section 6
Stress Range — Part 6/Section 6
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Structure, Temporary — Part 6/Section 3A
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Supply Pipe — Part 9/Section 1, Part 9/Section 2
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Surface Coefficient — Part 11
Surface Cracking — Part 6/Section 3B
Surface Resistance — Part 11
Surface Water — Part 9/Section 1, Part 9/Section 2
Surface Water Drain — Part 9/Section 1, Part 9/Section 2
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U

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The ratio of volume of building, measured in cubic metre, to the area of the plot, measured in square metre, and expressed in metre.

W

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* Definitions are different.

NATIONAL BUILDING CODE OF INDIA

PART 2 ADMINISTRATION

BUREAU OF INDIAN STANDARDS

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FOREWORD

This Code (Part 2) covers the administrative aspects, such as applicability of the Code, organization of building department for enforcement of the Code, procedure for obtaining development and building permits, and responsibility of the owner and all related professionals.

A need for codifying and unifying administrative provisions in different development control rules and building byelaws had been felt, particularly in regard to the applicability of such provisions, desirable qualifications for the enforcing Authority and the representative of the owner and responsibilities and duties of the Authority and the owner.

It is expected that the town and country planning department, department of local bodies, municipal administration, urban development, etc, as the case may be will coordinate the administrative provisions of this Part and the same given in the State Town and Country Planning Act, Municipalities Act/Municipal Corporation/Local Bodies Act, Development Authorities Act, etc.

This Part recommends the setting up of a 'Board of Appeal'. The 'Board of Appeal' gives the owner/architect/engineer an opportunity to defend the schemes which are based on conventional or new methods of design and construction or using new materials, which have been otherwise rejected by the Authority.

This Part also emphasizes the need for setting up an Arts Commission for metropolitan areas to safeguard existing aesthetics in the event of new schemes proposed for buildings of public importance or buildings coming up in an important area near historic/monumental buildings. The Commission can assist the civic authorities in reviewing plans for development from the stand point of assuring good taste and regard for often threatened natural beauties. The Commission can serve as a means whereby the government and public bodies and individuals could get advice on artistic questions in connection with building schemes.

The first version of this Part was brought out in 1970, which was subsequently revised in 1983 and 2005. As a result of implementing 1970 version of this Part in rewriting building byelaws and development control rules of some municipal corporations and municipalities, some useful suggestions were emerged. These were incorporated in the first revision to the extent possible. The significant changes in 1983 version of this Part included the new administrative provisions related to development control rules, additional information to be furnished/indicated in the building plan for multistoreyed and special buildings and modified provisions regarding submission of building plans by Government Departments to the Authority.

In the second revision, number of modifications were incorporated based on the experience gained over the years then. The provisions of this Part were thoroughly reviewed in the context of the natural calamities faced by the country then, such as the devastating earthquake in Gujarat in the year 2001, and provisions were modified accordingly to further ensure structural adequacy of the buildings. Structural design of buildings in accordance with the provisions of the Code and construction and supervision thereof by competent professionals to ensure structural safety were given due importance in the revision. Other significant modifications incorporated in the 2005 revision were: inclusion of the concept of team of building officials; provision of single window approach for permit for all services; provisions regarding computerization of approval process for building permit; provision to certify safety of buildings against natural disaster by engineer/structural engineer and owner; provision of two stage permit for high rise residential buildings and special buildings; provisions regarding inspection of completed and occupied building by the Authority from safety point of view; provision empowering engineers/architects for sanctioning plans of residential buildings up to 500 m^2; and modifications in the provisions for architectural control to effectively take care of the urban aesthetics, and inclusion of architectural engineer, landscape architect and urban designer among the registered professionals for the concerned applicable works.

In this third revision, number of modifications have been incorporated based on the experience gained over the years specially in the implementation of techno-administrative and techno-legal regime encountered and with a

view to strengthening the structural safety mechanism in building permit process. The significant modifications made in this revision are as follows:

a) Geotechnical engineer has been included among the registered professionals for the concerned applicable works;
b) With a view to ensuring ease of doing business in the built environment sector, a detailed provision for streamlining the approval process in respect of different agencies has been incorporated in the form of an integrated approval process through single window approach for enabling expeditious approval process, avoiding separate clearances from various authorities;
c) Provision on computerization of approval process has been detailed enabling online submission of plans, drawings and other details, and sanction thereof aiding in quicker approval process;
d) Provision has been made for getting the design, drawings and details of buildings peer reviewed/proof checked in case of important projects and projects having high complexity and sensitivity, before approving the same;
e) Responsibility of the owner seeking occupancy permit from the Authority has been detailed;
f) Provision of periodic audit of designated public buildings for accessibility for the elderly and persons with disabilities, has been included;
g) Qualification and competence of builder/constructor has been added along with the form for their engagement;
h) Form for certificate for subsurface investigation, wherever applicable, has been added;
j) Form for certificate for completed structural design work as per structural safety requirements has been included;
k) Form for certificate for supervision of work has been rationalized;
m) Form for certificate for completed work by constructor, has been added; and
n) Form for completion certificate has been rationalized.

The Sectional Committee responsible for the revision of the Code had examined the use of the words 'surveyor/ building surveyor/supervisor', etc, under various building byelaws with varying qualifications in different states. It was decided not to use the generic word 'surveyor' or such other words. The Sectional Committee had, on the other hand recommended association of various professionals for various job responsibilities depending upon their qualifications/competence.

The Sectional Committee observed that this Part has been so formulated as to ensure quality and safety in the whole gamut of activities primarily divided into planning, design, execution and supervision. This has been ensured by obtaining certification from the registered professionals involved in planning, design and supervision. Apart from these, various other persons are involved whose contribution may be duly taken into account depending on the type, nature, magnitude and complexity of the project, such as fire protection engineer, security system specialist, environment specialist/sustainability specialist, accessibility specialist, interior designer, project management consultant, etc, in proper planning, design, erection, commissioning and operation of buildings and built environment.

Also, it was noted that the words 'licencing/licensed, etc' were in use by local bodies in different states. The Sectional Committee, however, decided for use of words 'registration/registered, etc' for the same, which may be adopted uniformly. The registration requirements of professionals are given in Annex A.

NATIONAL BUILDING CODE OF INDIA

PART 2 ADMINISTRATION

SECTION 1 GENERAL

1 SCOPE

This Code (Part 2) covers the administrative aspects of the Code, such as applicability of the Code, organization of building department for enforcement of the Code, procedure for obtaining development and building permits, and responsibility of the owner.

NOTE — This Code is called the National Building Code of India, hereinafter referred to as 'the Code'.

2 TERMINOLOGY

For the purpose of this Part, the following definitions shall apply.

2.1 Accessory Use — Any use of the premises subordinate to the principal use and customarily incidental to the principal use.

2.2 Alteration — A change from one type of occupancy to another, or a structural change, such as an addition to the area or height, or the removal of part of a building, or any change to the structure, such as the construction of, cutting into or 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 fixtures or equipment.

2.3 Approved — Approved by the Authority having jurisdiction.

2.4 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'.

2.5 Building — Any structure for whatsoever purpose and of whatsoever materials constructed and every part thereof whether used as human habitation or not and includes foundation, plinth, walls, floors, roofs, chimneys, plumbing and building services, fixed platforms, verandah, balcony, cornice or projection, part of a building or anything affixed thereto or any wall enclosing or intended to enclose any land or space and signs and outdoor display structures. Tents/ *Shamianahs*, tarpaulin shelters, etc, erected for temporary and ceremonial occasions with the permission of the Authority shall not be considered as building.

2.6 Building, Height of — The vertical distance measured, in the case of flat roofs from the average level of the ground around and contiguous to the building or as decided by the Authority to the terrace of last livable floor of the building adjacent to the external walls; and 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 the case of gables facing the road, the midpoint between the eaves level and the ridge. Architectural features serving no other function except that of decoration shall be excluded for the purpose of measuring heights.

2.7 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 prescribed, if any, in any scheme. The building line may change from time to time as decided by the Authority.

2.8 Conversion — The change of occupancy or premises to any occupancy or use requiring additional occupancy permit.

2.9 Development — 'Development' with grammatical variations means the carrying out of building, engineering, mining or other operations in, or over, or under land or water, or in the use of any building or land, and includes redevelopment and layout and subdivision of any land; and 'to develop' shall be construed accordingly.

2.10 Drain — A conduit or channel for the carriage of storm water, sewage, waste water or other water-borne wastes in a building drainage system.

2.11 Drainage — The removal of any liquid by a system constructed for the purpose.

2.12 Occupancy or Use Group — The principal occupancy for which a building or a part of a building is used or intended to be used; for the purposes of classification of a building according to occupancy, an occupancy shall be deemed to include the subsidiary occupancies which are contingent upon it.

2.13 Occupier — It includes any person for the time being, paying or liable to pay rent or any portion of rent of the building in respect of which the ward is used, or compensation or premium on account of the occupation of such building and also a rent-free tenant, but does not include a lodger, and the words 'occupy' and 'occupation' do not refer to the lodger.

An owner living in or otherwise using his own building shall be deemed to be the occupier thereof.

2.14 Operational Construction/Installation — A construction/installation put up by Government Departments for operational purposes (*see* **12.1.2.1**).

2.15 Owner — A person, a group of persons or a body having a legal interest in land and/or building thereon. This includes freeholders, leaseholders or those holding a sublease, who will have a legal right to occupation and have liabilities in respect of safety or building condition.

In case of lease or sublease holders, as far as ownership with respect to the structure is concerned, the structure of a flat or structure on a plot belongs to the allottee/ lessee till the allotment/lease subsists.

2.16 Permit — A permission or authorization in writing by the Authority to carry out work regulated by the Code.

2.17 Registered Architect, Engineer, Structural Engineer, Geotechnical Engineer, Supervisor, Town Planner, Landscape Architect, Urban Designer — A qualified architect, engineer, structural engineer, geotechnical engineer, supervisor, town planner, landscape architect or urban designer who has been registered by the Authority or by the body governing such profession and constituted under a statute, as may be applicable. The registration requirements of these professionals shall be as given in Annex A.

NOTES

1 Unless specified otherwise, the world 'engineer' shall mean 'civil engineer' or 'architectural engineer'.

2 The word 'licencing/licensed', etc, if used by the Authority in the above context, shall be deemed to mean 'registration/ registered', etc.

2.18 Road — *See* **2.25**.

2.19 Road Line — *See* **2.27**.

2.20 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.

2.21 Sanctioned Plan — The set of plans, specifications and other details submitted in connection with a building or development and duly approved and sanctioned by the Authority.

2.22 Service Road — A road/lane provided at the rear or side of a plot for service purposes.

2.23 Set-Back Line — A line usually parallel to the plot boundaries and laid down in each case by the Authority, beyond which nothing can be constructed towards the site boundaries.

2.24 Site (Plot) — A parcel (piece) of land enclosed by definite boundaries.

2.25 Street — Any means of access, namely, highway, street, lane, pathway, alley, stairway, passageway, carriageway, footway, square, place or bridge, whether a thoroughfare or not, over which the public have a right of passage or access or have passed and had access uninterruptedly for a specified period, whether existing or proposed in any scheme and includes all bunds, channels, ditches, storm-water drains, culverts, sidewalks, traffic islands, roadside trees and hedges, retaining walls, fences, barriers and railings within the street lines.

2.26 Street Level or Grade — The officially established elevation or grade of the centre line of the street upon which a plot fronts and if there is no officially established grade, the existing grade of the street at its mid-point.

2.27 Street Line — The line defining the side limits of a street.

2.28 To Erect — To erect a building means,

a) to erect a new building on any site whether previously built upon or not;
b) to re-erect any building of which portions above the plinth level have been pulled down, burnt or destroyed.

2.29 Unsafe Building — Buildings which are structurally and constructionally unsafe or insanitary or not provided with adequate means of egress or which constitute a fire hazard or are otherwise dangerous to human life or which in relation to existing use constitute a hazard to safety or health or public welfare, by reason of inadequate maintenance, dilapidation or abandonment.

3 APPLICABILITY OF THE CODE

3.1 All Parts of the Code and their Sections shall apply to all buildings described in **3.2** to **3.8**, as may be applicable.

3.2 Where a building is erected, the Code applies to the design and construction of the building.

3.3 Where the whole or any part of the building is removed, the Code applies to all parts of the building whether removed or not.

3.4 Where the whole or any part of the building is demolished the Code applies to any remaining part and to the work involved in demolition.

3.5 Where a building is altered (*see* **12.4** and **12.4.1**), the Code applies to the whole building whether existing or new except that the Code applies only to part, if that part is completely self contained with respect to facilities and safety measures required by the Code.

3.6 Where the occupancy of a building is changed the Code applies to all parts of the building affected by the change.

3.7 Where development of land is undertaken the Code applies to the entire development of land.

3.8 Existing Buildings/Development

Nothing in the Code shall require the removal, alteration or abandonment, nor prevent continuance of the use or occupancy of an existing building/development, unless in the opinion of the Authority, such building/ development constitutes a hazard to the safety of the adjacent property or the occupants of the building itself.

4 INTERPRETATION

4.1 The heading which appears at the beginning of a clause or sub-clause of the Code shall be deemed to be a part of such clause or sub-clause, respectively.

4.2 The use of present tense includes the future tense, the masculine gender includes the feminine and the neuter, the singular number includes the plural and the plural includes the singular. The word 'person' includes a corporation as well as an individual; writing includes printing and typing and 'signature' includes thumb impression made by a person who cannot write if his name is written near to such thumb impression.

5 ALTERNATIVE MATERIALS, METHODS OF DESIGN AND CONSTRUCTION, AND TESTS

5.1 The provisions of the Code are not intended to prevent the use of any material or method of design or construction not specifically prescribed by the Code, provided any such alternative has been approved.

5.2 The Authority may approve any such alternative provided it is found that the proposed alternative is satisfactory and conforms to the provisions of relevant parts regarding material, design and construction and that material, method, or work offered is, for the purpose intended, at least equivalent to that prescribed in the Code in quality, strength, compatibility, effectiveness, fire and water resistance, durability and safety.

5.3 Tests

Whenever there is insufficient evidence of compliance with the provisions of the Code or evidence that any material or method of design or construction does not conform to the requirements of the Code or in order to substantiate claims for alternative materials, design or methods of construction not specifically prescribed in the Code, the Authority may require tests sufficiently in advance as proof of compliance. These tests shall be made by an approved agency at the expense of the owner.

5.3.1 Test methods shall be specified by the Code for the materials or design or construction in question. If there are no appropriate test methods specified in the Code, the Authority shall determine the test procedure. For methods of test for building materials, reference may be made to Part 5 'Building Materials' of the Code.

5.3.2 Copies of the results of all such tests shall be retained by the Authority for a period of not less than two years after the acceptance of the alternative material.

SECTION 2 ORGANIZATION AND ENFORCEMENT

6 DEPARTMENT OF BUILDINGS

6.1 The department of buildings shall be created by the Authority and a team of building officials shall be appointed to carry out work of such department.

6.2 Appointment of Team of Building Officials

The team of building officials shall be appointed by the Authority. The team shall comprise officials drawn from concerned disciplines such as engineer, architect, town planner, landscape architect and urban designer as may be decided by the Authority. For scrutiny of layout plans of plots of one hectare and above in metro cities and two hectares and above in other places, town planner shall be part of the team of building officials. For plots of five hectares and above, landscape architect shall also be part of the team. An urban designer shall also be required to be the part of team of building officials for examining proposals on integrated urban design and development for residential/business/ institutional and assembly building.

NOTE — Metro cities are cities with population more than 1 000 000.

6.3 Organization

In the department of buildings, such number of officers, technical assistants, inspectors and other employees shall be appointed to assist the team of building officials as shall be necessary for the administration of the Code and as authorized by the Authority.

6.4 Delegation of Powers

The Authority may designate one of the building officials who shall exercise all the powers of the team of building officials. The work of the team of building officials may be outsourced to competent professional/ agency/group as may be deemed necessary.

6.5 Qualification of Building Officials

The qualification of building officials scrutinizing the plans and carrying out inspection of buildings shall not

in any case be less than those prescribed in Annex A.

6.5.1 In small local bodies having insufficient resources to appoint such officials with the above qualifications, two or three such bodies contiguously located could join together and share the services of one team of building officials.

6.6 Qualifications of Assistant

No person shall be appointed as assistant unless he has got the qualifications prescribed in Annex A for a registered supervisor.

6.7 Restriction on Employees

No official or employee connected with the department of buildings except one whose only connection is that of a member of the Board of Appeals, established under **8** shall be engaged directly or indirectly in a work connected with the furnishing of labour, materials or appliances for the construction, alteration or maintenance of a building, or the preparation of plans or of specifications thereof unless he is the owner of building; nor shall such official or employee engage in any work which conflicts with his official duties or with the interests of the department.

6.8 Records

Proper records of all applications received, permits and orders issued, inspections made shall be kept and copies of all papers and documents connected with the administration of its duties shall be retained and all such records shall be open to public inspection at all appropriate times.

7 POWER AND DUTIES OF TEAM OF BUILDING OFFICIALS

The team of building officials shall enforce all the provisions of the Code and shall act on any question relative to the mode or manner of construction and the materials to be used in the erection, addition, alteration, repair, removal, demolition, installation of service equipment and the location, use, occupancy and maintenance of all buildings except as may otherwise be specifically provided.

7.1 Application and Permits

The team of building officials shall receive all applications and issue permits (*see* **12.10**) for the erection and alteration of buildings and examine the premises for which such permits have been issued and enforce compliance with the Code.

7.2 Building Notices and Orders

The team of building officials shall issue all necessary notices or orders to remove illegal or unsafe conditions, to require the necessary safeguards during construction, to require adequate exit facilities in existing buildings and to ensure compliance with all the requirements of safety, health and general welfare of the public as included in the Code.

7.3 Right of Entry

Upon presentation of proper credentials and with advance notice, the team of building officials or its duly authorized representative may enter at any reasonable time any building or premises to perform any duty imposed upon him by the Code.

7.4 Inspection

The team of building officials shall make all the required inspections or it may accept reports of inspections of authoritative and recognized services or individuals; and all reports of inspections shall be in writing and certified by a responsible officer of such authoritative service or by the responsible individual or engage any such expert opinion as he may deem necessary to report upon unusual technical issues that may arise, subject to the approval of the Authority.

7.5 Construction Not According to Plan

Should the team of building officials determine at any stage that the construction is not proceeding according to the sanctioned plan or is in violation of any of the provisions of the Code, or any other applicable Code Regulation, Act or Byelaw, it shall notify the owner, and all further construction shall be stayed until correction has been effected and approved.

7.5.1 Should the owner fail to comply with the requirements at any stage of construction, the Authority shall issue a notice to the owner asking explanation for non-compliance. If the owner fails to comply within 14 days from the date of receiving the notice, the Authority shall be empowered to cancel the building permit issued and shall cause notice of such cancellation to be securely pasted upon the said construction, if the owner is not traceable at his address given in the notice. Pasting of such a notice shall be considered sufficient notification of cancellation to the owner thereof. No further work shall be undertaken or permitted upon such construction until a valid building permit thereafter has been issued. If the owner, in violation of the notice for cancellation, continues the construction, the Authority may take all necessary means to stop such work and further appropriate actions including demolitions. The owner shall, however, have right to appeal against cancellation of permit, to the board of appeal, within a stipulated period, as may be decided by the Authority.

7.6 Modification

Wherever practical difficulties are involved in carrying

out any provision of the Code, the team of building officials may vary or modify such provisions upon application of the owner or his representative provided the spirit and intent of the Code shall be observed and public welfare and safety be assured. The application for modification and the final decision of the team of building officials shall be in writing and shall be officially recorded with the application for the permit in the permanent records of the Department of Building Inspection.

7.7 Occupancy Violations

Wherever any building is being used contrary to provisions of the Code, the team of building officials may order such use discontinued and the building or portion thereof, vacated by the notice served on any person, causing such use to be discontinued. Such person shall discontinue the use within 10 days after receipt of such notice or make the building or portion thereof, comply with the requirements of the Code.

8 BOARD OF APPEALS

In order to determine the suitability of alternative materials or methods of design or construction and to provide for reasonable interpretation of the provisions of the Code or in the matter of dispute relating to an ongoing construction *vis-a-vis* the sanctioned plan, a Board of Appeals consisting of members who are qualified by experience and training and to pass judgement upon matters pertaining to building construction, shall be appointed by the Authority. A representative of the team of building officials shall be an *ex-officio* member and shall act as secretary to the Board. The Board shall adopt reasonable rules and regulations for conducting its investigations and shall render all decisions and findings in writing to the team of building officials with a duplicate copy to the appellant and may recommend such modifications as are necessary.

9 VIOLATIONS AND PENALTIES

9.1 Offences and Penalties

9.1.1 Any person who contravenes any of the provisions of the Code or any requirements of obligations imposed on him by virtue of the Code, or who interferes with or obstructs any person in the discharge of his duties, shall be guilty of an offence and the Authority shall levy suitable penalty or take other actions as per the Code (*see also* **7.5** and **15**).

NOTE — The penalty may be in the form of collection of arrears of tax.

9.1.2 The buildings/developments violating any applicable statutory rules shall be demolished/brought within the limits as prescribed in such rules at the expense of the owner. The buildings coming up in the vicinity of an aerodrome in violation of the height restriction laid down by the Directorate General of Civil Aviation shall be accordingly demolished/brought within the limits prescribed by DGCA rules.

9.1.3 The registered architect, engineer, structural engineer, supervisor, town planner, landscape architect, urban designer and utility service engineer (*see* Annex A) responsible for the services rendered for supervision of the construction/development and for the completion certificate; in the event of violation of the provisions of the Code, shall be liable to penalties as prescribed by the Authority including cancellation of registration done by it or make such recommendation to the statutory body governing such profession.

9.2 Further Obligation of Offender

The conviction of any person for an offence under the provision of **9.1** shall not relieve him from the duty of carrying out the requirements or obligations imposed on him by virtue of the provisions of the Code; and if such requirements or obligations are not complied with in accordance with an order made under provisions of **9.1**, the Authority under the provisions of the Code may, if necessary and advisable, enter upon the premises in respect of which a conviction has been made and carry out at the expense of the convicted person, the requirements or obligations referred to in the said order and the expense, if not paid on demand, may be recovered with cost in a court.

9.3 Conviction No Bar to Further Prosecution

The conviction of any person under the provisions of this part for failing to comply with any of the said requirements or obligations shall not operate as a bar to further prosecution under this part for any subsequent failure on the part of such person to comply.

10 POWER TO MAKE RULES

The Authority may make rules for carrying out the provisions and intentions of the Code provided that any rule shall not be in direct/indirect conflict or nullify/dilute any of the provisions of the Code.

SECTION 3 PERMIT AND INSPECTION

11 DEVELOPMENT/BUILDING PERMIT

11.1 Permit Required

11.1.1 No person shall carry out any development, erect, re-erect or make alterations or demolish any building or cause the same to be done without first obtaining a separate permit for each such development/building from the Authority. No permit shall, however, be required for works referred to in **12.1.2.1** and **12.4.1**.

11.1.2 The development/building permit shall take into cognizance the provisions under the relevant Town Planning Act/Development Act/Municipal Act/any other applicable statutes for layout, building plans, water supply, sewerage, drainage, electrification, etc, as provided in the said Act/statute. Also, if so directed by the Authority, the permit shall take care of the need for landscape development plan in the layout and building plans.

11.1.3 Specific approvals shall be obtained from Airports Authority of India, Ministry of Environment, Forest and Climate Change, Fire Services Department, Pollution Control Board, designated authorities under Factories Act/Cinema Regulation Act, Urban Arts Commission, designated Coastal Regulation Zone Authority, Archaeological Survey of India, Heritage Committee and any such other authority as may be applicable. Approval of Fire Services Department shall be required for buildings of height 15 m or above and for such other buildings/special buildings referred to in Part 4 'Fire and Life Safety' of the Code.

11.1.4 *Integrated Approval Process*

11.1.4.1 In order to facilitate ease of doing business and ensure efficient and expeditious clearance from above bodies with the concept of single window clearance approach and thereby final approval by the Authority within the stipulated time frame, the Authority may constitute a Development/Building Permit Approval Committee consisting of representatives of the team of building officials, representatives of all bodies/organizations from whom clearance for development/building permit clearance is required.

Recommendations from such Committee shall be summarily utilized by the team of building officials in sanctioning process. The Committee may meet once in 15/30 days depending upon the work load. The first response/invalid notice/non-compliance intimation shall be issued by the Authority to the owner within 30 days of submission of the plans to the Authority (*see also* **12.10.2**).

11.1.4.2 It would be more appropriate that all the above authorities may make the information available in public domain delineating clearly the situations requiring their clearance. This information being available to the Authority as well, should be utilized by the Authority in deciding on the required sanction or otherwise without the need to go to the above multiple authorities. This can be achieved by providing, for necessary reference of the Authority, simplified environmental guidelines by the Ministry of Environment, Forest and Climate Change; colour coded zoning maps for Airports depicting restrictions imposed near airports, by Airports Authority of India; information on categorization of monuments with concerned degree of restrictions, by National Monuments Authority; etc.

The above could be further facilitated, if such requirements in respect of clearances from all such authorities be integrated in the Development Control Rules of the Master/Development Plan of the concerned city/town. The areas unaffected by any of the restrictions should be clearly marked out and mapped, preferably on a GIS platform. Area zones of differential control regulations (within the city) by any of these authorities may also be mapped accordingly so as to result in a composite map of the city/town with various control regulations by different authorities, clearly marked on the map. The sites which are located outside the restricted/regulated areas would not require availing clearance from the respective authorities.

Such integrated approval by the Authority shall be accorded within the time limit of 30 days (*see also* **12.10.2**).

11.1.5 The Authority shall permit a registered architect/engineer to approve the building proposals including plans, and certify completion of building for issue of related regulatory building permits and occupancy certificate for residential buildings designed by self or otherwise, on plot size up to 500 m^2. The responsibility of compliance with respect to provisions of Code shall rest with the registered architect/engineer. However, the plans shall be required to be submitted to the Authority for information and records.

NOTE — Where the experience clearly shows that satisfactory building permit activities are being carried out through the above empowerment of professionals, the Authority may extend such provision for larger areas and other building occupancies.

11.2 Pre-Code Development/Building Permit

If any development/building, permit for which had been issued before the commencement of the Code, is not wholly completed within a period of three years from the date of such permit, the said permission shall be deemed to have lapsed and fresh permit shall be necessary to proceed further with the work in accordance with the provisions of the Code.

12 APPLICATION FOR DEVELOPMENT/ BUILDING PERMIT

12.1 Application

Every owner who intends to develop, erect, re-erect or make alterations in any place in a building shall give an application in writing to the Authority of his said intention in the prescribed form (*see* Annex B) and such notice shall be accompanied by plans and statements in triplicate as required under **12.2** and **12.3** except for special buildings (high rise, non-residential) where

additional copies may be submitted as desired by the Authority. The Authority shall permit submission of plans/documents in electronic form.

12.1.1 *Computerization of Approval Process*

The Authority should progressively computerize the approval process. This may involve facilitating submission of building plans and other documents and requisite fee online by uploading the same through the designated portal of the Authority as well as sanction online. It may also require instituting appropriate procedure for registration and traceability along with responsibility of the applicant making such submissions.

12.1.2 Regarding submission of plans by Government Departments, the procedure shall be as given in **12.1.2.1** and **12.1.2.2**.

12.1.2.1 The operational construction/installation of the Government, whether temporary or permanent, which is essential for the operation, maintenance, development or execution of any of the following services may be exempted from the point of view of the byelaws:

a) Railways;
b) National highways;
c) National waterways;
d) Major ports;
e) Airways and aerodromes;
f) Posts and telegraphs, telephones, wireless, broadcasting, and other like forms of communications;
g) Regional grid for electricity;
h) Defence; and
j) Any other service which the Central/State Government may, if it is of opinion that the operation, maintenance, development of execution of such service is essential to the life of the community, by notification, declare to be a service for the purpose of this clause.

In case of construction/installation where no approvals are required, the concerned agencies which are exempted from seeking approval shall submit the drawings/plans/details for information and records of the Authority before construction/installation. The provisions of the Code, as applicable, shall however be followed for all such developments.

12.1.2.2 However, the following construction of the Government departments do not come under the purview of operational construction for the purpose of exemption under **12.1.2.1**:

a) New residential building (other than gate lodges, quarters for limited essential operational staff and the like), roads and drains in railway colonies, hospitals, clubs, institutes and schools, in the case of railways; and
b) A new building, new construction or new installation or any extension thereof in the case of any other services.

12.2 Information Accompanying Notice

The notice shall be accompanied by the key plan, site plan, building plan, services plans, specifications, structural sufficiency certificate and certificate of supervision as prescribed in **12.2.2** to **12.2.8**.

12.2.1 *Sizes of Drawing Sheets and Recommended Notation for Colouring Plans*

12.2.1.1 The size of drawing sheets shall be any of those specified in Table 1.

Table 1 Drawing Sheet Sizes
(*Clause* 12.2.1.1)

Sl No.	Designation	Trimmed Size mm
(1)	(2)	(3)
i)	A0	841 × 1189
ii)	A1	594 × 841
iii)	A2	420 × 594
iv)	A3	297 × 420
v)	A4	210 × 297
vi)	A5	148 × 210

12.2.1.2 The plans shall be coloured as specified in Table 2.

12.2.2 *Key Plan*

A key plan drawn to a scale of not less than 1 : 10 000 shall be submitted along with the application for a development/building permit showing the boundary locations of the site with respect to neighbourhood landmarks. The minimum dimension of the key plan shall be not less than 75 mm.

12.2.3 *Site Plan*

The site plan sent with an application for permit shall be drawn to a scale of not less than 1 : 500 for a site up to one hectare and not less than 1 : 1 000 for a site more than one hectare and shall show,

a) the boundaries of the site and of any contiguous land belonging to the owner thereof;
b) the position of the site in relation to neighbouring street;
c) the name of the streets in which the building is proposed to be situated, if any;
d) all existing buildings standing on, over or under the site including service lines;
e) the position of the building and of all other

Table 2 Colouring of Plans
(*Clause* 12.2.1.2)

Sl No.	Item	Site Plan			Building Plan		
		White Plan	Blue Print	Ammonia Print	White Plan	Blue Print	Ammonia Print
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Plot lines	Thick black	Thick black	Thick black	Thick black	Thick black	Thick black
ii)	Existing street	Green	Green	Green	—	—	—
iii)	Future street, if any	Green dotted	Green dotted	Green dotted	—	—	—
iv)	Permissible building lines	Thick dotted black	Thick dotted black	Thick dotted black	—	—	—
v)	Open spaces	No colour	No colour	No colour	No colour	No colour	No colour
vi)	Existing work	Black (outline)	White	Blue	Black	White	Blue
vii)	Work proposed to be demolished	Yellow hatched	Yellow hatched	Yellow hatched	Yellow hatched	Yellow hatched	Yellow hatched
viii)	Proposed work (*see* Note 1)	Red filled in	Red	Red	Red	Red	Red
ix)	Drainage and sewerage work	Red dotted	Red dotted	Red dotted	Red dotted	Red dotted	Red dotted
x)	Water supply work	Black dotted thin	Black dotted thin	Black dotted thin	Black dotted thin	Black dotted thin	Black dotted thin

NOTES
1 For entirely new construction this need not be done; for extension of an existing work this shall apply.
2 For land development, subdivision, layout, suitable colouring notations shall be used which shall be indexed.

buildings (if any) which the applicant intends to erect upon his contiguous land referred to in (a) in relation to:

1) the boundaries of the site and in case where the site has been partitioned, the boundaries of the portion owned by the applicant and also of the portions owned by others;
2) all adjacent street, buildings (with number of storeys and height) and premises within a distance of 12 m of the site and of the contiguous land (if any) referred to in (a); and
3) if there is no street within a distance of 12 m of the site, the nearest existing street;

f) the means of access from the street to the building, and to all other buildings (if any) which the applicant intends to erect upon his contiguous land referred to in (a);

g) space to be left about the building to secure a free circulation of air, admission of light and access for scavenging purposes;

h) the width of the street (if any) in front and of the street (if any) at the side or near the buildings;

j) the direction of north point relative to the plan of the buildings;

k) any physical features, such as wells, drains, etc; and

m) such other particulars as may be prescribed by the Authority.

12.2.4 *Subdivision/Layout Plan*

In the case of development work, the notice shall be accompanied by the subdivision/layout plan which shall be drawn on a scale of not less than 1 : 500 containing the following:

a) Scale used and north point;

b) Location of all proposed and existing roads with their existing/proposed/prescribed widths within the land;

c) Dimensions of plot along with building lines showing the setbacks with dimensions within each plot;

d) Location of drains, sewers, public facilities and services, and electrical lines, etc;

e) Table indicating size, area and use of all the plots in the subdivision/layout plan;

f) A statement indicating the total area of the site, area utilized under roads, open spaces for parks, playgrounds, recreation spaces and development plan reservations, schools, shopping and other public places along with their percentage with reference to the total area of the site proposed to be subdivided; and

g) In case of plots which are subdivided in built-up areas in addition to the above, the means of access to the subdivision from existing streets.

12.2.5 *Building Plan and Details*

The plan of the buildings and elevations and sections accompanying the notice shall be drawn to a scale of 1 : 100. The plans and details shall,

a) include floor plans of all floors together with the covered area clearly indicating the size and spacings of all framing members and sizes of rooms and the position of staircases, ramps and liftwells;
b) show the use or occupancy of all parts of the buildings;
c) show exact location of essential services, for example, WC, sink, bath and the like;
d) include at least one elevation from the front showing height of building and rooms and also the height of parapet.
e) include at least one section through the staircase.
f) include the structural arrangements with appropriate sections showing type/ arrangement of footings, foundations, basement walls; structural load bearing walls, columns and beams, and shear walls; and arrangement/spacing of framing members, floor slabs and roof slabs with the material used for the same.
g) show all street elevations;
h) give dimensions of the projected portions beyond the permissible building line;
j) include terrace plan indicating the drainage and the slope of the roof; and
k) give indications of the north point relative to the plan.

NOTE — The requirement of 1 : 100 is permitted to be flexible for specific details needed for further illustration; and also for drawings for these in electronic form.

12.2.5.1 *Building plan for high rise/special buildings*

For all high rise buildings which are 15 m or more in height and for special buildings like educational, assembly, institutional, business, mercantile, industrial, storage and hazardous and mixed occupancies with any of the aforesaid occupancies having covered area more than 500 m^2 (*see also* Part 4 'Fire and Lift Safety' of the Code), the building sanction shall be done in two stages. In case of important projects and projects having high complexity and sensitivity, the Authority may get the design, drawings and details of such buildings peer reviewed/proof checked before approving the same.

Stage 1 : Planning clearance

The following additional information shall be furnished/ indicated in the building plan in addition to the items given in **12.2.5** as applicable:

a) Access to fire appliances/vehicles with details of vehicular turning circle and clear motorable accessway around the building;
b) Size (width) of main and alternative staircases along with balcony approach, corridor, ventilated lobby approach;
c) Location and details of lift enclosures;
d) Location and size of fire lift;
e) Smoke stop lobby/door, where provided;
f) Refuse chutes, refuse chamber, service duct, etc;
g) Vehicular parking spaces;
h) Refuge area, if any;
j) *Details of building services* — Air conditioning system with position of fire dampers, mechanical ventilation system, electrical services, boilers, gas pipes, etc;
k) Details of exits including provision of ramps, etc, for hospitals and special risks;
m) Location of generator, transformer and switchgear room;
n) Smoke exhauster system, if any;
p) Details of fire alarm system network;
q) Location of centralized control, connecting all fire alarm systems, built-in-fire protection arrangements and public address system, etc;
r) Location and dimensions of static water storage tank and pump room along with fire service inlets for mobile pump and water storage tank;
s) Location and details of fixed fire protection installations such as sprinklers, wet risers, hose-reels, drenchers, etc; and
t) Location and details of first-aid firefighting equipment/installations.
u) Features relating to accessibility for the elderly and persons with disabilities, shall be in accordance with **13** of Part 3 'Development Control Rules and General Building Requirements' of the Code for the designated buildings and areas.

Stage 2 : *Building permit clearance*

After obtaining the sanction for planning (Stage 1) from the Authority, a complete set of structural plans, sections, details, design calculations duly signed by engineer/structural engineer (*see* Annex A) along with the complete set of details duly approved in Stage 1 and certificate of completed structural design work (*see* Annex J) shall be submitted. A copy of the subsurface investigation report prepared and duly signed by the geotechnical engineer shall also be submitted. The building plans/details shall be deemed sanctioned for the commencement of construction only after obtaining

the permit for Stage 2 from the Authority.

12.2.6 *Services Plans*

The services plans shall include all details of building and plumbing services, and also plans, elevations and sections of private water supply, sewage disposal system and rainwater harvesting system, if any (*see* Part 8 'Building Services' and Part 9 'Plumbing Services' of the Code).

12.2.7 *Specifications*

Specifications, both general and detailed, giving type and grade of materials to be used, duly signed by the registered architect, engineer, structural engineer or supervisor shall accompany the application (*see* Annex B).

12.2.8 *Structural Design Sufficiency Certificate*

The application shall be accompanied by structural sufficiency certificate in the prescribed form (*see* Annex C) signed by the engineer/structural engineer (*see* Annex A) and the owner jointly to the effect that the building is safe against various loads, forces and effects including due to natural disasters such as earthquakes, landslides, cyclones, floods, etc as per National Building Code of India and its Part 6 'Structural Design' and other relevant Codes. The engineer/structural engineer shall also have the details to substantiate his design.

12.2.9 *Execution and Supervision*

The notice shall be further accompanied by a certificate in the prescribed form (*see* Annex D) by a builder/ constructor (*see* Annex A) undertaking the execution.

The notice shall also be accompanied by a certificate in the prescribed form (*see* Annex E) by the registered architect/engineer/structural engineer/supervisor/town planner (*see* Annex A) undertaking the supervision (*see* **9.1.3**).

12.3 Preparation and Signing of Plans

The registered architect/engineer/supervisor/town planner/landscape architect/urban designer/utility service engineer shall prepare and duly sign the plans as per their competence (*see* Annex A) and shall indicate his/her name, address, qualification and registration number as allotted by the Authority or the body governing such profession. The structural plans and details shall also be prepared and duly signed by the competent professionals like registered engineer/ structural engineer (*see* Annex A). The plans shall also be duly signed by the owner indicating his address. The type and volume of buildings/development work to be undertaken by the registered professionals may generally be as in Annex A.

12.4 Notice for Alteration Only

When the notice is only for an alteration of the building (*see* **3.5**), only such plans and statements, as may be necessary, shall accompany the notice.

12.4.1 No notice and building permit is necessary for the following alterations, and the like which do not otherwise violate any provisions regarding general building requirements, structural stability and fire and health safety requirements of the Code:

a) Opening and closing of a window or door or ventilator;
b) Providing intercommunication doors;
c) Providing partitions;
d) Providing false ceiling;
e) Gardening;
f) White washing;
g) Painting;
h) Re-tiling and re-roofing;
j) Plastering and patch work;
k) Re-flooring; and
m) Construction of sunshades on one's own land.

12.5 Fees

No notice as referred to in **12.1** shall be deemed valid unless and until the person giving notice has paid the fees to the Authority and an attested copy of the receipt of such payment is attached with the notice.

NOTE — The fees may be charged as a consolidated fee. In the event of a building/development permit is not issued, the fees so paid shall not be returned to the owner, but he shall be allowed to re-submit it without any fees after complying with all the objections raised by the Authority within a period of one year from the date of rejection after which fresh fees shall have to be paid.

12.6 Duration of Sanction

The sanction once accorded shall remain valid up to three years. The permit shall be got revalidated before the expiration of this period. Revalidation shall be subject to the rules then in force.

12.7 Deviations During Construction

If during the construction of a building any departure (excepting for items as given in **12.4.1**) from the sanctioned plan is intended to be made (*see* **7.5**), sanction of the Authority shall be obtained before the change is made. The revised plan showing the deviations shall be submitted and the procedure laid down for the original plan heretofore shall apply to all such amended plans except that the time limit specified under **12.10.2** shall be three weeks in such cases.

12.8 Revocation of Permit

The Authority may revoke any permit issued under the

provisions of the Code, wherever there has been any false statement, misrepresentation of any material fact in the application on which the permit was based or violation of building permit or in case of noncompliance thereof, and shall state the reasons for revoking the permit.

12.9 Qualification of Architects, Engineers, Structural Engineers, Geotechnical Engineers, Supervisors, Town Planners, Landscape Architects, Urban Designers, Services Personnel and Builder/ Constructor

Architects, engineers, structural engineers, geotechnical engineers, supervisors, town planners, landscape architect, urban designer, utility service engineer and builder/constructor wherever referred in the Code, shall be registered by the Authority or the body governing such profession constituted under a statute, as competent to do the work for which they are employed. A guide for the equivalent technical qualifications and professional experience required for such registration with the Authority is given in Annex A. In case of building and plumbing services, qualifications for engineers for utility services shall be as given in **A-2.9**.

12.9.1 In case the registered professional associated with the preparation and signing of plans or for supervision, is being changed during any stage of building/land development process, the professional shall intimate the Authority in writing about the further non-association with the project.

12.10 Grant of Sanction or Refusal

The Authority may either sanction or refuse the plans and specifications or may sanction them with such modifications or directions as it may deem necessary and thereupon shall communicate its decision to the person giving the notice (*see* Annex F).

12.10.1 The building plans for buildings identified in **12.2.5.1** shall also be subject to the scrutiny of the Fire Authority and the sanction through building permit shall be given by the Authority after the clearance from the Fire Authority (*see also* **11.1.3**).

12.10.2 If within 30 days of the receipt of the notice under **12.1** of the Code, the Authority fails to intimate in writing to the person, who has given the notice, of its refusal or sanction, the notice with its plans and statements shall be deemed to have been sanctioned; provided the fact is immediately brought to the notice of the Authority in writing by the person who has given notice and having not received any intimation from the Authority within fifteen days of giving such written notice. Subject to the conditions mentioned in this clause, nothing shall be construed to authorize any person to do anything in contravention of or against the terms of lease or titles of the land or against any other regulations, byelaws or ordinance operating on the site of the work.

12.10.3 In the case of refusal, the Authority shall quote the reason and relevant sections of the Code which the plans contravene. The Authority shall as far as possible advise all the objections to the plans and specifications in the first instance itself and ensure that no new objections are raised when they are resubmitted after compliance of earlier objections.

12.10.4 Once the plan has been scrutinized and objections have been pointed out, the owner giving notice shall modify the plan to comply with the objections raised and resubmit it. The Authority shall scrutinize the re-submitted plan and if there be further objections, the plan shall be rejected.

13 RESPONSIBILITIES AND DUTIES OF THE OWNER

13.1 Neither the granting of the permit nor the approval of the drawings and specifications, nor inspections made by the Authority during erection of the building shall in any way relieve the owner of such building from full responsibility for carrying out the work in accordance with the requirements of the Code (*see* **9**).

13.2 Every owner shall,

a) permit the Authority to enter the building or premises for which the permit has been granted at any reasonable time for the purpose of enforcing the Code;

b) submit a document of ownership of the site;

c) obtain, where applicable, from the Authority, permits relating to building, zoning, grades, sewers, water mains, plumbing, signs, blasting, street occupancy, electricity, highways, and all other permits required in connection with the proposed work;

d) give notice to the Authority of the intention to start work on the building site (*see* Annex G);

e) give written notice to the Authority intimating completion of work up to plinth level;

f) submit the certificate of engagement of builder/constructor(s) for the buildings given in **12.2.5.1** (*see* Annex D), certificate for sub-surface investigation, where applicable (*see* Note 1) (*see* Annex H), certificate for completed structural design work as per structural safety requirements (*see* Annex J); certificate for supervision and execution of work (*see* Annex K); certificate for completed work by builder/constructor(s) (*see* Annex M) (*see* Note); and give written notice to the

Authority regarding completion of work described in the permit (*see* Annex N);

NOTE — *See* **3.1** and **3.1.1** of Part 6 'Structural Design, Section 2 Soils and Foundations' of the Code.

g) give written notice to the Authority in case of termination of services of a professional engaged by him; and

h) obtain an occupancy permit (*see* Annex P) from the Authority prior to any,

1) occupancy of the building or part thereof after construction or alteration of that building or part, or

2) change in the class of occupancy of any building or part thereof.

13.2.1 *Temporary Occupancy*

Upon the request of the holder of the permit, the Authority may issue a temporary certificate of occupancy for a building or part thereof, before the entire work covered by permit shall have been completed, provided such portion or portions may be occupied safely prior to full completion of building without endangering life or public welfare.

13.3 Documents at Site

13.3.1 Where tests of any materials are made to ensure conformity with the requirements of the Code, records of the test data shall be kept available for inspection during the construction of the building and for such a period thereafter as required by the Authority.

13.3.2 The person to whom a permit is issued shall during construction keep pasted in a conspicuous place on the property in respect of which the permit was issued,

a) a copy of the building permit; and

b) a copy of the approved drawings and specifications referred in **12**.

14 INSPECTION, OCCUPANCY PERMIT AND POST-OCCUPANCY INSPECTION

14.1 Generally all construction or work for which a permit is required shall be subject to inspection by the Authority and certain types of construction involving unusual hazards or requiring constant inspection shall have continuous inspection by special inspectors appointed by the Authority.

14.2 Inspection, where required, shall be made within 7 days following the receipt of notification, after which period the owner will be free to continue the construction according to the sanctioned plan. At the first inspection, the Authority shall determine to the best of its ability that the building has been located in accordance with the approved site plans. The final inspection of the completion of the work shall be made within 21 days following the receipt of notification [*see* **13.2**(f)] for the grant of occupancy certificate.

14.2.1 The owner/concerned registered architect/ engineer/structural engineer/town planner will serve a notice/completion certificate to the Authority that the building has been completed in all respects as per the approved plans. The deviations shall also be brought to the notice of the Authority (with relevant documents). The team of building officials or its duly authorized representative shall then visit the site and occupancy certificate shall be given in one instance.

14.2.2 The occupancy certificate should clearly state the use/type of occupancy of the building. However, the applicant can apply for change of use/occupancy permitted within the purview of the Master Plan/Zonal Plan/Building Bye laws, where so required.

14.3 When inspection of any construction operation reveals that any lack of safety precautions exist, the Authority shall have right to direct the owner to stop the work immediately until the necessary remedial measures to remove the violation of safety precautions are taken.

14.4 Periodic Occupancy Renewal

14.4.1 For buildings covered in **12.2.5.1,** after completion of the building and obtaining the occupancy certificate, periodic inspections of building shall be made by the Fire Authority to ensure the fire safety of the building and compliance with the provisions of fire and life safety requirements (*see* Part 4 'Fire and Life Safety' of the Code). Periodic occupancy renewal certificate shall be made available by the Authority/ Fire Authority which shall also include safe keep of firefighting installations and equipment for such buildings.

14.4.2 All buildings covered under **12.2.5.1** shall be subjected to periodic physical inspection by a team of multi-disciplinary professionals of local Authority. The work by team of professionals may be outsourced by the authority to competent professionals as may be deemed necessary. The team shall ensure the compliance of byelaws, natural lighting, ventilation, etc besides structural safety, electrical safety and accessibility (for designated public buildings and areas as per **13** of Part 3 'Development Control Rules and General Building Requirements' of the Code). After checking, the team shall be required to give the certificate for above aspects. If any shortcoming/ deficiencies or violations are noticed during inspection, the Authority shall ensure the compliance of these within a specified time frame of six months. If not complied with, the building shall be declared unsafe/ unfit. The period of inspection shall usually be 3 to 5 years but in any case not more than 5 years.

15 UNSAFE BUILDING

15.1 All unsafe buildings shall be considered to constitute danger to public safety and shall be restored by repairs or demolished or dealt with as otherwise directed by the Authority (*see* **15.2** to **15.5**).

15.2 Examination of Unsafe Building

The Authority shall examine or cause to be examined every building reported to be unsafe or damaged, and shall make a written record of such examination.

15.3 Notice to Owner, Occupier

Whenever the Authority finds any building or portion thereof to be unsafe, it shall, in accordance with established procedure for legal notice, give to the owner and occupier of such building written notices stating the defects thereof. This notice shall require the owner or the occupier within a stated time either to complete specified repairs or improvements or to demolish and remove the building or portion thereof.

15.3.1 The Authority may direct in writing that the building which in his opinion is dangerous, or has no provision for exit if caught fire, shall be vacated immediately or within the period specified for the purpose; provided that the Authority concerned shall keep a record of the reasons for such action with him.

If any person does not comply with the orders of vacating a building, the Authority may direct the police to remove the person from the building and the police shall comply with the orders.

15.4 Disregard of Notice

In case the owner or occupier fails, neglects, or refuses to comply with the notice to repair or to demolish the said building or portion thereof, the Authority shall cause the danger to be removed whether by demolition or repair of the building or portion thereof or otherwise.

15.5 Cases of Emergency

In case of emergency, which, in the opinion of the Authority involves imminent danger to human life or health, the decision of the Authority shall be final. The Authority shall forthwith or with such notice as may be possible promptly cause such building or portion thereof to be rendered safe by retrofitting/strengthening to the same degree of safety or removed. For this purpose, the Authority may at once enter such structure or land on which it stands, or abutting land or structure, with such assistance and at such cost as may be deemed necessary. The Authority may also get the adjacent structures vacated and protect the public by an appropriate fence or such other means as may be necessary.

15.6 Costs

Costs incurred under **15.4** and **15.5** shall be charged to the owner of the premises involved. Such costs shall be charged on the premises in respect of which or for the benefit of which the same have been incurred and shall be recoverable as provided under the laws (*see* Note).

NOTE — The costs may be in the form of arrears of taxes.

16 DEMOLITION OF BUILDING

Before a building is demolished, the owner shall notify all utilities having service connections within the building, such as water, electric, gas, sewer and other connections. A permit to demolish a building shall not be issued until a release is obtained from the utilities stating that their respective service connections and appurtenant equipment, such as meters and regulators have been removed or sealed and plugged in a safe manner.

17 VALIDITY

17.1 Partial Invalidity

In the event any part or provision of the Code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions thereof, which may or shall be determined to be legal, and it shall be presumed that the Code would have been passed without such illegal or invalid parts or provisions.

17.2 Segregation of Invalid Provisions

Any invalid part of the Code shall be segregated from the remainder of the Code by the court holding such part invalid, and the remainder shall remain effective.

17.3 Decisions Involving Existing Buildings

The invalidity of any provision in any clause of the Code as applied to existing buildings and structures shall not be held to effect the validity of such section in its application to buildings hereafter erected.

18 ARCHITECTURAL CONTROL

18.1 Compliance with the provisions of the Code is adequate for normal buildings. But for major public building complexes or buildings coming up in an important area near historic/monumental buildings and areas of heritage, the aesthetics of the whole scheme may also have to be examined, *vis-a-vis* existing structures. In addition, any development which may mar the general characteristics and environment of historical, architectural or other monuments should also be subject to the provisions of this clause. This clause is intended to cover very few structures to come up in

the vicinity of other declared/historically important structures, and the scrutiny shall be limited to the external architectural features only so as to ensure an aesthetic continuance of the existing structures with the new. The scrutiny shall not deal with the routine building plan scrutiny from other requirements of Code from the point of view of structural safety and functional requirements.

18.2 An Urban Arts Commission shall be established at the city/state level on issues related to urban aesthetics, through a statute. This statutory authority/ commission established by an Act of State Legislative Assembly, shall accord approval to all major buildings/ important development projects having bearing on the urban aesthetics, depending upon the importance of the area with respect to natural or built heritage or projects on plot areas above 1 ha and located in specifically identified areas. The Urban Arts Commission shall act as guardian of urban architecture; mainly with regard to building form and envelope, the relationship between the building, and the ambient environment *vis-a-vis* other dependents should be seen in depth.

18.3 The Commission may work in the following manner:

a) The Commission may select only the important buildings as in **18.1** and examine the same. The person responsible for the schemes, say an architect or an engineer, may examine either alone or with the owner. A study of the plans, elevations, models, etc, should be made. The architect/engineer should explain in general terms the purposes which the building is to serve and the main conditions which have influenced him in preparing the design.

b) The Commission after full discussion, may communicate their decision in writing to the parties concerned. The Commission may recommend a change in the whole scheme or suggest modifications in the existing scheme, if so required.

18.4 The Urban Arts Commission should also be charged with advising the city government, on schemes which will beautify the city and add to its cultural vitality.

ANNEX A

[*Foreword and Clauses* 2.17, 6.5, 6.6, 9.1.3, 12.2.5.1, 12.2.8, 12.2.9, 12.3 *and* 12.9]

GUIDE FOR THE QUALIFICATIONS AND COMPETENCE OF PROFESSIONALS

A-1 ESSENTIAL REQUIREMENTS

Every building/development work for which permission is sought under the Code shall be planned, designed and supervised by registered professionals. The registered professionals for carrying out the various activities shall be: (a) Architect, (b) Engineer, (c) Structural engineer, (d) Geotechnical engineer, (e) Supervisor, (f) Town planner, (g) Landscape architect, (h) Urban designer, and (j) Utility service engineer. Requirements of registration for various professionals by the Authority or by the body governing such profession and constituted under a statute, as applicable to practice within the local body's jurisdiction, are given in **A-2.1** to **A-2.8**. The competence of such registered personnel to carry out various activities is also indicated in **A-2.1.1** to **A-2.8.1**.

The qualification and competence of the engineers for utility services and of builder/constructor shall be as prescribed in **A-2.9** and **A-2.10**, respectively.

A-2 REQUIREMENTS FOR REGISTRATION AND COMPETENCE OF PROFESSIONALS

A-2.1 Architect

The minimum qualifications for an architect shall be the qualifications as provided for in the *Architects Act*, 1972 for registration with the Council of Architecture.

A-2.1.1 *Competence*

The registered architect shall be competent to carryout the work related to the building/development permit as given below:

a) Preparation of all plans and information connected with building permit except engineering services of high rise/special

buildings given in **12.2.5.1**.

b) Issuing certificate of supervision and completion of all buildings pertaining to architectural aspects.

c) Preparation of subdivision/layout plans and related information connected with development permit of area up to 1 hectare for metro-cities, and 2 hectare for other places.

d) Issuing certificate of supervision for development of land of area up to 1 hectare for metro-cities, and 2 hectare for other places.

A-2.2 Engineer

The minimum qualifications for an engineer shall be graduate in civil engineering/architectural engineering of recognized Indian or foreign university, or the Corporate Member of Civil Engineering Division/ Architectural Engineering Division of the Institution of Engineers (India) or the Member of the statutory body governing such profession, as and when established.

A-2.2.1 *Competence*

The registered engineer shall be competent to carryout the work related to the building/development permit as given below:

a) Preparation of all plans and information connected with building permit.

b) Structural details and calculations of buildings including subsurface investigation on plot up to 500 m^2 and up to 5 storeys or 16 m in height.

c) Issuing certificate of supervision and completion for all buildings.

d) Preparation of subdivision/layout plans and related information connected with development permit of area up to 1 hectare for metro-cities, and 2 hectare for other places.

e) Preparation of all service plans and related information connected with development permit.

f) Issuing certificate of supervision for development of land for all area.

A-2.3 Structural Engineer

The minimum qualifications for a structural engineer shall be graduate in civil engineering of recognized Indian or foreign university, or Corporate Member of Civil Engineering Division of Institution of Engineers (India), and with minimum 3 years experience in structural engineering practice with designing and field work.

NOTE — The 3 years experience shall be relaxed to 2 years in the case of post graduate degree of recognized Indian or foreign university in the branch of structural engineering. In case of doctorate in structural engineering, the experience required would be one year.

A-2.3.1 *Competence*

The registered structural engineer shall be competent to prepare the structural design, calculations and details for all buildings and carry out supervision.

A-2.3.1.1 In case of buildings having special structural features, as decided by the Authority, which are within the horizontal areas and vertical limits specified in **A-2.2.1**(b) and **A-2.5.1**(a) shall be designed only by structural engineers.

A-2.4 Geotechnical Engineer

The minimum qualifications for a geotechnical engineer shall be graduate in civil engineering of recognized Indian or foreign university, or Corporate Member of Civil Engineering Division of Institution of Engineers (India), and with minimum 3 years experience in geotechnical engineering practice with designing and field work.

NOTE — The 3 years experience shall be relaxed to 2 years in the case of post graduate degree of recognized Indian or foreign university in the branch of geotechnical engineering. In case of doctorate in geotechnical engineering, the experience required would be one year.

A-2.4.1 *Competence*

The registered geotechnical engineer shall be competent to carry out subsurface investigations and give report thereof. These may *inter-alia* include performing various tests required to determine engineering properties of sub-strata and ground water and making recommendations about the type of foundation, soil bearing capacity and the depth at which the foundations shall be placed, considering the structural system and loads supplied by the engineer/structural engineer.

A-2.5 Supervisor

The minimum qualifications for a supervisor shall be diploma in civil engineering or architectural assistantship, or the qualification in architecture or engineering equivalent to the minimum qualification prescribed for recruitment to non-gazetted service by the Government of India plus 5 years experience in building design, construction and supervision.

A-2.5.1 *Competence*

The registered supervisor shall be competent to carryout the work related to the building permit as given below:

a) All plans and related information connected with building permit for residential buildings on plot up to 200 m^2 and up to two storeys or 7.5 m in height; and

b) Issuing certificate of supervision for buildings as per (a).

A-2.6 Town Planner

The minimum qualification for a town planner shall be the Associate Membership of the Institute of Town Planners or graduate or post-graduate degree in town and country planning.

A-2.6.1 *Competence*

The registered town planner shall be competent to carryout the work related to the development permit as given below:

a) Preparation of plans for land subdivision/ layout and related information connected with development permit for all areas.
b) Issuing of certificate of supervision for development of land of all areas.

NOTE — However, for land layouts for development permit above 5 hectare in area, landscape architect shall also be associated, and for land development infrastructural services for roads, water supplies, sewerage/drainage, electrification, etc, the registered engineers for utility services shall be associated.

A-2.7 Landscape Architect

The minimum qualification for a landscape architect shall be the bachelor, master's degree in landscape architecture or equivalent from recognized Indian or foreign university.

A-2.7.1 *Competence*

The registered landscape architect shall be competent to carryout the work related to landscape design for building/development permit for land areas 5 hectare and above. In case of metro-cities, this limit of land area shall be 2 hectare and above.

NOTE — For smaller areas below the limits indicated above, association of landscape architect may also be considered from the point of view of desired landscape development.

A-2.8 Urban Designer

The minimum qualification for an urban designer shall be the master's degree in urban design or equivalent from recognized Indian or foreign university.

A-2.8.1 *Competence*

The registered urban designer shall be competent to carryout the work related to the building permit for urban design for land areas more than 5 hectare and campus area more than 2 hectare. He/she shall also be competent to carryout the work of urban renewal for all areas.

NOTE — For smaller areas below the limits indicated above, association of urban designer may be considered from the point of view of desired urban design.

A-2.9 Engineers for Utility Services

For buildings identified in **12.2.5.1**, the work of building and plumbing services shall be executed under the planning, design and supervision of competent personnel. The qualification for registered mechanical engineer (including HVAC), electrical engineer and plumbing engineers for carrying out the work of Air conditioning, Heating and Mechanical Ventilation, Electrical Installations, Lifts and Escalators and Water Supply, Drainage, Sanitation and Gas Supply installations respectively shall be as given in Part 8 'Building Services' and Part 9 'Plumbing Services' of the Code or as decided by the Authority taking into account practices of the national professional bodies dealing with the specialist engineering services.

Such an approach shall be followed for association of other/multi-disciplinary professionals for taking inputs and associating with their areas of specialization.

A-2.10 BUILDER/CONSTRUCTOR

The minimum qualification for the builder/constructor or his representative for execution of respective works shall be as given in **A-2.1**, **A-2.2**, **A-2.3**, **A-2.4**, **A-2.5**, **A-2.6**, **A-2.7**, **A-2.8** and **A-2.9** for the concerned professional.

A-2.10.1 Competence

The qualified builder/constructor or his representative shall be competent to carry out execution of work, which shall have the same extent as for supervision by such professional as prescribed in **A-2.1.1**, **A-2.2.1**, **A-2.3.1**, **A-2.4.1**, **A-2.5.1**, **A-2.6.1**, **A-2.7.1**, **A-2.8.1** and **A-2.9**.

ANNEX B

(*Clauses* 12.1 *and* 12.2.7)

FORM FOR FIRST APPLICATION TO DEVELOP, ERECT, RE-ERECT OR TO MAKE ALTERATION IN ANY PLACE IN A BUILDING

To

.....

.....

.....

Sir,

I hereby give notice that I intend to develop, erect, re-erect or to make alteration in the building No. .....or to ..... on/in Plot No.....in Colony/Street..... *Mohalla*/*Bazar*/Road.....City .....and in accordance with the building code of .....Part 2, Clauses .....and I forward herewith the following plans and specifications in triplicate duly signed by me and ..... the Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer[1)], Registration No. .....

(Name in block letters)

1) Key plan
2) Site plans
3) Subdivision/layout plan
4) Building plans
5) Services plans
6) Specifications, general and detailed[2)]
7) Title of ownership of land/building
8) Certificate for structural design sufficiency
9) Certificate for engagement of builder/constructor(s), where applicable
10) Certificates for supervision

I request that the development/construction may be approved and permission accorded to me to execute the work.

Signature of owner .....

Name of the owner .....

(in block letters)

Address of owner .....

.....

.....

.....

Date .....

[1)] Strike out whichever is not applicable.

[2)] A format may be prepared by the Authority for direct use.

ANNEX C

(*Clause* 12.2.8)

FORM FOR CERTIFICATE FOR STRUCTURAL DESIGN SUFFICIENCY

With respect to the building work of erection, re-erection or for making alteration in the building No. ..... or to ..... on/in Plot No. ..... in Colony/ Street ..... *Mohalla*/*Bazar*/Road .....City ....., we certify that the structural design of the building for which building plans are being submitted for approval shall be done and submitted for approval, to satisfy the structural safety requirements for all situations including natural disasters, as applicable, as stipulated in National Building Code of India and its Part 6 'Structural Design' and other relevant Codes; and the information given therein is factually correct to the best of our knowledge and understanding.

	Signature of owner with date	Signature of the registered engineer/structural engineer[1)] with date and registration No.
Name (in block letters):	.....	.....
Address :	.....	.....

[1)] Strike out whichever is not applicable. The entries shall be in respect of the professional who would do the structural design.

ANNEX D

[*Clauses* 12.2.9 *and* 13.2(f)]

FORM FOR ENGAGEMENT OF BUILDER/CONSTRUCTOR

(*Before the Commencement Stage of a Project*)

With respect to the building work of erection, re-erection or for making alteration in the building No. ..... or to ..... on/in Plot No. ..... Colony/ Street ..... *Mohalla*/*Bazar*/Road .....City .....
I certify that the following builder/constructor is engaged by me towards carrying out/executing the construction:

Name and details of the builder/constructor or his representative including:

.....

.....

.....

.....

	Signature of the builder/ constructor or his representative (who has agreed for the execution of above work) with date	Signature of owner with date
Name (in block letters):	.....	.....
Address:	.....	.....

ANNEX E

(*Clause* 12.2.9)

FORM FOR SUPERVISION

I hereby certify that the development, erection, re-erection or material alteration in/of building No. ..... or the ..... on/in Plot No. ..... in Colony/Street ..... *Mohalla*/*Bazar*/Road ..... City ..... shall be carried out under my supervision and I certify that all the materials (type and grade) and the workmanship of the work shall be generally in accordance with the general and detailed specifications submitted along with, and that the work shall be carried out according to the sanctioned plans.

Signature of Registered Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/ Urban Designer [1)] .....

Name of Registered Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer [1)] ..... (in block letters)

Registration No. of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer [1)] .....

Address of Registered Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer [1)]

.....

.....

.....

.....

Date .....

[1)] Strike out whichever is not applicable. The entries shall be in respect of the professional who would supervise the work.

ANNEX F

(*Clause* 12.10)

FORM FOR SANCTION OR REFUSAL OF DEVELOPMENT/BUILDING PERMIT

To

.....

.....

.....

.....

Sir,

With reference to your application ..... dated ..... for grant of permit for the development, erection, re-erection or material alteration in the building No. ..... or to ..... on/in Plot No.....in Colony/Street..... *Mohalla*/*Bazar*/Road ..... City..... I have to inform you that the sanction has been granted/refused by the Authority on the following grounds:

1.

2.

3.

4.

5.

6.

Office stamp .....

Office (Communication) No. .....

Date .....

Signature of the Authority .....

Name, Designation and Address of the Authority .....

.....

.....

ANNEX G

[*Clause* 13.2 (d)]

FORM FOR NOTICE FOR COMMENCEMENT

I hereby certify that the development, erection, re-erection or material alteration in/of building No. ..... or the ..... on/in Plot No..... in Colony/Street ..... *Mohalla*/*Bazar*/Road ..... City ..... will be commenced on ..... as per your permission, vide No..... dated ..... under the supervision of[1] ..... Registered Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer[2], Registration No..... and in accordance with the plans sanctioned, vide No..... dated..... .

Signature of owner .....

Name of owner .....
(in block letters)

Address of owner .....

.....

.....

Date .....

---

[1] Only professional who would supervise the work shall be named.
[2] Strike out whichever is not applicable.

ANNEX H

[*Clause* 13.2(f)]

FORM FOR CERTIFICATE FOR SUBSURFACE INVESTIGATION

With respect to the building work of erection, re-erection or for making alteration in the building No..... or to ..... on/in Plot No. ..... in Colony/ Street ..... *Mohalla*/*Bazar*/Road .....City ....., we certify that we have carried out subsurface investigation at site and have performed various tests required to determine engineering properties of soil substrata and ground water based on which we have given recommendations about the type of foundation, soil bearing capacity and the depth at which the foundations shall be placed, considering the structural system and loads supplied by the structural engineer to enable the engineer/structural engineer to design the foundations and other structures below ground, as stipulated in National Building Code of India and its Part 6 'Structural Design, Section 2 Soils and Foundations' and other relevant Codes.

I am enclosing a copy of the report of subsurface investigation carried out as above and submitted to the Structural Engineer.

	Signature of owner with date	Signature of the registered Engineer/ Structural Engineer/ Geotechnical Engineer[1)] and registration No. with date
Name (in block letters) :	.....	.....
Address :	.....	.....

[1)] Strike out whichever is not applicable. The professional who has done the subsurface investigation shall sign.

ANNEX J

[*Clause* 13.2(f)]

FORM FOR CERTIFICATE FOR COMPLETED STRUCTURAL DESIGN WORK AS PER STRUCTURAL SAFETY REQUIREMENTS

With respect to the building work of erection, re-erection or for making alteration in the building No. ..... or to ..... on/in Plot No. ..... in Colony/ Street ..... *Mohalla*/*Bazar*/Road ..... City ....., we certify that the structural design, structural drawings and details of the building which has been done by us satisfy the structural safety requirements for all situations including natural disasters, as applicable, as stipulated in National Building Code of India and its Part 6 'Structural Design' and other relevant Codes considering the report of subsurface investigation, where applicable.

	Signature of owner with date	Signature of the registered engineer/ structural engineer[1)]/ and with date and registration No.
Name (in block letters) :	.....	.....
Address :	.....	.....

[1)] Strike out whichever is not applicable. The professional who has done the structural design shall sign.

ANNEX K

[*Clause* 13.2(f)]

FORM FOR CERTIFICATE FOR SUPERVISION OF WORK

With respect to the building work of erection, re-erection or for making alteration in the building No. ..... or to ..... on/in Plot No. ..... in Colony/ Street ..... *Mohalla*/*Bazar*/Road .....City ....., we certify,

a) that the building has been constructed according to the sanctioned plans, specifications, details and structural drawings issued to the site by the Engineer/Structural Engineer (one set of drawings as executed enclosed); and

b) that the construction has been done under our supervision and guidance and records of supervision have been maintained.

Any subsequent changes from the completion drawings shall be the responsibility of the owner.

	Signature of owner with date	Signature of the registeredArchitect/ Engineer/Structural Engineer/Supervisor/ Town Planner/Landscape Architect/Urban Designer [1)] and registration No.
Name (in block letters) :	.....	.....
Address :	.....	.....

[1)] Strike out whichever is not applicable. The professional who has supervised the work shall sign.

ANNEX M

[*Clause* 13.2(f)]

FORM FOR CERTIFICATE FOR COMPLETED WORK BY BUILDER/CONSTRUCTOR

With respect to the building work of erection, re-erection or for making alteration in the building No..... or to.....on/in Plot No.....in Colony/Street .....*Mohalla*/*Bazar*/Road .....City....., we certify,

a) that the building has been constructed by us according to the sanctioned plans, structural drawings and details issued to the site by the Engineer/Structural Engineer[1)]; and

b) that the work has been completed with high level of workmanship observing due diligence and all the materials have been used strictly in accordance with the general and detailed specifications.

Signature of owner with date with date	Signature of representative of the builder/constructor
Name (in block letters) :	.....
Address :	.....

[1)] Substitute by details of relevant services and the concerned constructor in case of execution of services works.

ANNEX N

[*Clause* 13.2 (f)]

FORM FOR COMPLETION CERTIFICATE

I hereby certify that the development, erection, re-erection or material alteration in/of building No. ..... or the ..... on/in Plot No..... in Colony/Street ..... *Mohalla*/*Bazar*/Road ..... City ..... has been supervised by me and has been completed on ..... according to the plans sanctioned, vide No. ..... dated..... . The work has been completed to my best satisfaction, the workmanship and all the materials (type and grade) have been used strictly in accordance with general and detailed specifications subject to compliance the minimum parameters specified in National Building Code of India. No provisions of the Code, no requisitions made, conditions prescribed or orders issued thereunder have been transgressed in the course of the work. The land is fit for construction for which it has been developed or redeveloped or the building is fit for use for which it has been erected, re-erected or altered, constructed and enlarged.

I hereby also enclose the plans, drawings, details, reports and certificates of the building/work as executed, as follows:

1) Plans of completed works
2) Structural design, drawings and details
3) Services drawings and details (mechanical/electrical/plumbing/fire)
4) Certificate for subsurface investigation along with a copy of report
5) Certificate for completed structural design work as per structural safety requirements
6) Certificate for supervision of execution of work
7) Certificate for completed work by the builder/constructor

Permission to occupy or use the building may be granted.

Any subsequent change from completion drawings shall be the responsibility of the owner.

Signature of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer[1)] .....

Name of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer [1)] ..... (in block letters)

Registration No. of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/ Landscape Architect/ Urban Designer [1)] .....

Address of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer [1)] .....

.....

Signature of the owner

Date .....

[1)] Strike out whichever is not applicable.

ANNEX P

[*Clause* 13.2(h)]

FORM FOR OCCUPANCY PERMIT

The work of erection, re-erection or alteration in/of building No. .....or the .....on/in Plot No.....in Colony/Street..... *Mohalla*/*Bazar*/Road .....City .....completed under the supervision of ..... Architect/ Engineer/Structural Engineer/Supervisor, Registration No.....has been inspected by me. The building can be permitted/not permitted for occupation for.....occupancy subjected to the following:

1.

2.

3.

One set of completion plans duly certified is returned herewith.

Signature of the Authority .....

Office stamp

Date .....

NATIONAL BUILDING CODE OF INDIA

PART 3 DEVELOPMENT CONTROL RULES AND GENERAL BUILDING REQUIRMENTS

BUREAU OF INDIAN STANDARDS

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FOREWORD

This Code (Part 3) covers development control rules, including such aspects as subdivision and layout rules, land use classifications, open spaces, area and height limitations, means of access, and parking spaces. This Part also covers the general building requirements, including those of various parts of buildings.

It is expected that for proper coordination and enforcement of the development control rules and general building requirements, the departments concerned, namely, the town and country planning department, urban development authority, urban local body and the building department, will coordinate the total development and building activity at both organizational and technical levels.

Particular attention is invited to Table 5 on floor area ratio (FAR) limitations. It is emphasized that the floor area of a single storey building is limited in absolute terms by the type of construction and occupancy class. Also, the absolute floor areas for different types of construction and different occupancies have a definite ratio among them. The ratios as recommended in the American Iron and Steel Institute Publication of 1961 'Fire protection through modern building codes' have been generally adopted in this Part and Table 5 has been developed on this basis. This, Table 5 is repeated in Part 4 'Fire and Life Safety' of the Code also, for convenience of reading.

Limitation of areas and heights of buildings are regulated by specifying floor area ratio (FAR) or floor space index (FSI) and ground coverage. The significance of the contribution of different types of construction giving different fire resistances has not been taken cognizance of in specifying FAR for different occupancies, in the present development control rules and municipal byelaws of the country. Table 5, therefore, gives the comparative ratios of FAR between types of buildings and occupancy classes and these have been specified mainly from the fire protection aspect of buildings. To arrive at the actual FAR for different buildings coming up in different areas, the Authority should further modify them, by taking into consideration other aspects like population density of any area, parking facilities required, the traffic load (road width) and the services available. The heights of buildings shall also be regulated, keeping in view the local fire fighting facilities.

In some state byelaws, the FAR (or FSI) has been expressed in the form of percentage. However, the Committee responsible for the preparation of this Code is of the opinion that, it being a ratio should be expressed only in the form of a ratio, as done in this Part.

It is particularly to be borne in mind by the Authority that the ratios are definitive and it may assess the particular FAR for a type of construction and for an occupancy and establish a new table, but retaining the comparative ratios as given in Table 5.

Keeping in view the enormous problems faced by the country with regard to the ever increasing squatter settlements/ pavement dwellers in urban areas (cities of all sizes), it is imperative that all the urban local bodies and urban development authorities sooner or later evolve schemes for their rehabilitation. The resources are meagre and the problems are enormous. There has been a tendency on the part of a number of urban development authorities/ urban local bodies to link space norms with affordability. Affordability is an important criterion but at the same time a public agency may not ignore the basic minimum needs of the family to be housed (including the mental, physical and social health of the marginalized groups, which is linked with shelter). The urban local bodies shall have to evolve appropriate policies for their integration with the overall development process and generate/ allocate resources and more importantly adopt a planning process, which are people friendly and inclusive. Therefore, keeping in view the needs of low income housing, to cater to Economically Weaker Sections of Society (EWS) and Low Income Group (LIG), the requirements on planning, design of layout/shelter have been rationalized and the same are provided in this Part. This information is based on the provisions of IS 8888 (Part 1):1993 'Guide for requirements of low income housing: Part 1 Urban areas (*first revision*)'.

It is important that the fruits of development are equally shared by all cross-section of the society irrespective of their age and abilities. This Code therefore covered provisions for buildings and built environment to ensure a barrier-free

environment for elders and persons with disabilities. The goal of barrier free design is to provide an environment that supports the independent functioning of individuals so that they can participate without assistance, in everyday activities. It has been intended to progressively update these provisions and make the same more effective and elaborate based on experience gained with the implementation of the Code and feedback received from stakeholders. As a conscious decision, opportunity has been taken in this revision of the Code to further mainstream the issue of barrier free environment by covering the requirements at greater length. The concept of universal design has also been included herein that promotes the usability of built environment by all without discrimination. It is worthwhile to note that *The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act*, 1995 in its Chapter VIII 'Non-Discrimination', Section 44 to 46 mandates accessibility in public buildings and transportation systems. National policy for persons with disabilities also emphasizes the role of barrier-free environment as one that enables people with disabilities to move about safely and freely, and use the facilities within the built environment. Therefore, to the maximum extent possible, buildings/places/transportation systems for public use should be made barrier free. India has also signed and ratified the UN Convention on Rights of Persons with Disabilities that casts an obligation on the member states in its Article 9'Accessibility', to enable persons with disabilities to live independently and participate fully in all aspects of life.

Further, city development process would need a dynamic approach to take care of urban renewal and also development needs in dense core areas of the cities. Innovative approaches in planning and design with participatory models of public private-people's partnership become necessary to solve the emerging development needs. With this in view, many city development authorities have evolved innovative planning and development tools like transferable development rights (TDR) where the developer would receive a portion of the development rights in a new location, keeping in view the constraints in the existing land area and the development potential. Such development rights may be transferred into outskirts or new developed areas where land availability is assured. This would encourage the professionals and developers to participate in urban renewal and at the same time ensure that the developments in both the inner core areas and new areas take place in a planned manner. The TDR concept should be increasingly encouraged by the authority dealing with urban renewal, redevelopment projects including housing and redevelopment projects for slum dwellers.

Transit oriented development (TOD), as a concept, integrates land uses and mass transportation such as bus rapid transit (BRT) and rail based transit like metro-rail, mono-rail, light-rail, ring-rail, etc. The basic objective is to plan cities in a manner where people conveniently walk and use public transport for most of their trips and, thus, reduce dependence on private mode and provide benefits to the city which include reduction in congestion, delays and accidents on roads; reduction of pollution caused by automobiles; and improvement in liveability, mobility and convenience of the citizens. TOD makes city compact and increases its efficiency and functioning. The TOD is desirable as it, (a) reduces/discourages private vehicle dependency and induces public transport use though planning, designing, policy measures and enforcement; and (b) provides easy access to public transport, within walking distance, to a majority of people, through densification and enhanced connectivity.

Some of the planning and design principles applied to create TOD include creation of,

a) pedestrian and non-motorized transport friendly environment;
b) efficient public and para-transport system supporting the transit system;
c) multi-modal interchange and street connectivity;
d) mixed land uses and appropriate intensity of development; and
e) well designed and integrated parking thus requiring reduced parking requirements in comparison to the norms given in this Part.

TOD concept may be suitable for all newly planned green field cities. However, it can also be applied to existing brown field cities where new expansion/development are taken up backed up with effective mass rapid transport system and new nodes. The Authorities may take up appropriate studies to evaluate suitability of TOD concept under relevant situations.

Urbanization in India is taking place at a rapid pace. As per the 2011 Census, 31.16 percent of the country's population resides in urban areas. This figure was 27.8 percent in 2001. The urban component is expected to rise to around 40 percent by 2020. As Indian cities continue to grow demographically and spatially, the challenge of improving urban infrastructure is enormous. While the number of urban centres has increased manifold between 1901 and 2011, the urban population increased six fold, resulting in a top-heavy urban settlement hierarchy with a large number of primate settlements. It is expected that the number of towns and cities which was 7 933 as per Census, 2011 is likely to cross the 10 000 mark in next two decades. As a result of liberalization, the demographic

trends of urbanization are accompanied by both challenges and opportunities in the management and financing of urban development.

Unprecedented urbanization has been fuelled by rapid economic growth and even more rapid industrialization especially in the past three decades or so. With globalization, this trend of rapid economic growth and urbanization is likely to accentuate further. In 1901, Kolkata was the only metropolitan city (million plus) in the country. The number of metropolitan cities increased to 5 in 1951, 12 in 1981, 23 in 1991, 35 in 2001 and 53 in 2011. The 53 metropolitan cities together account for a population of about 158 million in 2011, that is, 42 percent of urban population of the country. It is expected that this number would be about 85 by 2051.

Going by the present trends, by 2051, India would be the most populous country with 1.70 billion people and 0.19 ha per capita land availability. By 2051, 820 million people will live in urban settlements constituting about 50 percent of the total population. Cities in the country would emerge as centres of both hope and despair: while being engines of economic and social development they may also be congested centres of poverty and environmental degradation. The million plus cities constitute 42 percent of the total urban population, while the Class I (more than 1 lakh population) towns constituted 60.04 percent, followed by 11 percent in Class II (50 000-100 000 population) towns, 15.4 percent in Class III (20 000- 50 000 population) towns and the rest 13.56 percent constituted by Class IV, V and VI towns (less than 20 000 population).

Further, in the Indian practice, mega-cities (cities over 50 lakhs population) are 8 in number; metro-cities (cities having 10 to 50 lakhs population) are 45 in number. These 53 cities above 10 lakhs population is likely to be above 70 by 2021. The other cities are either small or medium towns or cities with different population limits. Urbanization in above cities and towns (mega-cities, metro-cities, small and medium towns and cities) will be different in nature and the development challenges are also different keeping in view the extent of urbanization, industrialization, commercialization and the nature of transportation needs. Therefore, the Code provisions should be appropriately utilized depending upon the need of hierarchy of cities for which the administrative and technical requirements have been covered in the Code for various facets of the activity.

The first version of this Part was formulated in 1970. As a result of incorporation of this Part in the revised development control rules and building byelaws of some municipal corporations and municipalities, some useful suggestions had emerged. The first revision of this Part was brought out in 1983, where these suggestions were incorporated to the extent possible. The major modifications incorporated in the first revision included:

a) Addition of development control rules giving guidance on means of access, community spaces and other aspects required for planning layouts.
b) Addition of provisions regarding plot sizes and frontage for different types of buildings, such as detached, semi-detached, row type and special housing schemes.
c) Requirements of open spaces for other occupancies, such as educational, institutional, assembly, industrial buildings, etc were included.
d) Provisions relating to interior open space were elaborated, including requirements for ventilation shaft.
e) Requirements of open spaces for group housing development were covered.
f) Requirements of off-street parking spaces were covered.
g) Requirements for greenbelts and landscaping including norms for plantations of shrubs and trees were covered.
h) Requirements of certain parts of buildings, such as loft, store room, garage, basement, chimney, parapet, cabin, boundary wall, wells, septic tanks, office-cum-letter box room, meter room were included.
j) Special requirements of low income housing were covered.

The term Development Control Rules used in this Part encompasses the related aspects comprehensively with a view to promoting orderly development of an area.

The major modifications incorporated in the second revision included:

a) Terminology given in this Part were made exhaustive by incorporating definitions of additional terms used, such as access, chimney, to erect, etc, and number of terms pertaining to cluster planning for housing.
b) Detailed planning norms/open spaces for various amenities such as educational facilities, health care facilities, socio-cultural facilities, distribution services, police, civil defence and home guards, and fire services were included.

c) Off-street parking requirements were also included for cities with population, (1) between 1 000 000 and 5 000 000, and (2) above 5 000 000 (*see* Annex A).

d) Special requirements for low income housing were modified and updated based on the revision of concerned Indian Standard namely IS 8888:1978 as IS 8888 (Part 1):1993 'Guide for requirements of low income housing : Part 1 Urban area (*first revision*)'. Single room dwelling was discouraged, guidelines for water seal latrine were incorporated, and cluster planning approach were recommended.

e) Requirements for cluster planning for housing were added based on the guidelines given in IS 13727:1993 'Guide for requirements of cluster planning for housing'.

f) Special requirements for low income housing for rural habitat planning were added.

g) Special requirements for development planning in hilly areas were added.

h) The requirements for buildings and facilities for the physically challenged were revised, with listing of additional categories of physically challenged; modifications in requirements of ramps, stairs, doors, handrails and controls; and incorporation of additional requirements regarding windows.

In this third revision, following major modifications have been incorporated:

a) Definitions of additional terms have been included and some of the existing definitions have been modified in the terminology clause.

b) Reference of IS 3861 : 2002 'Method of measurement of plinth, carpet and rentable areas of buildings (*second revision*)' has been added for correct interpretation of plinth area and built-up area.

c) Land use classification has been modified.

d) A new clause on footpaths giving guidance on width of footpath to be adopted based on expected pedestrian traffic as also recommended width of footpath corresponding to adjacent land use, has been added.

e) Provisions on Transferable Development Rights (TDR) has been included.

f) Provisions on Accommodation Reservation (AR) have been included.

g) Provisions for buildings on podium including permitted uses in podium, general requirements for the same and requirements for fire tender movement have been incorporated under the clause on means of access.

h) Planning norms for amenities have been modified and new amenities have been covered.

j) Requirements for minimum clearances from an overhead electric supply line have been modified based on current *Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations,* 2010 taking into account effect of sag and wind pressure.

k) Provisions for sunken courtyard have been added for meeting the light and ventilation requirements for basement area.

m) For height restrictions in the vicinity of aerodromes, reference to concerned notification of the Ministry of Civil Aviation, Govt of India has been made.

n) Considering that high density developments are being increasingly promoted in master plans and development policies, maximum coverage and floor area ratio for densities 200 to 400 dwelling units/ hectare have been added.

p) Provisions for underground or multi-storeyed parking as also mechanized parking of vehicles has been included.

q) Provisions relating to basements have been reviewed and updated keeping in view the latest developments.

r) Requirements for accessibility in buildings and built environment for elders and persons with disabilities have been thoroughly revised and updated.

s) Provisions for solar energy utilization have been included.

t) Norms for off-street parking spaces have been revised.

u) Special requirements for low income housing have been updated.

w) Special requirements for development planning in hilly areas have been updated.

The information contained in this Part is also based on the following Indian Standards:

IS 4963 : 1987	Recommendations for buildings and facilities for physically handicapped (*first revision*)

IS 8888 (Part 1) : 1993 Guide for requirements of low income housing : Part 1 Urban area (*first revision*)

IS 13727 : 1993 Guide for requirements of cluster planning for housing

IS 4963 : 1987 is under revision, the provisions of revised version of this standard shall be referred when available.

In revising the provisions of this Part, assistance has also been derived from the following publications:

Urban and Regional Development Plans Formulation and Implementation Guidelines, 2014, Town and Country Planning Organization

IRC : 103-2012 Guidelines for Pedestrian Facilities (*first revision*)

ISO 21542 : 2011 Building construction — Accessibility and usability of the built environment

Planning a barrier free environment, 2011 prepared by Office of the Chief Commissioner for Persons with Disabilities, Ministry of Social Justice and Empowerment, Government of India

Harmonized guidelines and space standards for barrier free built environment for persons with disability and elderly persons, Ministry of Urban Development, 2016

All standards cross-referred here or in the main text of this Part, are subject to revision. The parties to agreement based on this Part are encouraged to investigate the possibility of applying the most recent editions of the standards.

For the purpose of deciding whether a particular requirement of this Part of the Code is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this Part.

NATIONAL BUILDING CODE OF INDIA

PART 3 DEVELOPMENT CONTROL RULES AND GENERAL BUILDING REQUIREMENTS

1 SCOPE

This Part deals with the development control rules and general building requirements to ensure health and safety of the public.

2 TERMINOLOGY

For the purpose of this Part, the following definitions shall apply.

2.1 Access — A clear approach to a plot or a building.

2.2 Accessory Use — Any use of the premises subordinate to the principal use and customarily incidental to the principal use.

2.3 Alteration — A change from one occupancy to another, or a structural change, such as an addition to the area or height, or the removal of part of a building, or any change to the structure, such as the construction of, cutting into or removal of any wall, partition, column, beam, joist, floor (including a mezzanine floor) or other support, or a change to or closing of any required means of ingress or egress or a change to the fixtures or equipment.

2.4 Approved — Approved by the Authority having jurisdiction.

2.5 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 to act on its behalf; hereinafter called the 'Authority'.

2.6 Back-to-Back Cluster — Clusters when joined back to back and/or on sides (*see* Fig. 1).

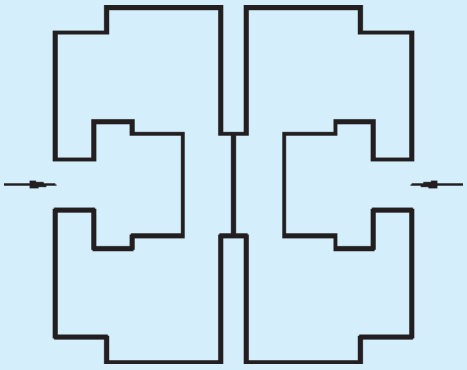


FIG. 1 BACK TO BACK CLUSTER

2.7 Balcony — A horizontal projection, with a handrail or balustrade or a parapet, to serve as passage or sitting out place.

2.8 Basement or Cellar — The lower storey of a building, below or partly below ground level.

2.9 Building — Any structure for whatsoever purpose and of whatsoever materials constructed and every part thereof, whether used as human habitation or not and includes foundation, plinth, walls, floors, roofs, chimneys, plumbing and building services, fixed platforms, *Verandah*, balcony, cornice or projection, part of a building or anything affixed thereto or any wall enclosing or intended to enclose any land or space and signs and outdoor display structures. Tents, *Shamianahs*, tarpaulin shelters, etc, erected for temporary and ceremonial occasions with the permission of the Authority shall not be considered as building.

2.10 Building, Height of — The vertical distance measured in the case of flat roofs, from the average level of the ground around and contiguous to the building or as decided by the Authority to the terrace of last livable floor of the building adjacent to the external walls; and 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 the case of gables facing the road, the mid-point between the eaves level and the ridge. Architectural features serving no other function except that of decoration shall be excluded for the purpose of measuring heights. *See* **9.4.2.1**.

2.11 Building Envelope — The horizontal spatial limits up to which a building may be permitted to be constructed on a plot.

2.12 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 prescribed, if any, in any scheme. The building line may change from time to time as decided by the Authority.

2.13 Cabin — A non-residential enclosure constructed of non-load bearing partition.

2.14 Canopy — A projection over any entrance.

2.15 Carpet Area — The covered area of the usable rooms at any floor level (excluding the area of the wall) {*see* accepted standard [3(1)]}.

2.16 *Chhajja* — A sloping or horizontal structural overhang usually provided over openings on external walls to provide protection from sun and rain.

2.17 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.

2.18 Chowk or Courtyard — A space permanently open to the sky, enclosed fully or partially by building and may be at ground level or any other level within or adjacent to a building.

2.19 Chowk, Inner — A chowk enclosed on all sides.

2.20 Chowk, Outer — A chowk one of whose sides is not enclosed.

2.21 Closed Clusters —Clusters with only one common entry into cluster open space (*see* Fig. 2).

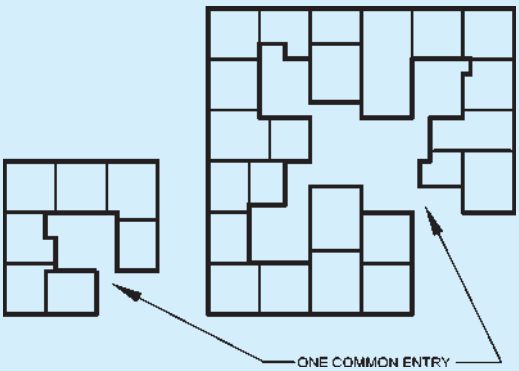


FIG. 2 CLOSED CLUSTER

2.22 Cluster — Plots or dwelling units or housing grouped around an open space (*see* Fig. 3). Ideally housing cluster should not be very large. In ground and one storeyed structures not more than 20 houses should be grouped in a cluster. Clusters with more dwelling units will create problems in identity, encroachments and of maintenance.

2.23 Cluster Court Town House — A dwelling in a cluster plot having100 percent or nearly 100 percent ground coverage with vertical expansion, generally limited to one floor only and meant for self use.

2.24 Cluster Plot — Plot in a cluster.

2.25 Cooking Alcove — A cooking space having direct access from the main room without any inter-communicating door.

2.26 Covered Area — Ground area covered by the building immediately above the plinth level. The area covered by the following in the open spaces is excluded

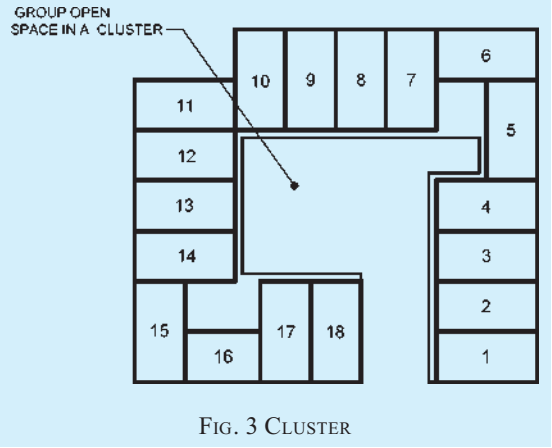


FIG. 3 CLUSTER

from covered area (*see* Table 5) :

a) Garden, rockery, well and well structures, plant nursery, water pool, swimming pool (if uncovered), platform round a tree, tank, fountain, bench, *Chabutra* with open top and unenclosed on sides by walls and the like;

b) Drainage culvert, conduit, catch-pit, gully pit, chamber, gutter and the like;

c) Compound wall, gate, unstoreyed porch and portico, canopy, slide, swing, uncovered staircase, ramps areas covered by *Chhajja* and the like; and

d) Watchmen's booth, pump house, garbage shaft, electric cabin or sub-stations, and such other utility structures meant for the services of the building under consideration.

NOTE — For the purpose of this Part, covered area equals the plot area minus the area due for open spaces.

2.27 *'Cul-de-Sac'* Cluster

Plots/dwelling units when located along a pedestrianized or vehicular '*cul-de-sac*' road (*see* Fig. 4).

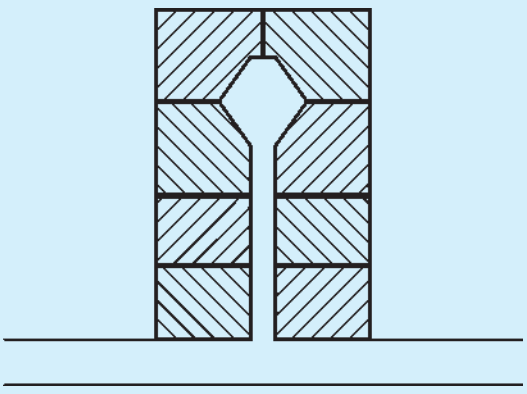


FIG. 4 *CUL-DE-SAC* CLUSTER

2.28 Density — The residential density expressed in terms of the number of dwelling units per hectare.

NOTE — Where such densities are expressed exclusive of community facilities and provision of open spaces and major roads (excluding incidental open spaces), these will be net residential densities. Where these densities are expressed taking into consideration the required open space provision and community facilities and major roads, these would be gross residential densities at neighbourhood level, sector level or town level, as the case may be. The provision of open spaces and community facilities will depend on the size of the residential community.

Incidental open spaces are mainly open spaces required to be left around and in between two buildings to provide lighting and ventilation.

2.29 Detached Building — A building detached on all sides.

2.30 Development — 'Development' with grammatical variations means the carrying out of building, engineering, mining or other operations, in, or over, or under land or water, on the making of any material change, in any building or land, or in the use of any building, land, and includes redevelopment and layout and subdivision of any land; and 'to develop' shall be construed accordingly.

2.31 Drain — A conduit, channel or pipe for the carriage of storm water, sewage, waste water or other water borne wastes in a building drainage system.

2.32 Drainage — The removal of any liquid by a system constructed for the purpose.

2.33 Dwelling Unit/Tenement — An independent housing unit with separate facilities for living, cooking and sanitary requirements.

2.34 Escalator — A power driven, inclined, continuous moving stairway used for raising or lowering passengers.

2.35 Exit — A passage, channel or means of egress from any building, storey or floor area to a street or other open space of safety.

2.36 External Faces of Cluster — Building edges facing the cluster open spaces.

2.37 Fire Separation — The distance in metres measured from the external wall of the building concerned to the external wall of any other building on the site, or from other site, or from the opposite side of a street or other public space for the purpose of preventing the spread of fire.

2.38 Floor — The lower surface in a storey on which one normally walks in a building. The general term 'floor' unless specifically mentioned otherwise shall not refer to a 'mezzanine floor'.

2.39 Floor Area Ratio (FAR) — The quotient obtained by dividing the total covered area (plinth area) on all floors by the area of the plot:

$$\text{FAR} = \frac{\text{Total covered area of all floors}}{\text{Plot area}}$$

2.40 Gallery — An intermediate floor or platform projecting from a wall of an auditorium or a hall providing extra floor area, additional seating accommodation, etc. It shall also include the structures provided for seating in stadia.

2.41 Garage, Private — A building or a portion thereof designed and used for parking of private owned motor driven or other vehicles.

2.42 Garage, Public — A building or portion thereof, other than a private garage, designed or used for repairing, servicing, hiring, selling or storing or parking motor driven or other vehicles.

2.43 Group Housing — Housing for more than one dwelling unit, where land is owned jointly (as in the case of cooperative societies or the public agencies, such as local authorities or housing boards, etc) and the construction is undertaken by one Agency.

2.44 Group Open Space — Open space within a cluster.

Group open space is neither public open space nor private open space. Each dwelling unit around the cluster open space have a share and right of use in it. The responsibility for maintenance of the same is to be collectively shared by all the dwelling units around.

2.45 Habitable Room — A room occupied or designed for occupancy by one or more persons for study, living, sleeping, eating, kitchen if it is used as a living room, but not including bathrooms, water-closet compartments, laundries, serving and store pantries, corridors, cellars, attics, and spaces that are not used frequently or during extended periods.

2.46 Independent Cluster — Clusters surrounded from all sides by vehicular access roads and/or pedestrian paths (*see* Fig. 5).

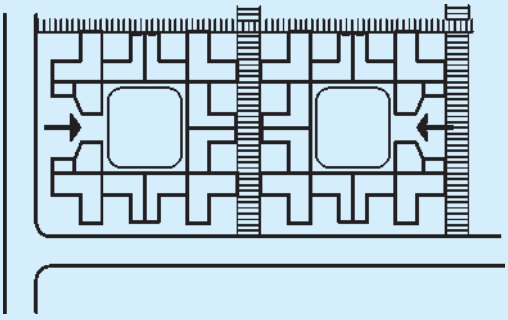


FIG. 5 INDEPENDENT CLUSTER

2.47 Interlocking Cluster — Clusters when joined at back and on sides with at least one side of a cluster common and having some dwelling units opening onto or having access from the adjacent clusters.

Dwelling units in such clusters should have at least two sides open to external open space. Houses in an interlocking cluster may have access, ventilation and light from the adjacent cluster and should also cater for future growth (*see* Fig. 6).

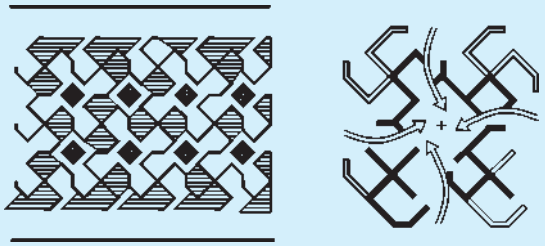


FIG. 6 INTERLOCKING CLUSTER

2.48 Internal Faces of Cluster — Building edges facing the adjacent cluster open space (as in case of interlocking cluster) of the surrounding pedestrian paths or vehicular access roads.

2.49 Ledge or *Tand* — A shelf-like projection, supported in any manner whatsoever, except by means of vertical supports within a room itself but not having projection wider than 1 m.

2.50 Lift — An appliance designed to transport persons or materials between two or more levels in a vertical or substantially vertical direction by means of a guided car or platform. The word 'elevator' is also synonymously used for 'lift'.

2.51 Loft — A structure providing intermediate storage space in between two floors with a maximum height of 1.5 m, without having a permanent access.

2.52 Master Plan — A master plan formulated under any relevant act (Town and Country Planning or Development Act or Municipal Act) for any town, approved and notified by the State Government.

2.53 Mezzanine Floor — An intermediate floor between two floors of any storey forming an integral part of floor below.

2.54 Occupancy or Use Group — The principal occupancy for which a building or a part of a building is used or intended to be used; for the purposes of classification of a building according to occupancy; an occupancy shall be deemed to include subsidiary occupancies which are contingent upon it.

2.55 Occupancy, Mixed — A multiple occupancy where the occupancies are intermingled.

2.56 Open Clusters — Clusters where cluster open spaces are linked to form a continuous open space (*see* Fig. 7).

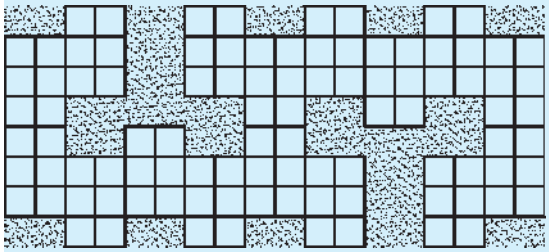


FIG. 7 OPEN CLUSTER

2.57 Open Space — An area, forming an integral part of the plot, left open to the sky.

NOTE — The open space shall be the minimum distance measured between the front, rear and side of the building and the respective plot boundaries.

2.58 Open Space, Front — An open space across the front of a plot between the building line and front boundary of the plot.

2.59 Open Space, Rear — An open space across the rear of a plot between the rear of the building and the rear boundary of the plot.

2.60 Open Space, Side — An open space across the side of the plot between the side of the building and the side boundary of the plot.

2.61 Owner — A person, a group of persons or a body having a legal interest in land and/or building thereon. This includes free holders, leaseholders or those holding a sublease, who will have a legal right to occupation and have liabilities in respect of safety or building condition.

In case of lease or sublease holders, as far as ownership with respect to the structure is concerned, the structure of a flat or structure on a plot belongs to the allottee/ lessee till the allotment/lease subsists.

Note — For the purpose of the Code, the word 'owner' will also cover the generally understood terms like 'client', 'user', etc.

2.62 Parapet — A low wall or railing built along the edge of a roof or floor.

2.63 Parking Space — An area enclosed or unenclosed, covered or open, sufficient in size to park vehicles, together with a drive-way connecting the parking space with a street or alley and permitting ingress and egress of the vehicles.

2.64 Partition — An interior non-load bearing barrier, one storey or part-storey in height.

2.65 Plinth — The portion of a structure between the surface of the surrounding ground and surface of the floor, immediately above the ground.

2.66 Plinth Area — The built up covered area measured at the floor level of the basement or of any storey {*see* accepted standard [3(1)]}.

2.67 Porch — A covered structure supported on pillars or otherwise for the purpose of pedestrian or vehicular approach to a building.

2.68 Road — *See* 'Street'.

2.69 Road Line — *See* 'Street Line'.

2.70 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.

2.71 Row Housing/Row Type Building — A row of buildings, with only front, rear and interior open spaces, where applicable.

2.72 Semi-Detached Building — A building detached on three sides.

2.73 Service Road/Lane — A road/lane provided adjacent to a plot(s) for access or service purposes as the case may be.

2.74 Set-Back Line — A line usually parallel to the plot boundaries and laid down in each case by the Authority, beyond which nothing may be constructed towards the plot boundaries.

2.75 Site (Plot) — A parcel (piece) of land enclosed by definite boundaries.

2.76 Site, Corner — A site at the junctions of and fronting on two or more intersecting streets.

2.77 Site, Depth of — The mean horizontal distance between the front and rear site boundaries.

2.78 Site, Double Frontage — A site, having a frontage on two streets, other than a corner plot.

2.79 Site, Interior or Tandem — A site access to which is by a passage from a street whether such passage forms part of the site or not.

2.80 Staircover (or *Mumty*) — A structure with a roof over a staircase and its landing built to enclose only the stairs for the purpose of providing protection from weather and not used for human habitation.

2.81 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.

2.82 Storey, Topmost — The uppermost storey in a building whether constructed wholly or partly on the roof.

2.83 Street — Any means of access, namely, highway, street, lane, pathway, alley, stairway, passageway, carriageway, footway, square, place or bridge, whether a thoroughfare or not, over which the public have a right of passage or access or have passed and had access uninterruptedly for a specified period, whether existing or proposed in any scheme, and includes all bunds, channels, ditches, storm-water drains, culverts, footpaths, sidewalks, traffic islands, roadside trees and hedges, retaining walls, fences, barriers and railings within the street lines.

2.84 Street Level or Grade — The officially established elevation or grade of the central line of the street upon which a plot fronts and if there is no officially established grade, the existing grade of the street at its mid-point.

2.85 Street Line — The line defining the side limits of a street.

2.86 To Erect — To erect a building means,

a) to erect a new building on any site whether previously built upon or not; and

b) to re-erect any building of which portions above the plinth level have been pull down, burnt or destroyed.

2.87 Tower-Like Structures — Structures shall be deemed to be tower-like structures when the height of the tower-like portion is at least twice the height of the broader base at ground level.

2.88 *Verandah* — A covered area with at least one side open to the outside with the exception of 1 m high parapet on the upper floors to be provided on the open side.

2.89 Volume to Plot Area Ratio (VPR) — The ratio of volume of building measured in cubic metre to the area of the plot measured in square metre, and expressed in metre.

2.90 Water Closet— A water flushed plumbing fixture designed to receive human excrement directly from the user of the fixture. The term is used sometimes to designate the room or compartment in which the fixture is placed.

2.91 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.

3 LAND USE CLASSIFICATION AND USES PERMITTED

3.1 Land Use Classification

The land use classification may be as indicated below:

Sl No.	*Level 1*					*Level 2*		
	N[1)]	A-N[2)]	Use Category	Colour Code[3), 4)]	Colour Code Description	N	A-N	Use Zone
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	1	R	Residential		Yellow	11	R-1	Primary residential zone
						12	R-2	Unplanned/Informal residential zone
ii)	2	C	Commercial		Red	21	C-1	Retail shopping zone
						22	C-2	General business and commercial district centres
						23	C-3	Wholesale, godowns, warehousing/regulated markets
						24	C-4	Service sector
						25	C-5	Regulated/Informal/Weekly markets
iii)	3	I	Industry		Purple	31	I-1	Service and light industry
						32	I-2	Extensive and heavy industry
						33	I-3	Special industrial zone - Hazardous, noxious and chemical
iv)	4	PS	Public and semi-public		Dark blue	41	PS-1	Govt/Semi Govt/Public offices
						42	PS-2	Govt land (use undetermined)
						43	PS-3	Police headquarter/Station, police line
						44	PS-4	Educational and research
						45	PS-5	Medical and health
						46	PS-6	Social, cultural and religious (including cremation and burial grounds)
						47	PS-7	Utilities and services
v)	5	M	Mixed use		Light yellow background with vertical hatching in black	51	M-1	Mixed industrial use zone
						52	M-2	Mixed residential zone
						53	M-3	Mixed commercial zone
vi)	6	P	Recreational		Light green	61	P-1	Playgrounds/Stadium/Sports complex
						62	P-2	Parks and gardens – Public open spaces
						63	P-3	Multi-open space (*Maidan*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
vii)	7	T	Transportation and communication		Brown/Grey[5)]	71	T-1	Roads/Bus rapid transit system (BRTS)
						72	T-2	Railways/Mass rapid transit system (MRTS)
						73	T-3	Airport
						74	T-4	Seaports and dockyards
						75	T-5	Bus depots/Truck terminals and freight complexes
						76	T-6	Transmission and communication
viii)	8	A	Primary activity		Dark green	81	PA-1	Agriculture
						82	PA-2	Forest and horticulture
						83	PA-3	Poultry and dairy farming
						84	PA-4	Rural settlements
						85	PA-5	Brick kiln and extractive areas
						86	PA-6	Others (Fishing, pottery, etc)
ix)	9	E	Protective and undevelopable use zone		Light blue	91	E-1	Water bodies
						92	E-2	Special recreation zone/Protective areas, such as sanctuaries/reserve forests and eco-sensitive zone
						93	E-3	Undevelopable use zone
x)	10	S	Special area		Pink	101	S-1	Old built-up (Core) area
						102	S-2	Heritage and conservation areas
						103	S-3	Scenic value areas
						104	S-4	Government restricted area (such as defence)
						105	S-5	Other uses/spot zone (*see* Note 5)

NOTES

1 Overall, there could be 43 use zones at the development plan level within 10 land use categories at the perspective plan level as given in the above table.

2 Areas of informal activities may be identified in the above land use categories at level 2 for 1 to 7 level 1 use zones only.

3 Mixed use zone shall be identified at the development plan level, having dominant use and mixed use.

4 Use permissions for different activities, as specified in the next section on simplified use zone regulations may be provided at the project/action plan level or with the approval of the Statutory Authority as the case may be.

5 The process of changing/relaxing/modifying land use of part or 'spot' of a 'zone' in a particular land use is termed as 'Spot Zoning'. Spot zoning may be done for comparatively smaller area in a particular land use zone in such a way that it does not affect the overall development plan.

6 Use zone regulations for the use permissibility (from the suggestive list) could be decided by the town planner depending upon the requirement/feasibility.

7 Appropriate code in terms of both numerical and alphabetic (letter) are provided to facilitate the reference and to have a simplified procedure to follow.

[1)] Numeric code.
[2)] Alpha-numeric code.
[3)] This colour code is for Level 1 land uses.
[4)] For subsequent levels of land uses different shades of Level 1 land use colour may be used along with relevant alpha-numeric code for clarity.
[5)] For transportation and communication facilities, brown colour, and for roads, grey colour may be used. If so decided by the planning agency, different shades of grey may be used for both roads and facilities.

3.2 The various building uses and occupancies (*see* **7**) permitted on the various zones shall be as given in the Master Plan of the town/city concerned.

3.3 Uses to be in Conformity with the Zone

Where the use of buildings or premises is not specifically designated on the Development/Master Plan or in the absence of Development Plan, shall be in conformity with the zone in which they fall.

3.4 Uses as Specifically Designated on Development/ Master Plan

Where the use of a site is specifically designated on the Development/Master Plan, it shall be used only for the purpose so designated.

3.5 Non-Conforming Uses

No plot shall be put to any use, occupancy or premises other than the uses identified in **3.1**, except with the prior approval of the Authority.

3.6 Fire Safety

Buildings shall be so planned, designed and constructed as to ensure fire safety and this shall be done as per Part 4 'Fire and Life Safety' of the Code.

3.7 Transferable Development Rights (TDR)

3.7.1 Transferable development rights (TDR) is a compensation, in the form of floor area ratio (FAR) or development right, which shall entitle the owner for construction of built-up area, as per applicable regulations, on designated sites. The FAR credit shall be issued, in a certificate called as development right certificate (DRC). The DRC is transferrable in full or part thereof.

3.7.2 *Development Right Certificate*

The development right certificate (DRC) shall be issued by the local body or the competent authority as per regulations and shall contain the following information:

a) Built-up area or FAR credit to which the owner is entitled;

b) Place and usage zone from which the DRC is generated (originating plot);

c) Place where the FAR credit shall be used (receiving plot); and

d) Details of development rights transferred and remaining.

3.7.3 *TDR Eligibility*

TDR may be granted for,

a) Lands earmarked for various public purposes including road widening, which are subjected to acquisition, and are proposed in the plan or regulations prepared under the applicable town planning/municipal or any other legislation;

b) Development or construction of the amenity on the reserved land;

c) Heritage structure or precinct under the provision of development control regulations or any other applicable regulations;

d) *In-lieu* of constructing housing for slum dwellers, slum redevelopment, disused mill sites, etc; and

e) Purposes as may be notified by the Government as per notification.

3.8 Accommodation Reservation (AR)

Accommodation reservation (AR) is a planning tool for development of public amenities reserved in a redevelopment plan wherein local authority is not required to acquire the land by incurring expenditure on payment of compensation. In case of AR, the owner of land earmarked as public amenity, in the redevelopment plan, shall be permitted to develop his land, using full permissible FAR on the plot, subject to handing over the built-up area for the proposed use to the local body/Authority, free of all encumbrances, in lieu of full permissible FAR granted to him. The area utilized for the amenity shall not form part of FAR calculation.

4 MEANS OF ACCESS

4.1 Every building/plot shall abut on a public/private means of access like streets/roads duly formed.

4.2 Every person who erects a building shall not at any time erect or cause or permit to erect any building which in any way encroaches upon or diminishes the area set apart as means of access required in the Code. No buildings shall be erected so as to deprive any other building of the means of access.

4.3 Width of Means of Access

The residential plots shall abut on a public means of access like street/road. Plots which do not abut on a street/road shall abut/front on a means of access, the width and other requirements of which shall be as given in Table 1.

Table 1 Width and Length of Means of Access

(*Clause* 4.3)

Sl No.	Width of Means of Access	Length of Means of Access *Max*
	m	m
(1)	(2)	(3)
i)	6.0	75
ii)	7.5	150
iii)	9.0	250
iv)	12.0	400
v)	18.0	1 000
vi)	24.0	above 1 000

NOTE — If the development is only on one side of the means of access, the prescribed widths may be reduced by 1m in each case.

In no case, development on plots shall be permitted unless it is accessible by a public street of width not less than 6 m.

4.3.1 *Other Buildings*

For all assembly buildings like, theatres, cinema houses, assembly halls, stadia; educational buildings; markets, hospitals; industrial buildings and other buildings which attract large crowd, the means of access shall not be less than the following:

Sl No.	*Width of Means of Access* m	*Length of Means of Access* m
i)	12.0	200
ii)	15.0	400
iii)	18.0	600
iv)	24.0	above 600

Further, in no case shall the means of access be lesser in width than the internal accessways in layouts and subdivision.

4.3.2 *Footpaths and Pathways*

4.3.2.1 *Footpaths*

4.3.2.1.1 Footpath should be normally designed for a pedestrian Level of Service (LOS) B, thereby providing wide pedestrian facilities for safe, pleasant and comfortable walking. Under resource constraint, LOS C may be adopted for deciding the width of footpath mentioned in Table 2. The width of footpaths depends upon the expected pedestrian traffic and may be fixed with the help of the following norms subject to not being less than 1.8 m.

Table 2 Capacity of Footpath and Design

(*Clause* 4.3.2.1.1)

Sl No.	Width of Foothpath	Design Flow in Number of Persons Per Hour			
		In Both Directions		All in One Direction	
	m	LOS B	LOS C	LOS B	LOS C
(1)	(2)	(3)	(4)	(5)	(6)
i)	1.8	1 350	1 890	2 025	2 835
ii)	2.0	1 800	2 520	2 700	3 780
iii)	2.5	2 250	3 150	3 375	4 725
iv)	3.0	2 700	3 780	4 050	5 670
v)	3.5	3 150	4 410	4 725	6 615
vi)	4.0	3 600	5 040	5 400	7 560

The land use adjacent to roads significantly influences generation of pedestrian traffic. Recommended width of footpath along various land uses are given in Table 3.

Table 3 Required Width of Footpath as per Adjacent Land Use

(*Clause* 4.3.2.1.1)

Sl No.	Description	Width m
(1)	(2)	(3)
i)	Minimum free walkway width and residential/mixed use areas	1.8
ii)	Commercial/Mixed use areas	2.5
iii)	Shopping frontages	3.5 to 4.5
iv)	Bus stops	3
v)	High intensity commercial areas	4

4.3.2.1.2 The footpath shall be level, non-slip and continuous, and shall be provided with tactile orientation, kerb and kerb ramp. The footpath shall comply with the requirements given in **B-2** other than for width which shall be as per **4.3.2.1.1**.

4.3.2.2 *Pathways*

The approach to the buildings from road/street/internal means of access shall be through paved pathway complying with requirements in **B-2**. The length of the pathway shall not be more than 30 m. The safety concern of cyclists and pedestrians should be addressed by encouraging the construction of segregated rights of way for bicycles and pedestrians.

4.3.2.2.1 In the case of special housing schemes for low income group and economically weaker section of society developed up to two storeyed row/cluster housing scheme, the main means of access through pedestrian pathway width shall be 3 m subject to provisions of **9.4.1**(a). The pedestrian pathway shall not serve more than 8 plots on each side of the pathway; the length of the pathway shall be not more than 60 m.

4.3.3 The length of the main means of access shall be determined by the distance from the farthest plot (building) to the public street. The length of the subsidiary accessway shall be measured from the point of its origin to the next wider road on which it meets.

4.3.4 In the interest of general development of an area, the Authority may require the means of access to be of larger width than that required under **4.3** and **4.3.1**.

4.3.5 In existing built-up areas in the case of plots facing street/means of access less than 4.5 m in width, the plot boundary shall be shifted to be away by 2.25 m from the central line of the street/means of accessway to give rise to a new street/means of accessway of 4.5 m width.

4.4 The means of access shall be levelled, metalled, flagged, paved, sewered, drained, channelled, lighted,

laid with water supply line and provided with trees for shade to the satisfaction of the Authority free of encroachment by any structure or fixture so as not to reduce its width below the minimum required under **4.3** and shall be maintained in a condition to the satisfaction of the Authority.

4.4.1 If any private street or any other means of access to a building is not levelled, metalled, flagged or paved, sewered, drained, channelled, lighted or laid with water supply line or provided with trees for shade to the satisfaction of the Authority, who may, with the sanction of the Authority, by written notice require the owner or owners of the several premises fronting or adjoining the said street or other means of access or abutting thereon or to which access is obtained through such street or other means of access or which shall benefit by works executed, to carry out any or more of the aforesaid requirements in such manner as he shall direct.

4.4.2 If any structure or fixture is set upon a means of access so as to reduce its width below the minimum required, the Authority may remove the same further and recover the expenses so incurred from the owner.

4.5 Access from Highways/Important Roads

No premises other than highway amenities like petrol pumps, motels, etc, shall have an access direct from highways and such other roads not less than 52 m in width, which the Authority with the approval of the highway authority shall specify from time to time. For all other buildings, the access to the plot from the highway shall be only through a service road/lane as per the stipulation of the highway authority. The Authority shall maintain a register of such roads which shall be open to public inspection at all times during office hours. The portion of such roads on which direct access may be permitted shall be as identified in the Development Plan. However, in the case of existing development on highways/other roads referred to above, the operation of this clause shall be exempted. These provisions shall, however, be subject to the provisions of the relevant State Highway Act, and *The National Highway Act*, 1956.

4.6 For high rise buildings and special buildings (*see* Part 4 'Fire and Life Safety' of the Code), the following additional provisions of means of access shall be ensured:

a) The width of the main street on which the building abuts shall not be less than 12 m and one end of this street shall join another street not less than 12 m in width.

b) The road shall not terminate in a dead end; except in the case of residential building, up to a height of 30 m.

c) The approach to the building and open spaces on all its sides shall be not less than 6 m in width, and a turning radius of minimum 9 m shall be provided for fire tender movement of fire tenders weighing up to 45 t. The same shall be hard surface capable of taking the mass of fire tender, weighing up to 45 t minimum. For heavier fire tenders, the minimum width, turning radius and the hard surface capable of taking the fire tender loads shall be as per the requirement laid down by the Fire Department. The layout for the open space for fire tender movement shall be done in consultation with the Chief Fire Officer of the city, which shall be kept free of obstructions and shall be motorable. The compulsory open spaces around the building shall not be used for parking.

d) The main entrance to the plot shall be of adequate width to allow easy access to the fire engine and in no case shall it measure less than 6 m. The entrance gate shall fold back against the compound wall of the premises, thus leaving the exterior accessway within the plot free for movement of fire tender. If the main entrance at the boundary wall is built over, the minimum clearance shall be 4.5 m.

4.6.1 *Buildings on Podium*

4.6.1.1 Podium is a horizontal projection (platform) extending beyond the building footprint on one or more sides, and may consist of one or more levels (*see* Fig. 8A).

4.6.1.2 *Uses permitted*

Podium may be used for the following purposes:

a) *Parking of vehicles* — When used for parking, one WC, two urinals and two washbasins for every 500 cars or part thereof, shall be provided on each podium floor. At least one accessible toilet complying with the requirements given in **B-9** shall be provided preferably near the accessible parking.

   Provision for driver's rest room for non-residential building shall be made.

b) Fire and building services/utilities in accordance with the provisions of other Parts/ Sections of the Code.

c) Topmost podium slab which is open to sky maybe landscaped and/or be used as recreational open space; subject to provision of 1.6 m high parapet wall.

d) Other habitable uses may be allowed by counting it in FAR subject to light, ventilation and fire safety requirements.

Uses proposed in (a) to (c), shall not be counted towards FAR.

4.6.1.3 *Requirements*

Following requirements shall be satisfied for buildings constructed on podium:

a) A podium may be permitted in a plot of area 1 500 m^2 or more.

b) A podium, if provided with ramp, may be permitted in one or more levels, however the total height shall not exceed 30.0 m above ground level.

c) In case a podium is not provided with ramp, but provided with car lift only, the same may also be permitted in one or more levels, however, the total height shall not exceed 9.0 m above ground level.

d) Requirements for ramp for vehicles (*see* Fig. 8B):

1) One way ramp of clear width of minimum 3.0 m and two way ramp with clear width of minimum 6.0 m shall be provided for LMV.

2) One way ramp of clear width of minimum 4.5 m and two way ramp with clear width of minimum 9.0 m shall be provided for LCV.

3) One way ramp of clear width of minimum 6.0 m and two way ramp with clear width of minimum 12.0 m shall be provided for HMV.

4) Ramp slope shall be maximum 1 in 8.

5) After a 40 m length of continuous ramp, a flat surface of minimum 6.0 m length shall preferably be provided (*see* Fig. 8B).

6) If podium is accessible to fire tender, minimum 7.5 m wide ramp shall be required for fire engine access with maximum slope of 1 in 10.

e) Podium shall not be permitted in required minimum front open space.

f) Podium, if accessible to fire tender, shall be so designed so as to take the load of fire tender weighing up to 45 t minimum or as per the requirement laid down by the Fire Department.

g) Requirement of accessibility for elders and persons with disabilities shall be ensured in compliance with the provisions of Annex B which may require providing ramps with specified gradient or accessible lifts for access to different levels.

4.6.1.4 *Requirements for fire tender movement*

a) Buildings having height more than 15 m above ground level shall necessarily be accessible by fire tender, as follows (*see* Fig. 9A):

1) For buildings having floor area less than 10 000 m^2, fire tenders shall have access to at least one-third of the perimeter of building which shall be minimum 6.0 m wide and having 9.0 m turning radius.

2) For buildings having floor area more than 10 000 m^2, fire engine shall have an access to at least to half of the perimeter of building which shall be minimum 6.0 m wide and having 9.0 m turning radius.

b) If podium is not accessible by fire tender, the podium may be such that it is not extended beyond the building footprint to an extent more than 11.0 m on the side where fire tender access is provided (*see* Fig. 9B and Fig. 9C). Such restriction shall not apply in case podium is accessible by fire engine (*see* Fig. 9D).

c) Minimum 6.0 m driveway width and 9.0 m width at turning shall be available for fire tender movement all around the podium.

NOTE — The width and turning radius of ramp for fire tender access, and requirements of motorable open space for fire tender movement given above pertain to fire tender weighing up to 45 t and its operability. For heavier fire tenders, these shall be as per the requirement laid down by the Fire Department [*see also* 4.6 (c)].

4.7 *Cul-de-sacs* giving access to plots and extending from 150 m to 275 m in length with an additional turning space at 150 m will be allowed only in residential areas, provided *cul-de-sacs* would be permissible only on straight roads and further provided the end of *cul-de-sacs* shall be higher in level than the level of the starting point of such dead end road. The turning space, in this case shall be not less than 81 m^2 in area, with no dimension less than 9 m.

4.8 Intersection of Roads

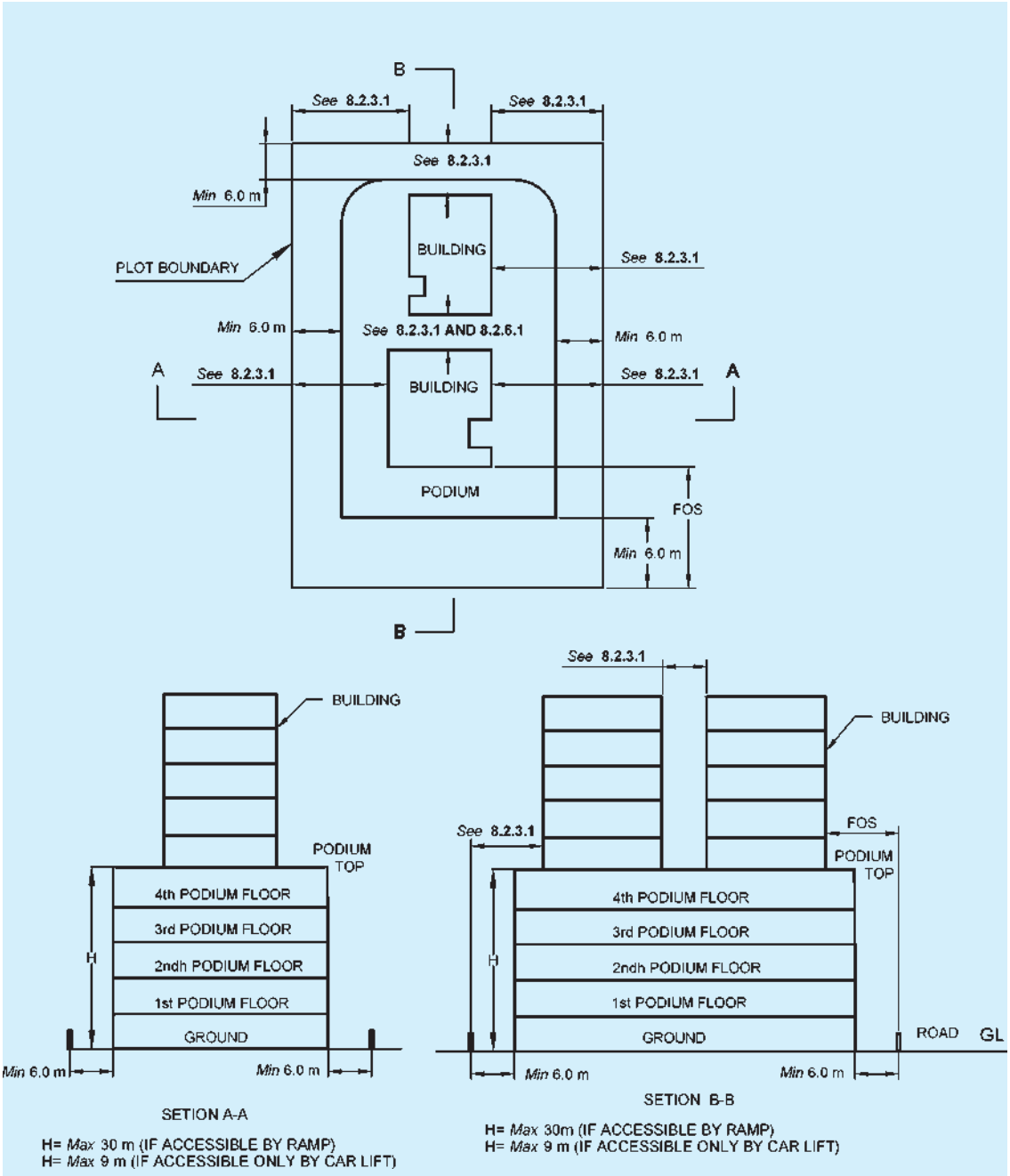
For intersection junctions of roads meeting at right angles as well as other than right angles, the rounding off or cut off or splay or similar treatment shall be done, to the approval of the Authority, depending upon the width of roads, the traffic generated, the sighting angle, etc, to provide clear sight distance.

4.9 The building line shall be set back at least 3 m from internal means of access in a layout of buildings in a plot subject to provisions of **8.2.1**.

5 COMMUNITY OPEN SPACES AND AMENITIES

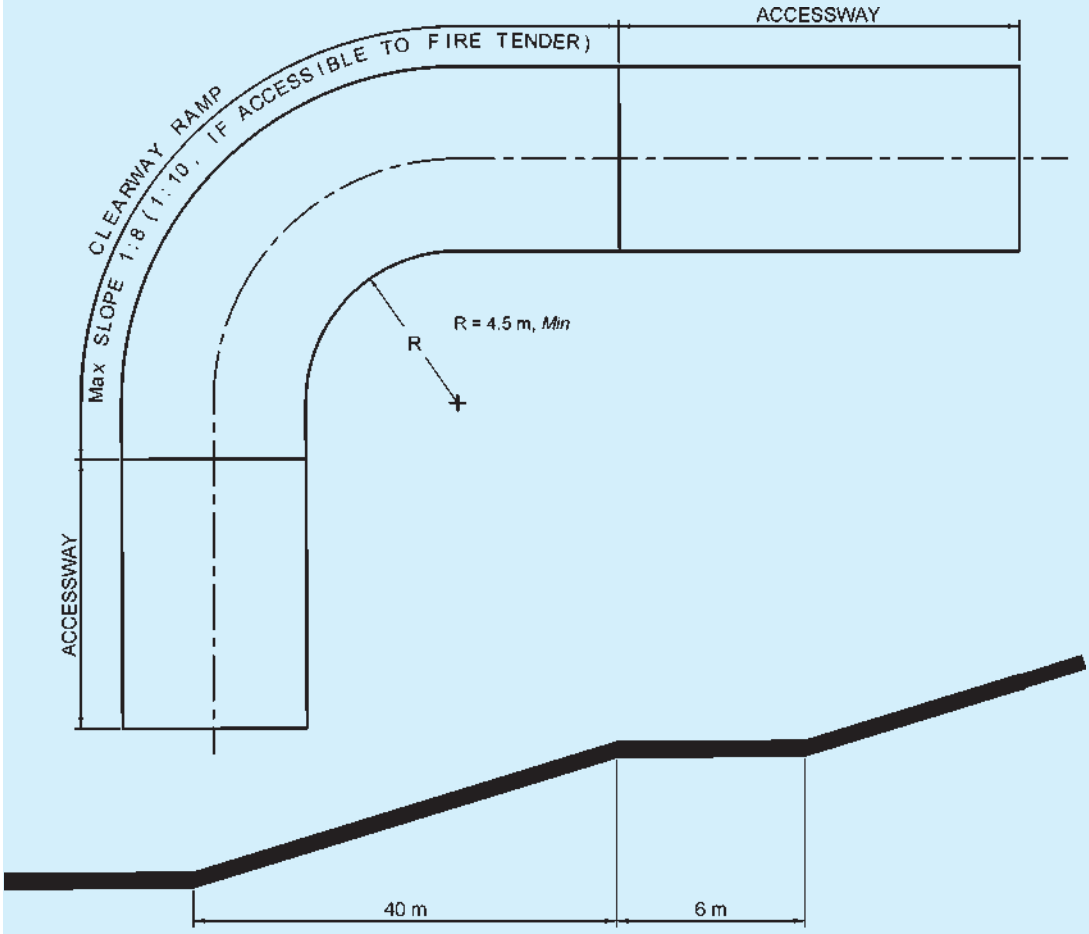
5.1 Residential and Commercial Zones

In any layout or sub-division of land measuring 0.3 ha or more in residential and commercial zones, the community open spaces shall be reserved for recreational purposes which shall as far as possible



8A BUILDING ON PODIUM

FIG. 8 — (*Continued*)



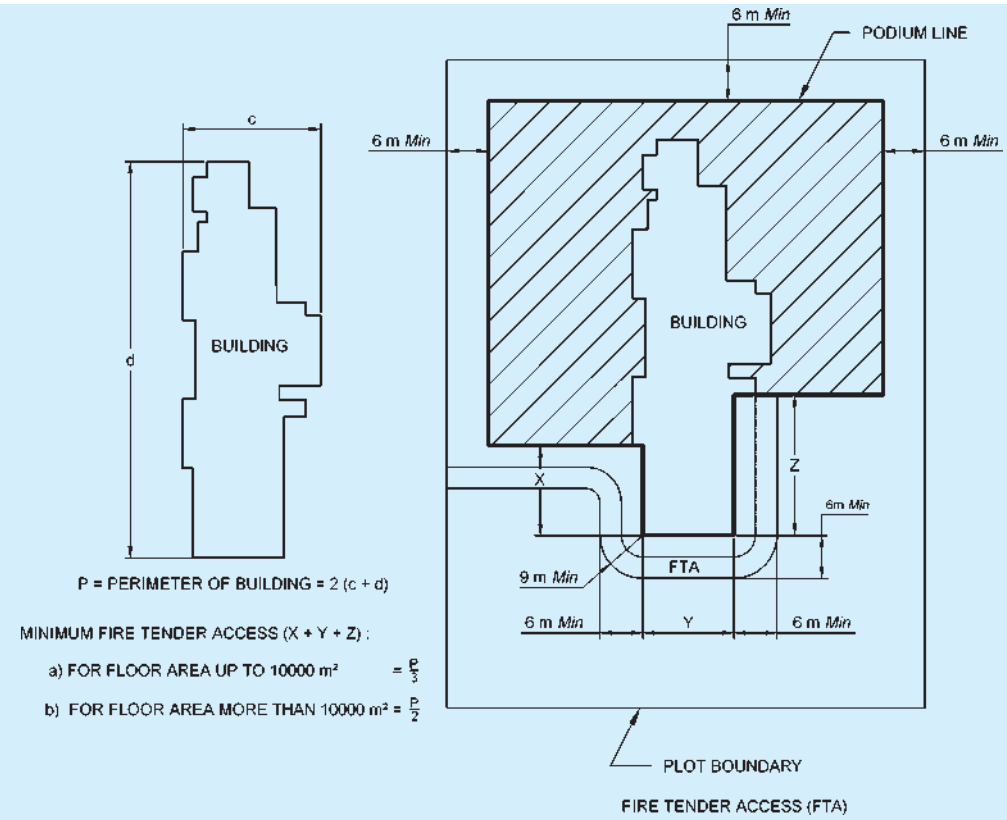
MAXIMUM CONTINUOUS RAMP LENGTH AND
MINIMUM LENGTH OF THE RAMP LANDING

MINIMUM CLEAR RAMP WIDTH, m

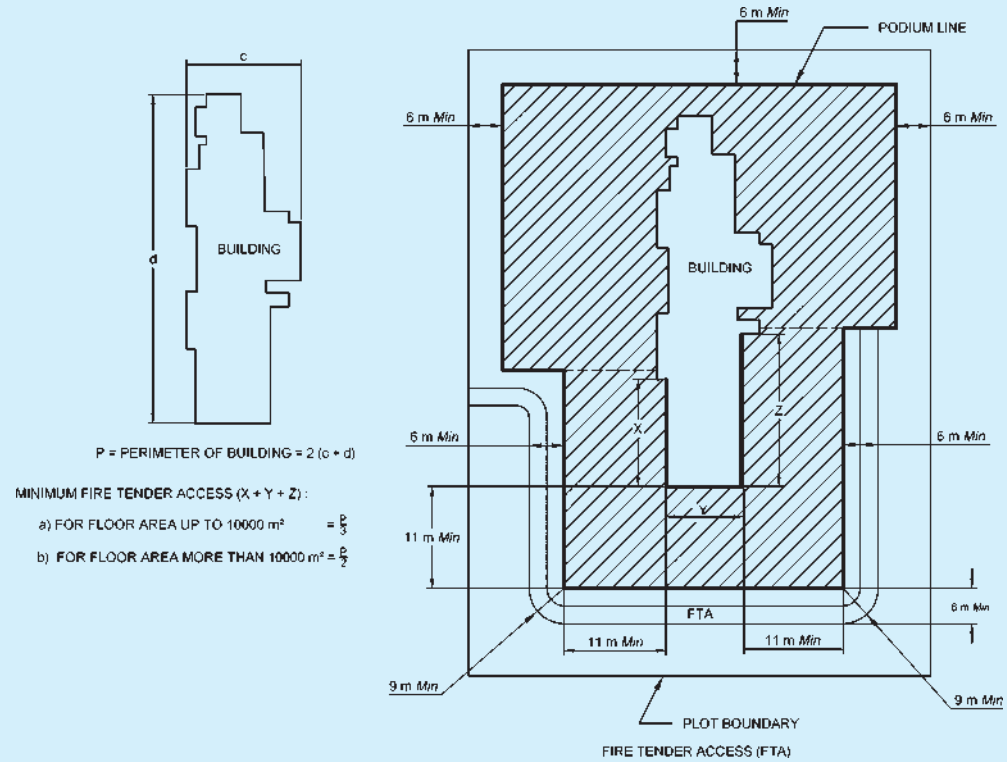
	ONE WAY	TWO WAY
LMV	3.0	6.0
LCV	4.5	9.0
HMV	6.0	12.0
FIRE TENDER	7.5	

8B RAMPS FOR PODIUM

FIG. 8 BUILDINGS ON PODIUM AND THEIR RAMPS

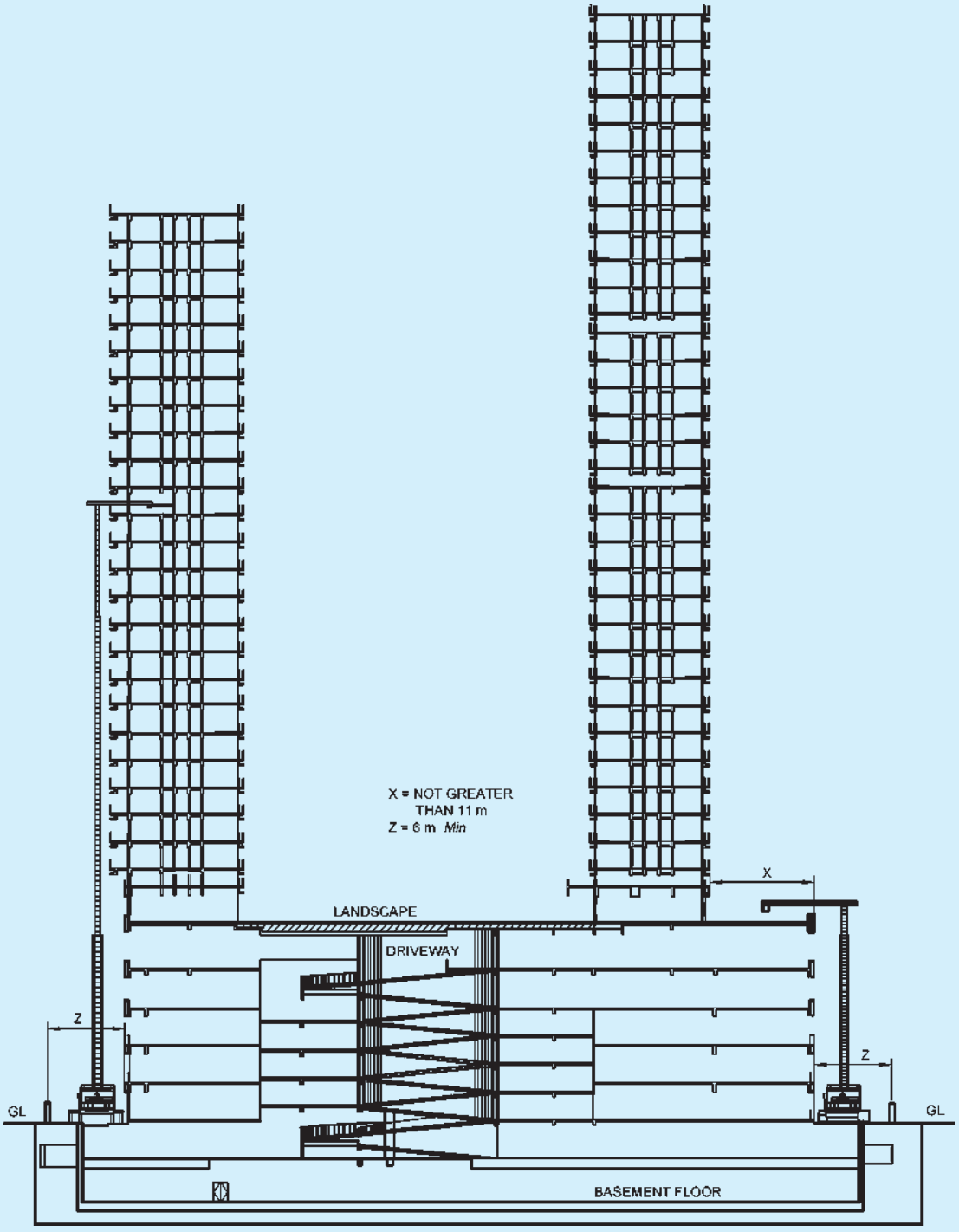


9A EMERGENCY VEHICLE ACCESS REQUIREMENT IN CASE PODIUM IS NOT ACCESSIBLE BY FIRE TENDER



9B EXTENT OF PODIUM PROJECTION ALLOWED BEYOND BUILDING ON SIDE HAVING FIRE TNEDER ACCESS (IF PODIUM IS NOT ACCESSIBLE BY FIRE TENDER)

FIG. 9 — (*Continued*)



9C PODIUM PROJECTION IF PODIUM IS NOT ACCESSIBLE BY FIRE TENDER

FIG. 9 — (*Continued*)

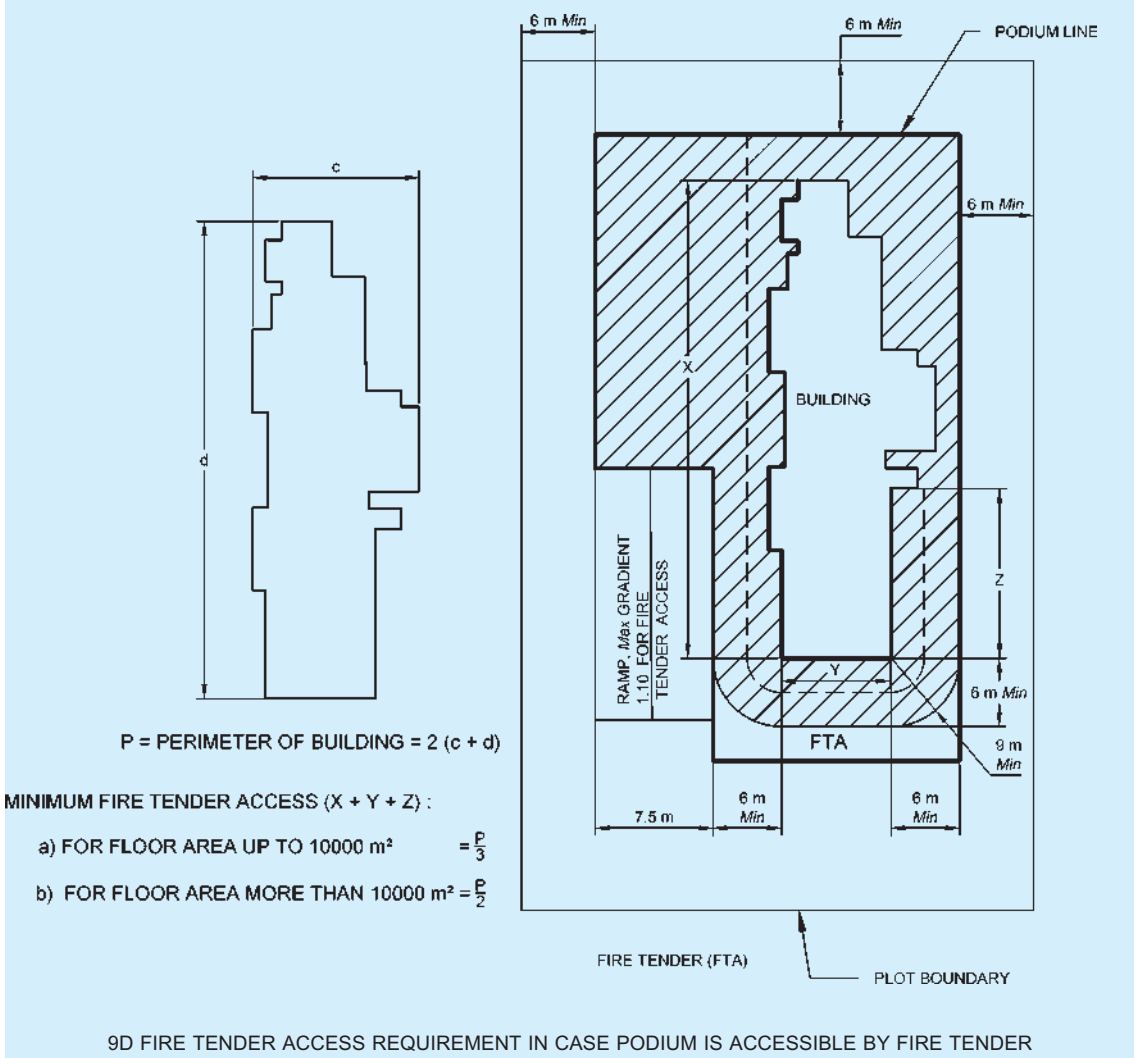


FIG.9 REQUIREMENT FOR FIRE TENDER ACCESS

be provided in one place or planned out for the use of the community in clusters or pockets.

5.1.1 The community open spaces shall be provided catering to the needs of area of layout, population for which the layout is planned and the category of dwelling units. The following minimum provision shall be made:

a) 15 percent of the area of the layout, or

b) 0.3 to 0.4 ha/1 000 persons; for low income housing, the open spaces shall be 0.3 ha/1 000 persons.

5.2 No recreational space shall generally be less than 450 m^2.

5.2.1 The minimum average dimension of such recreational space shall be not less than 7.5 m; if the average width of such recreational space is less than 24 m, the length thereof shall not exceed 2.5 times the average width. However, depending on the configuration of the site, commonly open spaces of different shapes may be permitted by the Authority, as long as the open spaces provided serve the needs of the immediate community contiguous to the open spaces.

5.2.2 In such recreational spaces, a single storeyed structure as pavilion or gymnasia up to 25 m^2 in area may be permitted; such area may be excluded from FAR calculations.

5.3 Each recreational area and the structure on it shall have an independent means of access. Independent means of access may not be insisted upon if recreational space is approachable directly from every building in the layout. Further, the building line shall be at least 3 m away from the boundary of recreational open space.

5.4 Industrial Zones

In the case of sub-division of land in industrial zones of area 0.8 hectare or more, 5 percent of the total area shall be reserved as amenity open space which shall also serve as a general parking space; when such amenity open space exceeds 1 500 m^2, the excess area could be utilized for the construction of buildings for banks, canteens, welfare centers and such other common purposes considered necessary for the industrial user, as approved by the Authority.

5.4.1 In all industrial plots measuring 1 000 m^2 or more in area, 10 percent of the total area shall be provided as an amenity open space to a maximum of 2 500 m^2. Such an amenity open space shall have a means of access and shall be so located that it could be conveniently utilized as such by the persons working in the industry.

5.5 Other Amenities

In addition to community open spaces, the layouts shall provide for the amenities as given in **5.5.1** to **5.5.13**. These provisions may be modified based on specific requirements, as decided by the Authority.

5.5.1 *Educational Facilities*

	Land Area Required, Min
a) *Pre-Primary to secondary education*	
1) Pre-primary, nursery school — 1 for every 2 500 population	
i) Area per school	0.08 ha
ii) Location of pre-primary/nursery school	to be located near a park
2) Primary school (class 1 to 5) — 1 for every 5 000 population	
i) Strength of the school — 500 students	
ii) Area per school:	0.40 ha
a) School building area	0.20 ha
b) Play field area (with a minimum of 18 m × 36 m to be ensured for effective play)	0.20 ha (which is inclusive of the limited parking requirement for functional uses)
3) Senior secondary school (class 6 to 12) — 1 for every 7 500 population	
i) Strength of the school — 1 000 students	
ii) Area per school:	1.80 ha
a) School building area	0.60 ha
b) Play field area (with a minimum of 68 m × 126 m to be ensured for effective play)	1.00 ha
c) Parking area	0.20 ha
4) Integrated school without hostel facility (class 1 to 12) — 1 for every 90 000 to 100 000 population	
i) Strength of the school — 1 500 students	
ii) Area per school:	3.50 ha
a) School building area	0.70 ha
b) Play field area	2.50 ha
c) Parking	0.30 ha
iii) Location	To be located near a sport facility
5) Integrated school with hostel facilities (class 1 to 12) — 1 for every 90 000 to 100 000 population	
i) Strength of school — 1 500 students	
ii) Area per school:	3.90 ha
a) School building area	0.70 ha
b) Play field area	2.50 ha
c) Residential (including hostel area)	0.40 ha
d) Parking area	0.30 ha
iii) Location	To be located near a sport facility
6) School for children with disabilities (Class 1 to 12) — 1 for every 45 000 population	
i) Strength of the school — 400 students	
ii) Area per school:	0.70 ha
a) School building area	0.20 ha

b) Play field area	0.30 ha
c) Parking area	0.20 ha
iii) Location	To be located near a park or sport facility

NOTE — The schools should be inclusive providing education to all children including those with disabilities. However it may be required to have exclusive schools in case of certain disabilities, such as, speech, hearing, sight and multiple disabilities.

7) School for children with intellectual and developmental disabilities — 1 for every 1 000 000 population

i) Area per school	0.20 ha
ii) Location of pre-primary/nursery school	To be located near a park and non-noise polluting zone

The schools should preferably face service roads and roads with less traffic intensity.

b) *Higher education — General*

1) College — 1 for every 125 000 population

i) Strength of the college — 1 000 to 1 500 students	
ii) Area per college:	5.00 ha
a) College building area	1.80 ha
b) Play field area	2.50 ha
c) Residential (including hostel area)	0.40 ha
d) Parking area	0.30 ha

2) University campus

Area:	10.00 ha to 60.00 ha
i) Residential (if included) area	25 percent of total land area
ii) Sports and cultural activities	15 percent of total land area
iii) Parks and landscape including green belt	15 percent of total land area

c) *Technical education*

1) Technical education centre (A) — 1 for every 1 000 000 population to include 1 industrial training institute (ITI) and 1 polytechnic

i) Strength of ITI — 400 students	
ii) Strength of polytechnic — 500 students	
iii) Area per technical education centre:	4.00 ha
a) Area for ITI	1.60 ha
b) Area for polytechnic	2.40 ha

2) Technical education centre (B) — 1 for every 1 000 000 population to include 1 ITI, 1 technical centre and 1 coaching centre

Area per technical education centre:	4.00 ha
i) Area for ITI	1.60 ha
ii) Area for technical centre	2.10 ha
iii) Area for coaching centre	0.30 ha

d) *Professional education*

1) Engineering college — 1 for every 1 000 000 population

i) Strength of the college — 1 500 students	
ii) Area per college	6.00 ha

2) Medical college — 1 for every 1 000 000 population

Area of site including space for general hospital	15.00 ha

3) Nursing and paramedic institute — 1 for every 1 000 000 population

Plot area per institute (subject to Nursing Council of India/Ministry of Health Norms)	0.20 ha

4) Veterinary institute Area — As per Veterinary Council of India/ Ministry of Agriculture norms (subject to availability of land)

5) Other professional colleges — 1 for every 1 000 000 population	
i) Strength of the college — 250 to 1 500 students	
ii) Area of site:	
a) for students strength up to 250 students	2.00 ha
b) additional area of site for every additional 100 students or part thereof up to total strength of 1 000 students	0.50 ha
c) for strength of college from 1 000 to 1 500 students	6.00 ha

5.5.2 *Health Care Facilities*

	Land Area Required, Min
a) *Dispensary — 1 for every 15 000 population*	
Area	0.08 ha to 0.12 ha
b) *Nursing home, child welfare and maternity centre — 1 for every 45 000 to 100 000 population*	
1) Capacity — 25 to 30 beds	
2) Area 0.20 ha to 0.30 ha	
c) *Poly-clinic with some observation beds — 1 for every 100 000 population)*	
Area	0.20 ha to 0.30 ha
d) *Intermediate hospital (category B) — 1 for every 100 000 population*	
1) Capacity — 80 beds (initially the provision may be for 50 beds including 20 maternity beds)	
2) Total area:	1.00 ha
i) Area for hospital	0.60 ha
ii) Area for residential accommodation	0.40 ha
e) *Intermediate hospital (category A) — 1 for every 100 000 population*	
1) Capacity — 200 beds (initially the provision may be for 100 beds)	
2) Total area:	3.70 ha
i) Area for hospital	2.70 ha
ii) Area for residential accommodation	1.00 ha
f) *General hospital — 1 for every 250 000 population*	
1) Capacity — 500 beds (initially the provision may be for 300 beds)	
2) Total area:	6.00 ha
i) Area for hospital	4.00 ha
ii) Area for residential accommodation	2.00 ha
g) *Multi-speciality hospital — 1 for 100 000 population*	
1) Capacity — 200 beds (initially the provision may be for 100 beds)	
2) Total area:	9.00 ha
i) Area for hospital	6.00 ha
ii) Area for residential accommodation	3.00 ha
h) *Speciality hospital — 1 for every 100 000 population*	
1) Capacity — 200 beds (initially the provision may be for 100 beds)	
2) Total area:	3.70 ha
i) Area for hospital	2.70 ha
ii) Area for residential accommodation	1.00 ha
j) *Family welfare centre — 1 for every 50 000 population*	
Area	500 m^2 to 800 m^2
k) *Diagnostic centre — 1 for every 50 000 population*	
Area	500 m^2 to 800 m^2

m) *Veterinary hospital for pets and animals — 1 for every 500 000 population*	
Area	0.20 ha
n) *Dispensary for pet animals and birds — 1 for every 100 000 population*	
Area	300 m^2
p) *Rehabilitation centres*	
Area	As per requirement

5.5.3 *Socio-Cultural Facilities*

	Land Area Required, Min
a) *Community room — 1 for every 5 000 population*	
Area	750 m^2
b) *Community hall, Mangal Karyalaya/Kalyana Mandapam/Barat Ghar/ library — 1 for every 15 000 population)*	
Area	2 000 m^2
c) *Recreational club — 1 for every 100 000 population*	
Area	10 000 m^2
d) *Music, dance and drama centre — 1 for every 100 000 population*	
Area	1 000 m^2
e) *Meditation and spiritual centre — 1 for every 100 000 population*	
Area	5 000 m^2
f) *Socio-cultural centre/Exhibition cum fair ground — 1 for every 1 000 000 population*	
Area	15.00 ha
g) *Anganwadi-housing area/cluster — 1 for every 5 000 population*	
Area	200 to 300 m^2
h) *Old age home — 1 for every 500 000 population*	
Area	1000 m^2 *Max*, subject to availability of land
j) *Religious facilities*	
1) At neighbourhood/housing cluster level — 1 for every 5 000 population	
Area	400 m^2
2) At sub-city level in urban extension — 1 for every 1 000 000 population	
Area	4.00 ha
k) *Science centre — 1 for every 1 000 000 population*	
Area	As per requirement
m) *International convention centre — 1 at city level*	
Area	As per requirement
n) *Other facilities*	
1) Orphanage/Children's centre (one each) — 1 for every 1 000 000 population	
Area	1 000 m^2 *Max*, subject to availability of land
2) Centre for support services for persons with disabilities — 1 for every 1 000 000 population	
Area	1 000 m^2 *Max*, subject to availability of land
3) Working women/men hostel — 1 for every 1 000 000 population	
Area	1 000 m^2 *Max*, subject to availability of land
4) Adult education centre — 1 for every 1 000 000 population	
Area	1 000 m^2 *Max*, subject to availability of land
5) Night shelter — 1 for every 1 000 000 population	
Area	1 000 m^2 *Max*, subject to availability of land

5.5.4 *Distribution Services*

	Land Area Required, Min
a) *Petrol/diesel filling and servicing centre* — May be permitted in central as well as sub-central business district, district centres, community centres (only filling station), residential and industrial use zones in urban areas, along the national highways, state highways, villages identified as growth centres, freight complex, proposed major roads and police/security force services (for captive use only).	
1) Location	
i) Shall not be located on the road having right of way less than 30 m.	
ii) Shall be approved by the explosive/fire department.	
iii) Special cases in old city areas may be considered based on the approval by statutory authorities.	
2) Area/Size	
i) Only filling station	30 m × 17 m
ii) Filling cum service station	36 m × 30 m
iii) Filing cum service station cum workshop	45 m × 36 m
iv) Filling station only for two and three wheelers	18 m × 15 m
b) *Compressed natural gas (CNG) filling centre* — Permitted in all use zones (except in regional parks and developed district parks) and along the national highways, state highways and villages identified as growth centres, freight complex and on proposed major roads.	
1) Location	
i) Shall not be located on the road having right of way less than 30 m.	
ii) Shall be approved by the explosive/fire department.	
2) Area/Size for CNG mother station (including building component — control rooms/office/dispensing room/store, pantry and W.C.)	1 080 m^2 (36 m × 30 m)
c) *LPG godowns/Gas godown — 1 for every 40 000 to 50 000 population* The major concern for its storage and distribution is the location which shall be away from the residential areas and shall have open spaces all around as per *The Explosive Rules*, 2008	
1) Capacity – 500 cylinders or 8 000 kg of LPG	
2) Area (inclusive of guard room)	520 m^2 (26 m × 20 m)
d) *Milk distribution booth — 1 milk booth for every 5 000 population* Area inclusive of service area	150 m^2
e) *Fruit and vegetable distribution booth — 1 booth for every 5 000 population* Area	250 m^2

5.5.5 *Police, Civil Defence and Home Guards*

	Land Area Required, Min
a) *Police station — 1 for every 90 000 population* Area (inclusive of essential residential accommodation; 0.05 ha additional to be provided for civil defence and home guards)	1.50 ha
b) *Police post — 1 for every 40 000 to 50 000 population (not served by a police station)* Area (inclusive of essential residential accommodation)	0.16 ha

c) *District office and battalion — 1 for every 1 000 000 population*	
Total area:	4.80 ha
1) Area for district office	0.80 ha
2) Area for battalion	4.00 ha
d) *Police line — 1 for every 2 000 000 population*	
Area	4.00 to 6.00 ha
e) *District jail — 1 for every 1 000 000 population*	
Area	10.00 ha
f) *Civil defence and home guards — 1 for every 1 000 000 population*	
Area	2.00 ha
g) *Traffic and police control room*	
Area	As per requirement
h) *Police training institute/college — 1 at city level*	
1) Location — To be located in fringe areas	
2) Area	5.00 ha
j) *Police firing range — 1 at city level*	
1) Location — To be located in fringe areas	
2) Area	Up to 10.00 ha
k) *Police camp including Central Police Organization/security forces (including Central security forces)*	
Area	Up to 10.00 ha
m) *Police booth (to be provided by transport planners)*	
1) Location — at major road intersections	
2) Area	10 to 12 m^2

5.5.6 *Safety Management*

	Land Area Required, Min
a) *Fire station — 1 for every 200 000 population or 1 within 5 to 7 km radius*	
Area inclusive of residential accommodation	1.00 ha
b) *Sub fire station/fire post — 1 within a radius of 3 to 4 km*	
Area inclusive of essential residential accommodation	0.6 ha
c) *Disaster management centre — 1 in each administrative zone*	
Area	1) 1.00 ha along with suitable open area 2) 2.00 ha if soft parking, temporary shelter, parade ground, etc, included
d) *Fire training institute/college*	
Area	3.0 ha

5.5.7 *Telephone, Postal and Banking Facilities*

	Land Area Required, Min
a) *Telephone and Communications*	
1) Telephone exchange of 40 000 lines — 1 for every 400 000 population	
Area	4.00 ha
2) Radio/TV station — 1 for every 500 000 to 800 000 population	
Area	1 700 m^2
3) Remote subscriber unit (RSU) — 1 for 3 km radius	
Area	300 m^2
b) *Postal*	
1) Post office counter without delivery — 1 for every 15 000 population	
Floor area to be provided in local shopping centre	85 m^2
2) Head post office with delivery office — 1 for 250 000 population	
Area	750 m^2
3) Head post office and administrative office — 1 for 500 000 population	
Area	2 500 m^2

c) *Banking*

1) *Bank with extension counters with ATM facility — 1 for every 15 000 population*	
i) Floor area for counters	75 m^2
ii) Floor area for ATM	6 m^2
2) *Bank with locker, ATM and other banking facilities — 1 for 100 000 population*	
Area	2 500 m^2

5.5.8 *Sports Facilities*

	Land Area Required, Min
a) *Divisional sports centre — 1 for 1 000 000 population*	
Area	20.00 ha
b) *District sports centre — 1 for 100 000 population*	
Area	8.00 ha
c) *Neighbourhood play area — 1 for 15 000 population*	
Area	1.50 ha
d) *Residential unit play area — 1 for 5 000 population*	
Area	5 000 m^2

5.5.9 *Commercial Centres*

	Land Area Required, Min
a) *Convenience shopping — 1 for every 5 000 population*	
Area	1 500 m^2
b) *Local shopping including service centre — 1 for every 15 000 population*	
Area	4 600 m^2
c) *Community centre with service centre — 1 for every 100 000 population*	
Area	5.00 ha
d) *District centre — 1 at district level/1 for every 500000 population*	
Area	40.00 ha
e) *Sub-city centre — 1 for every 2 500 000 to 5 000 000 population*	
Area	As per requirement
f) *City centre — 1 for every 5 000 000 plus population*	
Area	As per requirement
g) *Local wholesale market/Mandi — 1 for 1 000 000 population*	
Area	10.00 ha
h) *Weekly markets — 1 to 2 locations for every 100 000 population with 300 to 400 units per location*	
Parking and other open spaces with in the commercial centres can be so designed that weekly markets may operate in these areas during non-working hours.	
The area of informal sector should have suitable public conveniences and solid waste disposal arrangements.	
Area per location	0.40 ha
j) *Organized informal eating spaces — 1 for every 100 000 population*	
Area	2 000 m^2

5.5.10 *Electrical Sub-Station*

	Land Area Required, Min
a) *11 kV sub-station — 1 for 15 000 population*	
Area	500 m^2
b) *66 kV sub-station — 2 for 100 000 population*	
Area for each sub-station	6 000 m^2 (that is, 60 m × 100 m)
c) *220 kV sub-station — 1 for 500 000 population*	
Area	4.00 ha

5.5.11 *Transport*

	Land Area Required, Min
a) *Three wheeler and taxi stand — 1 for 15 000 population*	
Area	500 m^2
b) *Bus terminal — 1 for 100 000 population*	
Area	4 000 m^2
c) *Bus depot — 1 for 500 000 population*	
Area	2.00 ha

5.5.12 *Cremation/Burial Ground*

The site shall not be in proximity to residential areas and should preferably be in urban extension.

	Land Area Required, Min
a) *Electric crematorium — 1 for large size towns*	
Area	2.00 ha
b) *Cremation ground — 1 for 500 000 population*	
Area	2.50 ha
c) *Burial ground — 1 for 500 000 population*	
Area	4.00 ha

5.5.13 *Dhobi Ghat*

	Land Area Required, Min
Dhobi ghat with appropriate arrangements for water and drainage facilities and it shall be ensured that the water bodies are not polluted as a result of such activities 1 for 100 000 population	
Area	5 000 m^2

5.6 Every layout or subdivision shall take into account the provisions of development plan and if the land is affected by any reservation for public purposes, the Authority may agree to adjust the location of such reservations to suit the development.

6 REQUIREMENTS OF PLOTS

6.1 No building shall be constructed on any site, on any part of which there is deposited refuse, excreta or other offensive matter objectionable to the Authority, until such refuse has been removed therefrom and the site has been prepared or left in a manner suitable for building purposes to the satisfaction to the Authority.

6.2 Damp Sites

Wherever the dampness of a site or the nature of the soil renders such precautions necessary, the ground surface of the site between the walls of any building erected thereon shall be rendered damp-proof to the satisfaction of the Authority.

6.3 Surface Water Drains

Any land passage or other area within the curtilage of a building shall be effectively drained by surface water drains or other means.

6.3.1 The written approval of the Authority shall be obtained for connecting any subsoil or surface water drain to a sewer.

6.4 Distance from Electric Lines

An overhead line shall not cross an existing building as far as possible and no building shall be constructed under an existing overhead line. No accessible point from any *Verandah,* balcony, or the like shall be allowed to be erected or re-erected or any additions or alterations made to a building not having the following minimum clearances from an overhead electric supply line, in accordance with the current *Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations,* 2010 as amended from time to time:

a) *Clearance of buildings from lines of voltages and service lines not exceeding 650 V*

1) An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.

2) Where an overhead line of voltage not exceeding 650 V passes above or adjacent to or terminates on any building, the following minimum clearances from any accessible point, on the basis of maximum sag, shall be observed:

i) For any flat roof, open balcony, *Verandah* roof and lean-to-roof:

a) where the line passes above the building, a vertical clearance of 2.5 m from the highest point, and

b) when the line passes adjacent to the building, a horizontal clearance of 1.2 m from the nearest point, and

ii) For pitched roof:

a) where the line passes above the building, a vertical clearance of 2.5 m immediately under the line, and

b) when the line passes adjacent to the building, a horizontal clearance of 1.2 m.

3) The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to wind pressure.

4) Any conductor so situated as to have a clearance less than that specified above shall be adequately insulated and shall be attached at suitable intervals to a bare earthed bearer wire having a breaking strength of not less than 350 kg.

b) *Clearances from buildings of lines of voltages exceeding 650 V*

1) An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.

2) Where an overhead line of voltage exceeding 650 V passes above or adjacent to any building or part of a building, it shall have on the basis of maximum sag a vertical clearance above the highest part of the building immediately under such line, of not less than:

i) For lines of voltages exceeding 650 V : 3.7 m upto and including 33 kV; and

ii) For lines of voltages exceeding 33 kV : 3.7 m plus 0.30 m for every additional 33 kV or part thereof.

3) The horizontal clearance between the nearest conductor and any part of such building shall, on the basis of maximum deflection due to wind pressure, be not less than:

i) For lines of voltages exceeding 650 V and up to and including 11 kV : 1.2 m

ii) For lines of voltages exceeding 11 kV and up to and including 33 kV : 2.0 m

iii) For lines of voltages exceeding 33 kV : 2.0 m plus 0.3 m for every additional 33 kV or part thereof

4) For high voltage direct current (HVDC) systems, vertical clearance and horizontal clearance, on the basis of maximum deflection due to wind pressure, from building shall be maintained as below:

Sl No.	*d.c. Voltage*	*Vertical Clearance*	*Horizontal Clearance*
	kV	m	m
(1)	(2)	(3)	(4)
i)	100	4.6	2.9
ii)	200	5.8	4.1
iii)	300	7.0	5.3
iv)	400	7.0	6.2
v)	500	9.1	7.4
vi)	600	10.3	8.6
vii)	800	12.4	10.7

6.5 Distance from Water Course/Area

Distance of site from the normal edge of water course/ area may be specified by the Authority, keeping in view the normal maximum flood/tide level.

6.6 Size of Plots

6.6.1 *Residential*

Each plot shall have a minimum size/frontage corresponding to the type of development as given below:

Sl No.	*Type of Development*	*Plot Size* m^2	*Frontage* m
(1)	(2)	(3)	(4)
i)	Detached building	Above 250	above 12
ii)	Semi-detached building	125-250	8 to 12
iii)	Row type building	50-125	4.5 to 8

NOTE — For low income housing, *see* **14**.

6.6.1.1 The minimum size of the site for group housing development shall be as given in the Master Plan and local development control rules.

6.6.2 *Industrial*

The size of the plot shall not be less than 300 m^2 and its width shall not be less than 15 m.

6.6.3 *Other Land Uses*

The minimum size of plots for buildings for other uses not covered under **5.5** shall be as decided by the Authority. Various requirements with respect to cinema buildings shall be in accordance with the good practice [3(2)].

7 CLASSIFICATION OF BUILDINGS

Buildings are classified based on occupancy and types of construction.

7.1 For the purpose of the Code, the following shall be the occupancy classification and types of construction; for more detailed information, reference may be made to Part 4'Fire and Life Safety' of the Code.

7.1.1 *Occupancy Classification*

a) Residential;
b) Educational;
c) Institutional;
d) Assembly;
e) Business;
f) Mercantile (will include both retail and wholesale stores);
g) Industrial (will include low, moderate and high fire hazards);
h) Storage; and
j) Hazardous.

7.1.2 *Types of Construction*

a) Type 1,
b) Type 2,
c) Type 3, and
d) Type 4.

8 OPEN SPACES (WITHIN A PLOT)

8.1 General

Every room intended for human habitation shall abut on an interior or exterior open space or an open *Verandah* open to such interior or exterior open space.

8.1.1 The open spaces inside and around a building have essentially to cater for the lighting and ventilation requirements of the rooms abutting such open spaces, and in the case of buildings abutting on streets in the front, rear or sides, the open spaces provided shall be sufficient for the future widening of such streets.

8.1.2 *Open Spaces Separate for Each Building or Wing*

The open spaces shall be separate or distinct for each building and where a building has two or more wings, each wing shall have separate or distinct open spaces for the purposes of lighting and ventilation of the wings.

However, separation between accessory and main buildings more than 7 m in height shall not be less than 1.5 m; for buildings up to 7 m in height no such separation shall be required.

8.1.3 The open space shall be the minimum distance measured between the front, rear and side of the building and the respective plot boundaries. The front, rear and side of the building shall be the point of the building nearest to the boundary.

8.2 Residential Buildings

8.2.1 *Exterior Open Spaces*

The exterior open spaces for residential buildings up to a height of 10 m shall be in accordance with **8.2.1.1** to **8.2.1.3**.

8.2.1.1 *Front open space*

a) Every building fronting a street shall have a front space, forming an integral part of the site

as given below:

Sl No. (1)	*Front Open Space, Min* *m* (2)	*Width of Street Fronting the Plot* *m* (3)
i)	1.5[1)]	Up to 7.5[1)]
ii)	3.0	7.5 to 18
iii)	4.5	18 to 30
iv)	6.0	Above 30

[1)] For buildings up to a maximum height 7 m.

NOTE — In case a building abuts two or more streets, the value of open spaces is to be based on the average width of streets, subject to a minimum of 1.8 m for Sl No. (ii), (iii) and (iv).

b) For streets less than 7.5 m in width, the distance of the building (building line) shall be at least 5 m from the centre line of the street (*see* **4.3.5**).

NOTE — This limiting distance has to be determined by the Authority for individual road/street widths taking into account the traffic flow.

8.2.1.2 *Rear open space*

a) Every residential building shall have a rear open space, forming an integral part of the site, of an average width of 3.0 m and at no place measuring less than 1.8 m, except that in the case of a back-to-back sites, the width of the rear open space shall be 3.0 m throughout. Subject to the condition of free ventilation, the open space left up to half the width of the plot shall also be taken into account for calculating the average width of the rear open space. For plots of depths less than 9 m, for buildings up to 7 m in height, the rear open space may be reduced to 1.5 m.

b) *Rear open space to extend the rear wall* — The rear open space shall be co-extensive with the entire face of the rear wall. If a building abuts on two or more streets, such rear open space shall be provided throughout the face of the rear wall. Such rear wall shall be the wall on the opposite side of the face of the building abutting on the wider street unless the Authority directs otherwise.

c) In case of corner plots less than 300 m^2 in area, the rear open space should be 2.4 m minimum.

8.2.1.3 *Side open space*

a) Every semi-detached and detached building shall have a permanently open air space, forming an integral part of the site as given below:

1) For detached buildings there shall be a minimum side open space of 3.0 m on both the sides.

NOTE — For detached residential buildings up to 7 m in height on plots with a frontage less than 12 m (*see* **6.6.1**), one of the side open spaces may be reduced to 1.5 m.

2) For semi-detached buildings, there shall be a minimum side open space of 3.0 m on one side.

NOTE — For semi-detached buildings up to 7 m in height on plots with a frontage less than 9 m (*see* **6.6.1**), the side open spaces may be reduced to 1.5 m.

3) For row-type buildings, no side open is required.

b) In the case of semi-detached buildings, the open spaces provided on one side shall be as in **8.2.1.3** (a) (2) and all habitable rooms shall abut either on this side open space or front and rear open spaces or an interior open space (*see* **8.2.5**).

8.2.2 The provisions of **8.2.1.2** and **8.2.1.3** are not applicable to parking lock-up garages up to 3 m in height located at a distance of 7.5 m from any street line or front boundary of the plot.

8.2.3 The exterior open spaces for residential buildings of height above 10 m shall be in accordance with **8.2.3.1** and **8.2.3.2**.

8.2.3.1 For buildings of height above 10 m, the open spaces (side and rear) shall be as given in Table 4. The front open spaces for increasing heights of buildings shall be governed by **9.4.1**(a).

8.2.3.2 For tower-like structures, as an alternative to **8.2.3.1**, open spaces shall be as given below:

a) Up to a height of 24 m, with one set-back, the open spaces at the ground level, shall be not less than 6 m [*see* Fig. 10A];

b) For heights between 24 m and 37.5 m with one set-back, the open spaces at the ground level, shall be not less than 9 m [*see* Fig. 10B];

c) For heights between37.5 m and 70 m with two set-backs, the open spaces at the ground level, shall be not less than 12 m [*see* Fig. 10C];

d) For heights between 70 m and 120 m with two set-backs, the open spaces at the ground level, shall be not less than 14 m [*see* Fig. 10D];

e) For heights above 120 m and above with two set-backs, the open spaces at the ground level, shall be not less than 16 m [*see* Fig. 10E]; and

f) The deficiency in the open spaces shall be made good to satisfy **8.2.3.1** through the set-backs at the upper levels; these set-backs shall not be accessible from individual rooms/flats at these levels.

Table 4 Side and Rear Open Spaces for Different Heights of Buildings

(*Clause* 8.2.3.1)

Sl No.	Height of Building	Side and Rear Open Spaces to be Left Around Building
	m	m
(1)	(2)	(3)
i)	10	3
ii)	15	5
iii)	18	6
iv)	21	7
v)	24	8
vi)	27	9
vii)	30	10
viii)	35	11
ix)	40	12
x)	45	13
xi)	50	14
xii)	55	16
xiii)	70	17
xiv)	120	18
xv)	Above 120	20

NOTES

1 For buildings above 24 m in height, there shall be a minimum front open space of 6 m.

2 Where rooms do not derive light and ventilation from the exterior open space, the width of such exterior open space as given in col 3 may be reduced by 1 m subject to a minimum of 3 m and a maximum of 8 m. No further projections shall be permitted.

3 If the length or depth of the building exceeds 40 m, add to col (3) ten percent of length or depth of building minus 4.0 m subject to maximum requirement of 20 m.

8.2.4 The width of the abutting road and the front open space would govern the height of the building (*see* **9.4**).

8.2.5 *Interior Open Spaces*

a) *Inner courtyard* — In case the whole of one side of every room excepting bath, WC and store room, is not abutting on either the front, rear or side open spaces, it shall abut on an inner courtyard, whose minimum width shall be 3 m.

Further, the inner courtyard shall have an area, throughout its height, of not less than the square of one-fifth the height of the highest wall abutting the courtyard. Provided further that, when any room (excluding staircase bay, bathroom and water-closet) is dependent for its light and ventilation on an inner courtyard, the dimension shall be such as is required for each wing of the building.

Where only water-closet and bath room are abutting on the inner courtyard, the size of the inner courtyard shall be in line with the provision for ventilation shaft as given in **8.2.5** (b).

b) *Ventilation shaft* — For ventilating the spaces for water-closets and bath rooms, if not opening on to front, side, rear or interior open spaces, these shall open on to the ventilation shaft, the size of which shall not be less than the values given below:

Sl No.	*Height of Building*	*Size of Ventilation Shaft*	*Minimum One Dimension of the Shaft*
	m	m^2	m
(1)	(2)	(3)	(4)
i)	Up to 10	1.2	0.9
ii)	12	2.8	1.2
iii)	18	4.0	1.5
iv)	24	5.4	1.8
v)	30	8.0	2.4
vi)	Above 30	9.0	3.0

NOTES

1 For buildings of height above 30 m, a mechanical ventilation system shall be installed besides the provision of minimum ventilation shaft.

2 For fully air conditioned residential/business buildings, the ventilation shaft need not be insisted upon, provided the air conditioning system works in an uninterrupted manner, also, provided there is an alternative source of power supply.

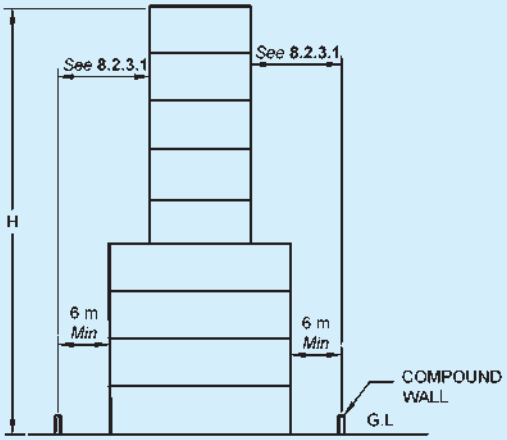
c) *Outer courtyard* — The minimum width of the outer courtyard (as distinguished from its depth) shall be not less than 2.4 m. If the width of the outer courtyard is less than 2.4 m, it shall be treated as a notch and the provisions of outer courtyard shall not apply. However, if the depth of the outer courtyard is more than the width, the provisions of **8.1.2** shall apply for the open spaces to be left between the wings when any habitable room depends on light and ventilation from such outer courtyard.

d) *Sunken courtyard* — Sunken courtyard up to 3 m in depth from the ground level as 'light well' within building envelope shall be permitted for light and ventilation for basement area, provided all concerns relating to drainage are taken care of.

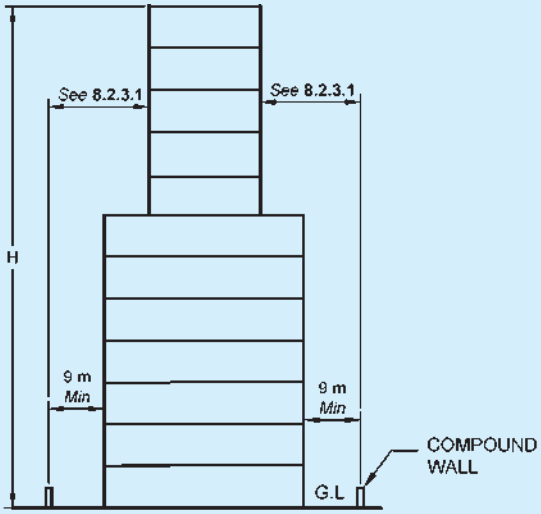
8.2.6 *Joint Open Air Space*

Every such interior or exterior open air space, unless the latter is a street, shall be maintained for the benefit of such building exclusively and shall be entirely within the owner's own premises.

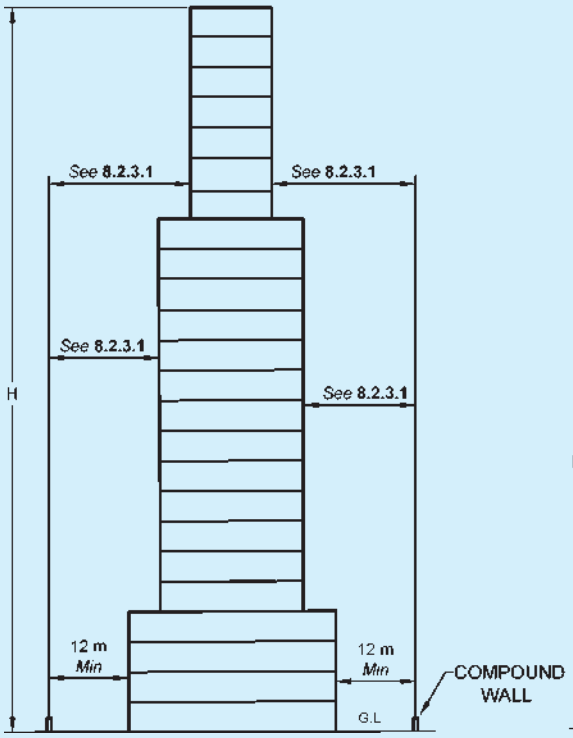
8.2.6.1 If such interior or exterior open air space is intended to be used for the benefit of more than one building belonging to the same owner, the width of such open air space shall be the one specified for the tallest building as specified in **8.2.3** abutting on such open air space [*see* Fig. 8A].



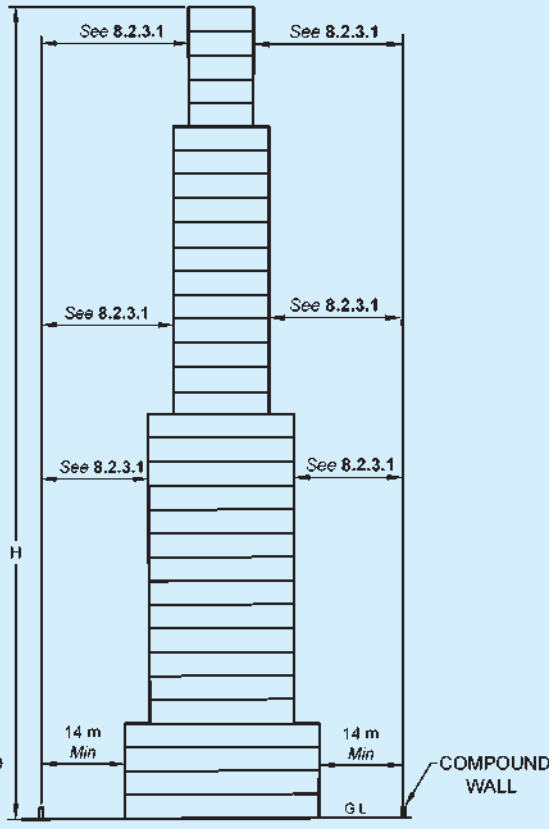
10A FOR BUILDINGS HEIGHT (H) UP TO 24 m



10B FOR BUILDINGS HEIGHT (H) BETWEEN 24 m AND 37.5 m

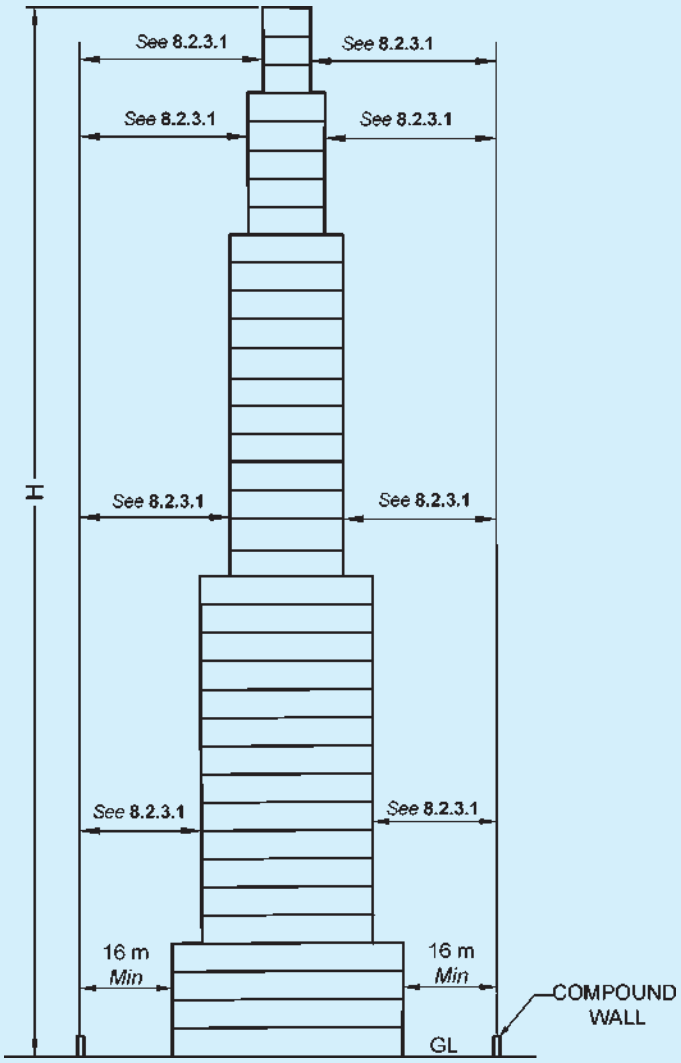


10C FOR BUILDINGS HEIGHT (H) BETWEEN 37.5 m AND 70 m



10D FOR BUILDINGS HEIGHT (H) BETWEEN 70 m AND 120 m

FIG. 10 — (*Continued*)



10E FOR BUILDINGS HEIGHT (H) ABOVE 120 m

FIG. 10 OPEN SPACES AROUND TOWER-LIKE STRUCTURES

8.2.6.2 If such interior or exterior open air space is jointly owned by more than one person, its width shall also be as specified in **8.2**, provided every such person agrees in writing to allow his portion of such joint open air space to be used for the benefit of every building abutting on such joint open air space and provided he sends such written consent to the Authority for record. Such common open air space shall thenceforth be treated as a permanently open air space required for the purposes of the Code. No boundary wall between such joint open air space shall be erected or raised to a height of more than 2.0 m.

8.3 Other Occupancies

8.3.1 Open spaces for other occupancies shall be as given below:

a) *Educational buildings* — Except for nursery schools, the open spaces around the building shall be not less than 6 m.

b) *Institutional buildings* — The open spaces around the building shall be not less than 6 m.

c) *Assembly buildings* — The open space at front shall be not less than 12 m and the other open spaces around the building shall be not less than 6 m.

NOTE — However, if assembly buildings are permitted in purely residential zones, the open spaces around the building shall be not less than 12 m.

d) *Business, mercantile and storage buildings* — The open spaces around the building shall be not less than 4.5 m for heights up to 16 m, with an increase of the open spaces of 0.25 m for every increase of 1 m or fraction thereof in height above 16 m. Where these occur in a purely residential zone or in a residential with incidental shops line zone the open spaces may be relaxed.

e) *Industrial buildings* — The open spaces around the building shall be not less than 4.5 m for heights up to 16 m, with an increase of the open spaces of 0.25 m for every increase of 1 m or fraction thereof in height above 16 m.

NOTE — Special rules for narrow industrial plots in the city, namely plots less than 15 m in width, and with appropriate set-backs from certain streets and highways, shall be applicable.

f) *Hazardous occupancies* — The open spaces around the building shall be as specified for industrial buildings [*see* **8.3.1**(e)].

8.4 Exemption to Open Spaces

8.4.1 *Projections into Open Spaces*

Every open space provided either interior or exterior shall be kept free from any erection thereon and shall be open to the sky, except as given below:

a) Cornice, roof or weather shade not more than 0.75 m wide;

b) Sunshades over windows/ventilators or other openings not more than 0.75 m wide;

c) Canopy not to be used as a sit out with clearance of 1.5 m between the plot boundary and the canopy;

d) Projected balcony at higher floors of width not more than 1.2 m; and

e) Projecting rooms/balconies [*see* **8.4.1**(d)] at alternate floors such that rooms of the lower two floors get light and air and the projection being not more than the height of the storey immediately below.

However, these projections into open spaces shall not reduce the minimum required open spaces.

8.4.1.1 *Accessory building*

The following accessory buildings may be permitted in the open spaces:

a) In an existing building, sanitary block of 2.4 m in height subject to a maximum of 4 m2 in the rear open space at a distance of 1.5 m from the rear boundary may be permitted, where facilities are not adequate.

b) Parking lock up garages not exceeding 2.4 m in height shall be permitted in the side or rear open spaces at a distance of 7.5 m from any road line or the front boundary of the plot; and

c) Suction tank and pump room each up to 2.5 m^2 in area.

8.4.2 *Projection into Street*

8.4.2.1 In existing built-up or congested areas, no projection of any sort whatsoever, except sunshades (*see* **8.4.2.3**) extending more than 230 mm below a height of 4.3 m, shall project over the road or over any drain or over any portion outside the boundaries of the site, provided the projection arising out of the vertical part of the rain-water spouts projecting at the road level or the water pipe may be permitted in accordance with the drainage plan.

8.4.2.2 *Porticos in existing developed area*

Porticos in bazaar areas of existing developed areas may be permitted to project on road land subject to the following limitations:

a) Porticos may be allowed on such roads leaving a minimum clear space of 18 m between kerbs;

b) The porticos shall not be less than 3 m wide;

c) Nothing shall be allowed to be constructed on the portico which shall be used as an open terrace;

d) Nothing shall be allowed to project beyond the line of arcades; and

e) The space under the portico shall be paved and channeled according to the directions of the Authority.

8.4.2.3 *Sunshades over windows and ventilators*

Projections of sunshades over windows or ventilators in existing built-up or congested areas when permitted by the Authority shall fulfill the following conditions:

a) No sunshade shall be permitted over the road or over any drain or over any portion outside the boundaries of the site below a height of 2.8 m from the road level;

b) Sunshades provided above a height of 2.8 m from the ground level shall be permitted to project up to a maximum width of 60 cm, if the road over which they project exceeds 9 m in width; and

c) No sunshade shall be permitted on roads less than 9 m in width or on roads having no footpaths.

8.5 Limitations to Open Spaces

8.5.1 *Safeguard Against Reduction of Open Space*

No construction work on a building shall be allowed if

such work operates to reduce an open air space of any other adjoining building, belonging to the same owner to an extent less than what is prescribed at the time of the proposed work or to reduce further such open space if it is already less than that prescribed.

8.5.2 *Additions or Extensions to a Building*

Additions or extensions to a building shall be allowed, provided the open spaces for the additions/extensions satisfy **8.2** after such additions/extensions are made.

8.6 In case of buildings on podium, the requirements for spaces shall also comply with **4.6.1.3** [*see also* Fig. 8(a)].

9 AREA AND HEIGHT LIMITATIONS

9.1 General

The limitation of area and height of buildings of different occupancy classes and types of construction shall be achieved by specifying it in terms of FAR, which shall take into account the various aspects that govern in specifying FAR as given below:

a) Occupancy class;
b) Types of construction;
c) Width of street fronting the building and the traffic load;
d) Locality where the building is proposed and the density;
e) Parking facilities;
f) Local fire fighting facilities; and
g) Water supply, drainage and sanitation facilities.

9.2 The comparative FARs for different occupancies and types of construction are as given in Table 5 and the Authority shall select a basic FAR for one occupancy and a type of construction and arrive at the FAR values for other combinations taking into account the other local factors (*see* **9.1**).

9.2.1 *Unlimited Areas*

The minimum fire separation on all sides of buildings of unlimited areas (*see* Table 5) and of Type 1 construction shall be 9 m.

9.3 Street Width

The area limits shall apply to all buildings fronting on a street or public space not less than 9 m in width accessible to a public street.

9.4 Height Limit

The height and number of storeys shall be related to FAR and the provisions of **8**.

9.4.1 Where a building height is not covered by Table 5, the maximum height shall be limited according to the width of the street as follows:

a) The maximum height of building shall not exceed 1.5 times the width of road abutting plus the front open space, subject to the requirement of front open space of a maximum of 16 m;
b) If a building abuts on two or more streets of different widths, the building shall be deemed to face upon the street that has the greater width and the height of the building shall be regulated by the width of that street and may be continued to this height to a depth of 24 m along the narrower street subject to conformity of **8**; and
c) For buildings in vicinity of aerodromes, provisions of **9.5** shall apply.

9.4.2 *Height Exceptions*

9.4.2.1 *Roof structures*

The following appurtenant structures shall not be included in the height of the building unless the aggregate area of such structures, including pent-houses, exceeds one-third of the area of the roof of building upon which they are erected:

a) Roof tanks and their supports (with support height not exceeding 1 m);
b) Ventilating, air conditioning, lift rooms and similar service equipment;
c) Stair cover (*Mumty*) not exceeding 3 m in height; and
d) Chimneys, parapet walls and architectural features not exceeding 1.2 m in height.

9.4.2.2 The building height for different occupancy types shall not exceed the maximum height prescribed in Part 4 'Fire and Life Safety' of the Code.

9.5 Restrictions in the Vicinity of Aerodromes

9.5.1 For buildings in the vicinity of aerodromes, the maximum height of such buildings shall be decided in consultation with the Airports Authority of India who shall be responsible for issuing the no objection certificate. This shall be in accordance with the concerned notification of the Ministry of Civil Aviation, Govt of India.

9.5.1.1 For the purpose of **9.5.1,** new buildings and structures coming up in the vicinity of an aerodrome shall be subjected to height restrictions in accordance with the subject notification.

No building or structure higher than the height specified in the subject notification shall be constructed or erected and no tree which is likely to grow or ordinarily grows

Table 5 Comparative Floor Area Ratios for Occupancies Facing One Public Street of at least 9 m Width

(*Foreword*, *Clauses* 2.26, 9.2 *and* 9.2.1)

Sl No.	Occupancy Classification	Type of Construction			
		Type 1	Type 2	Type 3	Type 4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Residential	UL	2.0	1.4	1.0
ii)	Educational	UL	2.0	1.4	1.0
iii)	Institutional	UL	1.5	1.0	0.8
iv)	Assembly	UL	1.0	0.7	0.5
v)	Business	UL	2.9	2.3	1.6
vi)	Mercantile	8.0	1.8	1.4	1.0
vii)	Industrial	7.5	1.9	1.6	1.3
viii)	Storage (*see* Note 4)	6.0	1.5	1.3	1.0
ix)	Hazardous (*see* Note 4)	2.8	1.1	0.9	NP

UL – Unlimited.

NP – Not Permitted.

NOTES

1 This table has been prepared, taking into account the combustible content in the different occupancies as well as the fire resistance offered by the type of construction (*see* Part 4 'Fire and Life Safety' of the Code).

2 This table shall be modified by the Authority, taking into account the other aspects as given below (*see* **9.1**):

a) Density in terms of dwelling units/hectare;
b) Traffic considerations;
c) Parking spaces;
d) Local fire fighting facilities; and
e) Water supply, drainage and sanitation requirements.

3 The FAR specified may be increased by 20 percent for the following:

a) A basement or cellar and space under a building constructed on stilts and used as a parking space, and air conditioning plant room used as accessory to the principal use;
b) Electric cabin or substation watchman's booth of maximum size of 1.6 m^2 with minimum width or diameter of 1.2 m, pump house, garbage shaft, space required for location of fire hydrants, electric fittings and water tank;
c) Projections and accessory buildings as specifically exempted (*see* **8.4.1**); and
d) Staircase room and lift rooms above the topmost storey, architectural features; and chimneys and elevated tanks of dimensions as permissible under the Code; the area of the lift shaft shall be taken only on one floor.

4 In so far as single storey storage and hazardous occupancies are concerned, they would be further governed by volume to plot area ratio (VPR), to be decided by the Authority.

higher than the height specified in the subject notification shall be planted on any land within the specified radius from the aerodrome reference point, as given in the notification.

9.5.1.2 In the case of buildings or structures to be erected in the vicinity of defence aerodromes, the maximum height of such buildings shall be decided by the Defence Authority.

9.5.2 The location of slaughter house/butcher house and other areas for activities like depositing of garbage dumps which would attract high flying birds like eagles/ hawks, etc, shall not be permitted within a radius of 10 km from aerodrome reference point.

9.6 Group Housing

9.6.1 Group housing development may be in low rise house clusters or high rise multi-storeyed apartments for high density development.

9.6.2 No limit to floors and height shall be applicable, but the coverage and floor area ratio for various densities may be as given in Table 6 unless provided otherwise in the Master Plan and local development control rules.

9.6.3 The minimum size of the site for group housing multi-storeyed apartment shall be 3 000 m^2.

9.6.3.1 The number of dwelling units are calculated on the basis of the density pattern given in the Development Plan taking into consideration a population of 4.5 persons per dwelling unit.

9.6.3.2 The basement may vary between 33.33 and 50 percent of the plot area and is to be used for parking, servicing and for essential household storage without counting in FAR.

9.6.3.3 Parking space shall be provided in accordance with **10**. Designated accessible parking spaces shall be provided in accordance with **B-3**.

9.6.4 With a view to providing adequate parking for occupancies and the vehicular load, appropriate off-street parking provisions have to be made in the

Table 6 Floor Area Ratio and Coverage for Group Housing

(*Clause* 9.6.2)

Sl No.	Net Residential Density Dwelling Units/Hectare	Maximum Coverage Percent	Floor Area Ratio
(1)	(2)	(3)	(4)
i)	25	25	0.50
ii)	50	30	0.75
iii)	75	33	0.90
iv)	100	35	1.00
v)	125	35	1.25
vi)	150	35	1.50
vii)	175	35	1.75
viii)	200	35	2.00
ix)	225	35	2.25
x)	250	35	2.50
xi)	275	35	2.75
xii)	300	35	3.00
xiii)	325	35	3.25
xiv)	350	35	3.50
xv)	375	35	3.75
xvi)	400	35	4.00

NOTE — The coverage shall be calculated on the basis of the whole area reserved for group housing.

building/on-site. This can also be permitted in basement areas (*see* **12.9**) and in podium (*see* **4.6.1**) and the footprint for the basement parking may exceed the ground coverage of the building subject to no basement building construction to cross the building line and all other safety features for structural, fire, health and public safety being ensured (*see also* **12.9.2.2** and Fig. 11).

10 OFF-STREET PARKING SPACES

10.1 The off-street parking (on-site parking) spaces in a plot to be provided shall be in accordance with Annex A. The spaces given in Annex A shall be considered by the Authority in conjunction with the Development Rules, in force, if any.

10.2 The spaces to be left out for off-street parking as given in **10.3** to **10.6** shall be in addition to the open spaces left out for lighting and ventilation purposes as given in **20**.

10.2.1 Further 50 percent of the open spaces required around buildings under **8** may be allowed to be utilized for parking or loading or unloading spaces, provided a minimum distance of 3.6 m around the building is kept free from any parking, loading or unloading spaces subject to the provisions of Part 4 'Fire and Life Safety' of the Code.

10.3 Each off-street parking space provided for vehicles shall be as follows:

a) For car, the minimum parking space to be 3 m × 6 m when individual parking space is required and 2.75 m × 5 m when common parking space is required.

b) Space for scooter/two wheeler and bicycle to be not less than 1.25 m^2 and 1.00 m^2, respectively.

c) Area for each equivalent car space inclusive of circulation area is 23 m^2 for open parking, 28 m^2 for ground floor covered parking and 32 m^2 for basement.

10.4 For buildings of different occupancies, off-street parking space for vehicles shall be provided as stipulated below:

a) *Motor vehicles* — Space shall be provided as specified in Annex A for parking motor vehicles (cars).

b) *Other types of vehicles* — For non-residential building, in addition to the parking areas provided in (a) above, 25 to 50 percent additional parking space shall be provided for parking other types of vehicles and the additional spaces required for other vehicles shall be as decided by the Authority, keeping in view the nature of traffic generated in the city.

For residential occupancy, space for motorcycle/scooter/cycle/two-wheeler shall be provided at the rate of one for each tenement.

10.5 Off-street parking space shall be provided with adequate vehicular access to a street; and the area of drives, aisles and such other provisions required for adequate manoeuvering of vehicle shall be exclusive of the parking space stipulated in these provisions.

10.6 If the total parking space required by these provisions is provided by a group of property owners for their mutual benefits, such use of this space may be construed as meeting the off-street parking requirements under these provisions, subject to the approval of the Authority.

10.7 In buildings of mercantile (commercial), industrial and storage type, in addition to the parking spaces provided, a space at the rate of 3.5 m × 7.5 m, shall be provided for loading and unloading activities, for each 1 000 m^2 of floor area or fraction thereof.

10.8 Parking spaces shall be paved and clearly marked for different types of vehicles.

10.9 Apart from parking at ground level, provision of underground or multi-storeyed parking or podium parking may be permitted. The parking of vehicles at different level may also be mechanized. In the case of parking spaces provided in basement(s), at least two ramps of width and slope as per **4.6.1.3** shall be

provided, located preferably at opposite ends. In case of underground/multi-storeyed parking, special measures with regard to fire safety shall be taken (*see* Part 4 'Fire and Life Safety' of the Code).

10.10 Designated accessible parking spaces shall be provided in accordance with **B-3** for the occupancies specified in **13**.

11 GREENBELTS, LANDSCAPING AND WATER CONSERVATION

11.1 General

Greenbelts and landscaping including plantation of shrubs and trees help to certain extent in enhancing the environmental quality.

11.1.1 Planting of trees in streets and in open spaces should be done carefully to take advantage of both shades and sunshine without obstructing the flow of wind circulation and sight. Their advantage for abating glare and for providing cool and/or warm pockets in developed areas should also be taken.

11.2 Norms for Planting of Shrubs and Trees

11.2.1 Suitable provisions may be made for greeneries including plantation of shrubs and trees as a part of environmental protection in general. This aspect shall be taken care of from the initial stage of town and country planning, zoning and planning of development of particular area and group housing. Finally, this aspect shall also be taken into account in planning individual building of different occupancies.

11.2.2 The types of plants, the distance between trees/ plants from the building and the distance between plants shall be carefully worked out keeping in view the structural safety and aesthetic requirements of buildings.

11.3 Trees shall be numbered area-wise, plot-wise and road-wise by the concerned authority and they shall be checked periodically.

11.4 Cutting and pruning of trees in public as well as private areas shall be suitably regulated. Trees shall be cut only after obtaining the permission of the Authority designated for this purpose.

11.5 The landscape planning and design shall be done in accordance with Part 10 'Landscape Development, Signs and Outdoor Display Structures, Section 1 Landscape Planning, Design and Development' of the Code.

11.6 Water Conservation and Augmentation

In view of critical shortage of water, conservation of water by rain water harvesting and by use of recycled water to the maximum extent possible is required. In this regard the provisions given in **11.6.1** to **11.6.5** may be adopted.

11.6.1 The local authority preparing a town-planning scheme or a development plan should see that the local water bodies are preserved, and if dry, are activated by directing water-courses appropriately. If required, the same should be enlarged, deepened, etc.

11.6.2 The water body should be protected by ensuring that no permanent/temporary construction/development takes place around it up to a distance of 50 m from the edge of the water body and the same shall be suitably landscaped. Further, the public shall have easy access to the water body.

11.6.3 The rain water run off shall be suitably directed to recharging wells in plots belonging to the local authority and of appropriate design. The local authority should encourage for collection of rain-water from roofs and terraces and direct the same either to a storage tank or to a recharging well. These shall be done in accordance with Part 9 'Plumbing Services (including Solid Waste Management), Section 2 Drainage and Sanitation' of the Code.

11.6.4 Buildings having central air conditioning plants requiring water for cooling purposes may not be allowed to use fresh water for the purpose.

11.6.5 Commercial or residential multi-storeyed complexes may use recycled water for flushing of toilets, horticulture and fire fighting purposes. Separate storage tanks and separate distribution pipes shall be provided for the purpose.

12 REQUIREMENTS OF PARTS OF BUILDINGS

The requirements for various parts of buildings shall be in accordance with **12.1** to **12.9**. The requirements as given in **13**, for public buildings and sites as accessible and barrier free for elders and persons with disabilities, shall also be complied with.

12.1 Plinth

12.1.1*Main Buildings*

The plinth or any part of a building or outhouse shall be so located with respect to the surrounding ground level that adequate drainage of the site is assured. The height of the plinth shall be not less than 450 mm from the surrounding ground level.

12.1.2 *Interior Courtyards and Covered Parking*

Every interior courtyard shall be raised at least 150 mm above the determining ground level and shall be satisfactorily drained.

12.2 Habitable Rooms

12.2.1 *Height*

The height of all rooms for human habitation shall not be less than 2.75 m measured from the surface of

the floor to the lowest point of the ceiling (bottom of slab). In the case of pitched roof, the average height of rooms shall not be less than 2.75 m. The minimum clear head room under a beam, folded plates or eaves shall be 2.4 m. In the case of air conditioned rooms, a height of not less than 2.4 m measured from the surface of the floor to the lowest point of air conditioning duct or the false ceiling shall be provided.

12.2.1.1 The requirements of **12.2.1** apply to residential, business and mercantile buildings. For educational and industrial buildings, the following minimum requirements apply :

a) Educational buildings : Ceiling height 3.6 m for all regions; in cold regions, 3 m

b) Industrial buildings : Ceiling height 3.6 m, conditioned, 3 m (*Factory Act*, 1948 and rules therein shall govern such heights, where applicable)

12.2.2 *Size*

The area of habitable room shall not be less than 9.5 m^2, where there is only one room with a minimum width of 2.4 m. Where there are two rooms, one of these shall not be less than 9.5 m^2 and the other not less than 7.5 m^2, with a minimum width of 2.1 m.

12.3 Kitchen

12.3.1 *Height*

The height of a kitchen measured from the surface of the floor to the lowest point in the ceiling (bottom slab) shall not be less than 2.75 m, except for the portion to accommodate floor trap of the upper floor.

12.3.2 *Size*

The area of a kitchen where separate dining area is provided, shall be not less than 5.0 m^2 with a minimum width of 1.8 m. Where there is a separate store, the area of the kitchen may be reduced to 4.5 m^2. A kitchen, which is intended for use as a dining area also, shall have a floor area of not less than 7.5 m^2 with a minimum width of 2.1 m.

12.3.3 *Other Requirements*

Every room to be used as kitchen shall have,

a) unless separately provided in a pantry, means for the washing of kitchen utensils which shall lead directly or through a sink to a grated and trapped connection to the waste pipe;

b) an impermeable floor;

c) a flue, if found necessary; and

d) a window or ventilator or opening of size not less than as specified in **20.1.1** subject to increase in area of opening in accordance with **20.1.2** (Note 3).

12.4 Bathrooms and Water-Closets

12.4.1 *Height*

The height of a bathroom or water-closet measured from the surface of the floor to the lowest point in the ceiling (bottom of slab) shall not be less than 2.1 m.

12.4.2 *Size*

The area of a bathroom shall not be less than 1.8 m^2 with a minimum width of 1.2 m. The floor area of water-closet shall be 1.1 m^2 with a minimum width of 0.9 m. If bath and water-closet are combined, its floor area shall not be less than 2.8 m^2 with a minimum width of 1.2 m.

12.4.3 *Other Requirements*

Every bathroom or water-closet shall,

a) be so situated that at least one of its walls shall open to external air;

b) not be directly over or under any room other than another water-closet, washing place, bath or terrace, unless it has a water-tight floor;

c) have the platform or seat made of water-tight non-absorbent material;

d) be enclosed by walls or partitions and the surface of every such wall or partition shall be finished with a smooth impervious material to a height of not less than 1 m above the floor of such a room;

e) be provided with an impervious floor covering, sloping towards the drain with a suitable grade and not towards *Verandah* or any other room; and

f) have a window or ventilator, opening to a shaft or open space, of area not less than 0.3 m^2 with side not less than 0.3 m.

12.4.4 No room containing water-closets shall be used for any purpose except as a lavatory and no such room shall open directly into any kitchen or cooking space by a door, window or other opening. Every room containing water-closet shall have a door completely closing the entrance to it.

12.5 Ledge or Tand/Loft

12.5.1 *Height*

The minimum head-room of ledge or *Tand*/loft shall be 2.2 m. The maximum height of loft shall be 1.5 m.

12.5.2 *Size*

A ledge or *TAND*/loft in a habitable room shall not cover more than 25 percent of the area of the floor on which it is constructed and shall not interfere with the ventilation of the room under any circumstances.

12.6 Mezzanine Floor

12.6.1 *Height*

It shall have a minimum height of 2.2 m.

12.6.2 *Size*

The minimum size of the mezzanine floor, if it is to be used as a living room, shall not be less than 9.5 m^2. The aggregate area of such mezzanine floor in a building shall in no case exceed one-third the plinth area of the building.

12.6.3 *Other Requirements*

A mezzanine floor may be permitted over a room or a compartment, provided,

a) it conform to the standard of living rooms as regards lighting and ventilation in case the size of mezzanine floor is 9.5 m^2 or more (*see* **20.1.2**);
b) it is so constructed as not to interfere under any circumstances with the ventilation of the space over and under it;
c) such mezzanine floor is not subdivided into smaller compartments;
d) such mezzanine floor or any part of it shall not be used as a kitchen; and
e) in no case shall a mezzanine floor be closed so as to make it liable to be converted into unventilated compartments.

12.7 Store Room

12.7.1 *Height*

The height of a store room shall be not less than 2.2 m.

12.7.2 *Size*

The size of a store room, where provided in a residential building, shall be not less than 3 m^2.

12.8 Garage

12.8.1 *Height*

The height of a garage shall be not less than 2.4 m.

12.8.2 *Size*

The size of garages shall be as below:

a) *Private garage* — 3.0 m × 6.0 m, minimum; and
b) *Public garage* — Based on the number of vehicles parked, etc (*see* **10**).

12.9 Basement

12.9.1 The basement shall not be used for residential purposes.

12.9.2 The construction of the basement shall be allowed by the Authority in accordance with the land use and other provisions specified under the Development Control Rules.

12.9.2.1 The following uses shall be permitted in the basements:

a) Storage of household or other goods of ordinarily non-combustible material;
b) Strong rooms, bank cellars, etc;
c) Air conditioning equipment and other machines used for services and utilities of the building; and
d) Parking spaces.

The Authority may also consider permitting mercantile occupancy as well as institutional occupancy for medical, health care services involving radiation facilities in the first basement subject to compliance of all requirements for fire safety in accordance with Part 4 'Fire and Life Safety' of the Code and necessary measures for required lighting, ventilation and water supply, drainage and sanitation.

12.9.2.2 The basements can be permitted below the ground and beyond the building lines at ground level subject to a clear minimum front margin of 4.5 m and side and rear margins of 3 m, and further subject to non-habitable uses and provision for mechanical ventilation and all safety provisions and drainage (*see* Fig. 11). However, it is essential that the basement top slab below the external circulation at ground level should be designed for fire fighting vehicular loads as given in **4.6**.

12.9.3 The basement shall have the following requirements:

a) Every basement shall be in every part at least 2.4 m in height from the floor to the underside of the roof slab or ceiling;
b) Adequate ventilation shall be provided for the basement. The ventilation requirements shall be the same as required by the particular occupancy according to byelaws. Any deficiency may be met by providing adequate mechanical ventilation in the form of blowers, exhaust fans, air conditioning systems, etc;
c) The height of the ceiling of any basement shall be minimum 0.9 m and the maximum, 1.2 m above the average surrounding ground level. However, in case of parking, mercantile or business occupancy at ground floor, minimum height of the ceiling of the basement may

be 0.3 m above the average surrounding ground level subject to mechanical ventilation being provided (*see* Fig. 11);

d) Adequate arrangements shall be made such that surface drainage does not enter the basement;

e) The walls and floors of the basement shall be watertight and be so designed that the effects of the surrounding soil and moisture, if any, are taken into account in design and adequate damp proofing treatment is given;

f) The access to the basement shall be separate from the main and alternative staircase providing access and exit from higher floors. Where the staircase is continuous in the case of buildings served by more than one staircase, the same shall be of enclosed type serving as a fire separation from the basement floor and higher floors. Open ramps shall be permitted if they are constructed within the building line subject to the provision of (d);

g) Access to basements through ramps shall be permitted subject to provision of (d). The requirements for the ramps shall be in accordance with **4.6.1.3** [*see also* Fig. 8 (b)];

h) For all public buildings and uses including group housing, having basement going up to more than one level, access to all levels shall also be provided through lift.

The exit requirements in basements shall comply with the provisions of Part 4 'Fire and Life Safety' of the Code.

12.10 Chimneys

The chimneys shall be built at least 0.9 m above flat roofs, provided the top of the chimneys is not below the top of the adjacent parapet wall. In the case of sloping roofs, the chimney top shall not be less than 0.6 m above the ridge of the roof in which the chimney penetrates.

12.11 Parapet

Parapet walls and handrails provided on the edges of roof terraces, balcony, *Verandah*, etc, shall not be less than 1.0 m and not more than 1.2 m in height from the finished floor level.

12.12 Cabin

The size of cabins shall not be less than 3.0 m^2 with a minimum width of 1.0 m. The clear passages within the divided space of any floor shall not be less than 0.75 m and the distance from the farthest space in a cabin to any exit shall not be more than 18.5 m. In case the subdivided cabin does not derive direct lighting and ventilation from any open spaces/ mechanical means, the maximum height of the cabin shall be 2.2 m.

12.13 Boundary Wall

The requirements of the boundary wall are given below:

a) Except with the special permission of the Authority, the maximum height of the compound wall shall be 1.5 m above the centre line of the front street. Compound wall up to 2.4 m height may be permitted if the top 0.9 m is of open type construction of a design to be approved by the Authority.

b) In the case of a corner plot, the height of the boundary wall shall be restricted to 0.75 m for a length of 10 m on the front and side of the intersections and the balance height of 0.75 m, if required in accordance with (a) may be made up of open type construction (through railings) and of design to be approved by the Authority.

c) However, the provisions of (a) and (b) are not applicable to boundary walls of jails. In industrial buildings, electric substations, transformer stations, institutional buildings like sanitoria, hospitals, industrial buildings like workshops, factories and educational buildings like schools, colleges, including hostels, and other uses of public utility undertakings and strategically sensitive buildings, a height up to 2.4 m may be permitted by the Authority.

12.14 Wells

Wells, intended to supply water for human consumption or domestic purposes, where provided, shall comply with the requirements of **12.14.1** and **12.14.2**.

12.14.1 *Location*

The well shall be located,

a) not less than 15 m from any ash pit, refuse pit, earth closet or privy and shall be located on a site upwards from the earth closet or privy;

b) not less than 18 m from any cess pit soakway or borehole latrine and shall be located on a site upwards from the earth closet or privy;

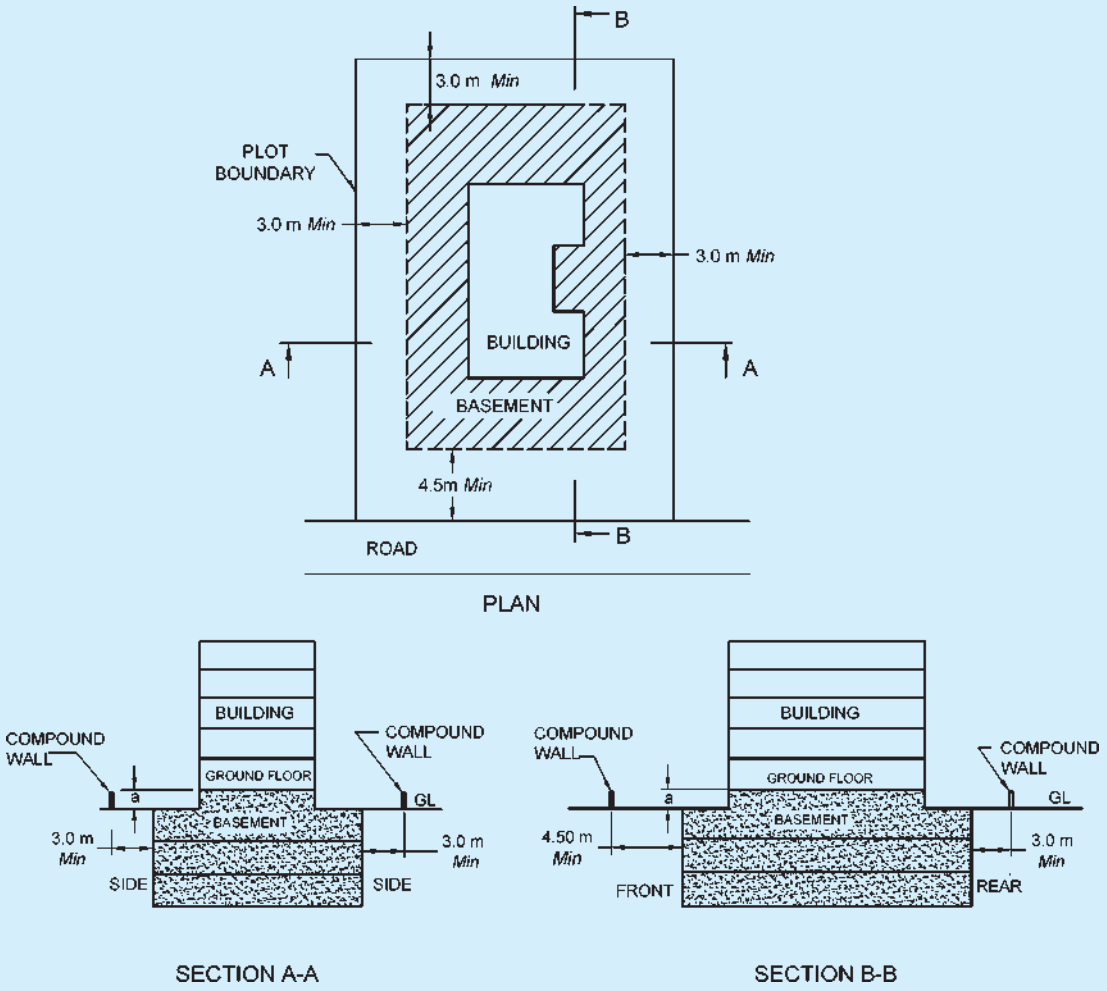
c) such that contamination by the movement of sub-soil or other water is unlikely; and

d) not under a tree or otherwise it should have a canopy over it, so that leaves and twigs may not fall into the well and rot.

12.14.2 *Requirements*

The well shall,

a) have a minimum internal diameter of not less than 1 m;



NOTE — For 'a', *see* **12.9.3** (c)

FIG. 11 BASEMENT

b) be constructed to a height not less than 1 m above the surrounding ground level, to form a parapet or kerb and to prevent surface water from flowing into a well, and shall be surrounded with a paving constructed of impervious material which shall extend for a distance of not less than 1.8 m in every direction from the parapet from the kerb forming the well head and the upper surface of such a paving shall be sloped away from the well;

c) be of sound and permanent construction (*Pucca*) throughout. Temporary or exposed (*Kutcha*) wells shall be permitted only in fields or gardens for purposes of irrigation; and

d) have the interior surface of the lining or walls of the well be rendered impervious for a depth of not less than 1.8 m measured from the level of the ground immediately adjoining the well-head.

12.15 Septic Tanks

Where a septic tank is used for sewage disposal, the location, design and construction of the septic tank shall conform to requirements of **12.15.1** and **12.15.2** [*see also* Part 9 'Plumbing Services (including Solid Waste Management), Section 2 Drainage and Sanitation' of the Code].

12.15.1 *Location of the Septic Tanks and Subsurface Absorption Systems*

A subsoil dispersion system shall not be closer than 18 m from any source of drinking water, such as well, to mitigate the possibility of bacterial pollution of water supply. It shall also be as far removed from the nearest habitable building as economically feasible but not closer than 6 m, to avoid damage to the structures.

12.15.2 *Requirements*

a) *Dimensions of septic tanks* — Septic tanks shall have a minimum width of 750 mm, a minimum depth of 1 m below the water level and a minimum liquid capacity of 1 m^3. The length of tanks shall be 2 to 4 times the width;

b) Septic tanks may be constructed of brickwork, stone masonry, concrete or other suitable materials as approved by the Authority;

c) Under no circumstances shall effluent from a septic tank be allowed into an open channel drain or body of water without adequate treatment;

d) The minimum nominal diameter of the pipe shall be 100 mm. Further, at junctions of pipes in manholes, direction of flow from a branch connection shall not make an angle exceeding 45° with the direction of flow in the main pipe;

e) The gradients of land drains, under-drainage as well as the bottom of dispersion trenches and soakways shall be between 1:300 and 1:400;

f) Every septic tank shall be provided with ventilating pipe of at least 50 mm diameter. The top of the pipe shall be provided with a suitable cage of mosquito-proof wire mesh.

The ventilating pipe shall extend to a height which would cause no smell nuisance to any building in the area. Generally, the ventilating pipe may extend to a height of about 2 m, when the septic tank is at least 15 m away from the nearest building and to a height of 2 m above the top of the building when it is located closer than 15 m;

g) When the disposal of septic tank effluent is to a seepage pit, the seepage pit may be of any suitable shape with the least cross-sectional dimension of 0.90 m and not less than 1.00 m in depth below the invert level of the inlet pipe. The pit may be lined with stone, brick or concrete blocks with dry open joints which should be backed with at least 75 mm of clean coarse aggregate. The lining above the inlet level should be finished with mortar. In the case of pits of large dimensions, the top portion may be narrowed to reduce the size of the RCC cover slabs. Where no lining is used, specially near trees, the entire pit should be filled with loose stones. A masonry ring may be constructed at the top of the pit to prevent damage by flooding of the pit by surface runoff. The inlet pipe may be taken down a depth of 0.90 m from the top as an anti-mosquito measure; and

h) When the disposal of the septic tank effluent is to a dispersion trench, the dispersion trench shall be 0.50 m to 1.00 m deep and 0.30 m to 1.00 m wide excavated to a slight gradient and shall be provided with 150 mm to 250 mm of washed gravel or crushed stones. Open jointed pipes placed inside the trench shall be made of unglazed earthenware clay or concrete and shall have a minimum internal diameter of 75 mm to 100 mm. Each dispersion trench shall not be longer than 30 m and trenches shall not be placed closer than 1.8 m.

12.16 Office-Cum-Letter Box Room

In the case of multi-storeyed multifamily dwelling apartments constructed by existing and proposed Cooperative Housing Societies or Apartment Owners Associations, limited companies and proposed societies, an office-cum-letter box room of dimension 3.6 m × 3 m shall be provided on the ground floor. In case the number of flats is more than 20, the maximum size of the office-cum-letter box room shall be 20 m^2.

12.16.1 *Business Buildings*

Provision shall be made for letter boxes on the entrance floor as per the requirements of the postal department.

12.17 Meter Rooms

For all buildings above 15 m in height and in special occupancies, like educational, assembly, institutional, industrial, storage, hazardous and mixed occupancies with any of the aforesaid occupancies having area more than 500 m^2 on each floor, provision shall be made for an independent and ventilated meter (service) room, as per requirements of electric (service) supply undertakings on the ground floor with direct access from outside for the purpose of termination of electric supply from the licensee's service and alternative supply cables. The door/doors provided for the service room shall have fire resistance of not less than two hours.

12.18 Staircase/Exit Requirements

12.18.1 The minimum width, minimum tread width and maximum riser of staircases for buildings shall be as given in **12.18.1.1** to **12.18.1.3** (*see also* Part 4 'Fire and Life Safety' of the Code).

12.18.1.1 *Minimum clear width*

The following minimum width shall be provided for staircases for respective occupancies (*see* **7.1** and Part 4 'Fire and Life Safety' of the Code for classification of buildings based on occupancy):

a)	Residential (A-2) NOTE — For row housing with 2 storeys, the minimum width shall be 0.75 m.	: 1.00 m
b)	Residential (A-1, A-3 and A-4)	: 1.25 m
c)	Residential hotel (A-5 and A-6)	: 1.50 m
d)	Assembly NOTE — The width of stairs may be accepted to be 1.50 m in case of assembly occupancy having less than 150 persons	: 2.00 m
e)	Educational	: 1.50 m
f)	Institutional	: 2.00 m
g)	All other occupancies	: 1.50 m

12.18.1.2 *Minimum tread*

The minimum width of tread without nosing shall be 300 mm. However, for one or two family dwelling, it may be reduced to not less than 250 mm.

12.18.1.3 *Maximum riser*

The maximum height of riser shall be 150 mm. However, for one or two family dwelling, it may be increased to not more than 190 mm.The number of risers shall be limited to 12 per flight.

12.18.2 The minimum head-room in a passage under the landing of a staircase shall be 2.2 m. The minimum clear head-room in any staircase shall be 2.2 m.

12.18.3 *Exit Requirements*

All aspects of exit requirements for corridors, doors, staircases, ramps, etc, in respect of widths, travel distance shall be as per Part 4 'Fire and Life Safety' of the Code.

12.19 Roofs

12.19.1 The roof of a building shall be so designed and constructed as to effectively drain water by means of sufficient rain water pipes of adequate size, wherever required, so arranged, jointed and fixed as to ensure that the rain water is carried away from the building without causing dampness in any part of the walls, roof or foundations of the building or an adjacent building.

12.19.2 The Authority may require rain water pipes to be connected to a drain or sewer to a covered channel formed beneath the public footpath to connect the rain-water pipe to the road gutter or in any other approved manner.

12.19.3 Rain-water pipes shall be affixed to the outside of the external walls of the building or in recesses or chases cut or formed in such external walls or in such other manner as may be approved by the Authority.

12.19.4 It is desirable to conserve rain water using suitable rain water harvesting techniques including by roof water collection. In this context, reference shall be made to Part 9 'Plumbing Services (including Solid Waste Management), Section 2 Drainage and Sanitation' of the Code.

13 REQUIREMENTS FOR ACCESSIBILITY IN BUILT ENVIRONMENT FOR ELDERS AND PERSONS WITH DISABILITIES

13.1 General

13.1.1 These requirements deal with barrier free access to, movement within and around buildings, by the elderly persons and persons with disabilities who may have non-ambulatory disabilities, ambulatory disabilities, sight disabilities, hearing disabilities, disabilities of inco-ordination, ageing, allergies, heart and lung diseases, epilepsy, haemophilia, incontinence, enterostomy, etc.

It is intended to make all buildings and facilities used by the public accessible to, and usable by all people including those living with disabilities and may include those with inability to walk or difficulty in walking, reliance on walking/mobility aids, blindness and visual impairments, speech and hearing impairments, in-coordination of motor movements, reaching and manipulation, lack of stamina, difficulty in interpretation and reacting to sensory information and extremes in physical sizes. It supplements the general requirements of this Part of the Code, and reflects greater concern for safety of life and limb of every resident irrespective of age, gender or abilities.

13.1.2 These requirements apply to all buildings and facilities open to and used by the public. These shall also apply to all forms of public housing by the government/civic bodies or private developers. It does not apply to private residences. For extent of application of requirements covered under **13** to different building occupancy types, reference shall be made to **13.5**.

13.1.3 The reference to the accessibility needs of persons with disabilities, made in this Part shall also mean a reference to such needs of the elderly persons, children and persons of too short stature in so far as the concerned provision is applicable to the type of disabilities that may be associated therewith.

13.2 For the purpose of this clause, the following definitions shall apply.

13.2.1 *Ability* — identifiable human attribute, including but not exclusively, to walk, to speak, to hear, to see, to feel by touch, to taste, to understand, and to recognize.

13.2.2 *Access Aisle* — An accessible pedestrian space between elements, such as parking spaces, seating and desks, that provides clearances appropriate for use of the elements

13.2.3 *Accessible Site, Building, Facility or Portions* — A site, building, facility, or portions thereof that complies with the requirements given in this clause to

which people, regardless of their disability, age or gender are able to gain access to, in to them, to use them and exit from them with dignity.

NOTE — Accessibility includes ease of independent approach, entry, evacuation and/or use of a building and its services and facilities, by all of the building's potential users with an assurance of individual health, safety and welfare during the course of those activities.

13.2.4 *Accessible Route* — A continuous unobstructed path connecting all accessible elements and spaces in a building or facility that may be negotiated by a person with disabilitiy using a wheelchair and that is also safe for and usable by persons with other disabilities. Interior accessible routes may include corridors, ramps, elevators, lifts, and clear floor space at fixtures. Exterior accessible routes may include parking, access aisles, kerb ramps, walkways, pathways, footpaths/sidewalks, and ramps.

13.2.5 *Accessible Toilet* — A compartment having the basic requirements of minimum clear spaces, water-closet, washbasin and other essential washroom accessories as required by people with non-ambulatory disabilities. There are also toilets for ambulant disabled which provide accessibility for convenient use by persons with ambulatory disabilities.

13.2.6 *Ageing* — Those manifestations of the ageing processes that significantly reduce mobility, flexibility, coordination, and perceptiveness but are not accounted for in disability categories mentioned elsewhere in this Part.

13.2.7 *Area of Rescue Assistance* — Building space directly adjoining, and visible from, a main vertical evacuation route, robustly and reliably protected from heat, smoke and flame during and after a fire, where people can temporarily wait with confidence for further information, instructions, and/or rescue assistance, without obstructing or interfering with the evacuation travel of other building users

NOTE — 'Robust' means structurally hardened and resistant to mechanical damage during the fire and for a period of time afterwards, that is, the cooling phase.

13.2.8 *Assistive Product/Device* — Product/device especially produced or generally available, for preventing, compensating for, monitoring, relieving or neutralizing impairments, activity limitations and participation restrictions.

13.2.9 *Assisted Evacuation* — Strategy that exists during which a designated person or persons provide assistance, during an emergency, to another person to leave a building or a specific part of the built environment and to reach a final place of safety.

13.2.10 *Automatic Door* — A door equipped with a power operated mechanism and controls that open and close the door automatically upon receipt of a momentary signal. The switch that begins the automatic cycle may be photoelectrical device, floor mat, sensing device, or manual switch mounted on or near the door itself.

13.2.11 *Circulation Path* — An exterior or interior way of passage from one place to another for pedestrians, including walkways, pathways, hallways, courtyards, stairways and stair landings.

13.2.12 *Circulation Space* — Unobstructed space necessary for access to, into and within and egress from any part of the built environment.

13.2.13 *Clear* — Unobstructed.

13.2.14 *Colour Contrast* — The difference in colour that makes an object (or its representation in an image or display) distinguishable. It is determined by the difference in the colour of the object and other objects within the same field of view. Distinguishing one form/object from another by hue is the most basic and easily understood contrast.

NOTE — The basic guidelines for making effective colour choices are based on the hue value of the colours. The most commonly used methods of achieving colour contrast incorporate either harmonizing or contrasting colour combinations. Contrast of hue is what relates most directly to the colour wheel combinations. The further away from each other two colours are, the higher the contrast. This means that the complementary colour combination has the highest contrast, while the analogous combination has the lowest.

13.2.15 *Disability* — An umbrella term for impairments, activity limitations, and participation restrictions, denoting the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors(environmental and personal factors). Disability is neither simply a biological nor a social phenomenon but arises from the relationship between health condition and context.

13.2.16 *Grab Bars* — A bar used to give a steadying or stabilizing assistance to a person engaged in a particular function.

13.2.17 *Handrails* — A rail used in circulation areas such as corridors, passageways, ramps and stairways to assist in continuous movement.

13.2.18 *Hue* — Attribute of visual sensation which has given rise to colour names, such as, blue, green, yellow, red and purple.

NOTE — People with normal colour vision report that hues follow a natural sequence based on their similarity to one another. With most colour deficits, the ability to discriminate between colours on the basis of hue is diminished.

13.2.19 *Impairment* — Limitation in body function or structure such as a significant deviation or loss which can be temporary due, for example to injury, or permanent, slight or severe and can fluctuate over time, in particular, deterioration due to ageing.

NOTE — Body function can be a physiological or psychological function of a body system; body structure refers to an anatomic part of the body such as organs, limbs and their components.

13.2.20 *International Symbol of Accessibility* — The symbol consisting of a square overlaid with a stylized image of a person using a wheelchair (*see* **B-24.2.16** and Fig. 105).

NOTE — The symbol is often provided where access has been improved, particularly for wheelchair users and other mobility impaired persons. The symbol denotes a barrier free environment, to help older people, parents with prams and travellers with luggage besides persons with disabilities. The wheelchair symbol is always facing to the right.

13.2.21 *Kerb* — A side barrier to a trafficable surface or the edge where a raised sidewalk/footpath, road median, or road shoulder meets an unraised street or other roadway.

13.2.22 *Kerb Ramp* — A short ramp cutting through a kerb or built up to it.

13.2.23 *Knurled Surface* — Roughened area, often in a crisscross pattern; used on grab bars to improve grasp and to prevent slipping.

13.2.24 *Landing* — A platform or part of a floor structure at the end of a flight of stairs or a ramp or at the entrance to a lift car.

13.2.25 *Light Reflectance Value (LRV)* — The total quantity of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source.

13.2.26 *Manoeuvring Zone* — The minimum three dimensional space within which it is feasible to complete a manoeuvre needed to gain access to a specific facility, component or fitting, in particular while using a wheelchair or a walking aid.

13.2.27 *Ramp* — The construction, in the form of an inclined plane that is steeper than or equal to 1:20 (5 percent) from the horizontal, together with any intermediate landing, that makes it possible to pass from one level to another (*see* **B-6.2**).

13.2.28 *Operable Parts* — A part of a piece of equipment or appliance used to insert or withdraw objects, or to activate, deactivate, or adjust the equipment or appliance (for example coin slot, push button, handle, etc).

13.2.29 *Persons with Disabilities* — A person with any physical, mental, intellectual or sensory impairment which in interaction with various barriers may hinder full and effective participation in society on an equal basis with others.

13.2.30 *Space* — A definable area (for example toilet room, hall, assembly area, entrance, storage, room alcove, courtyard, or lobby).

13.2.31 *Tactile* — That relating to perception using the sense of touch.

NOTE — It relates to information and interpretations derived from the sense of touch. This involves sensory transfer through physical contact of the hands or feet with other surfaces, as well as sensory transfers received by contact with non-physical elements such as pressure, wind and temperature.

13.2.32 *Tactile Ground Surface Indicators* — Indicators profiled paving surface with visual contrast criteria to enable a person with impaired sight using a long cane, underfoot or visual identification to detect a specific route (guiding pattern) or the presence of a hazard (attention pattern). These are also called tactile tiles or tactile walking surface indicators.

NOTE — These indicators which provide a distinctive surface pattern of strips and truncated domes or cones (small domes or cones that have had their tops cut off, or truncated) are used to guide/alert persons with vision impairments of their approach to facilities, streets and hazardous drop-offs. People who are blind or visually impaired are alerted of impending danger from vehicle impact or a grade change.

13.2.33 *Tactile Guiding Blocks* — Tiles of size 300 mm × 300 mm that incorporate flat topped bars 5 mm (± 0.5 mm) high, 20 mm wide and spaced 50 mm from the centre of one bar to the centre of the next, and are easily detectable underfoot by persons with visual impairments. They are used externally to guide people with visual impairments along the circulation path. They may also be used internally in large busy areas such as railway stations and airports.

13.2.34 *Tactile Warning Blocks* — Tiles of size 300 mm × 300 mm that incorporate rows of 5 mm (± 0.5 mm) high flat topped blister like domes that are easily detectable underfoot by persons with visual impairments, recognized as a sign of approaching hazards. These are placed along the approach path to unavoidable obstacles and hazards to warn persons with visual impairments of the approaching danger or level change.

13.2.35 *Tactile Signs* — Tactile signage incorporates raised text or symbols to enable touch reading by people who are blind, and touch enhancement of visual perception for people who are vision impaired.

13.2.36 *Unobstructed Width* — Free unobstructed space necessary for passage through a doorway, along a passageway, or other route element (for example stairway).

13.2.37 *Unobstructed Width, Door* — Available width for passage through a door opening, clear of all obstructions, measured when the door is opened 90°, or when a sliding or folding door is opened to its fullest extent

13.2.38 *Unisex Accessible Toilet* — Accessible toilets that can be used by both sexes.

NOTE — Unisex accessible toilets allow the greatest flexibility for people who require assistance.

13.2.39 *Universal Design* — The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

13.2.40 *Visual Contrast* — Visual perception between one element of a building and another. This can be produced by a difference in light reflectance value (LRV) or luminance, also called luminance contrast.

NOTE — Light reflectance value is measured on a scale of 0 to 100 where 0 equals black meaning total light absorption and 100 equals white meaning total light reflection.

A simple formula for visual contrast is given below for guidance:

Visual contrast = $[(B1 - B2)/B1] \times 100$, in percent

where

$B1$ = LRV of the lighter area; and

$B2$ = LRV of the darker area.

In most circumstances, a difference in these values of 30 percent is considered adequate. However, research suggests that signs are more legible for the visually impaired when characters contrast with their background by at least 70 percent.

13.2.41 *Walks (Walkways)* — A predetermined prepared surface, exterior pathway leading to or from a building or facility, or from one exterior area to another, placed on the existing ground level and not deviating from the level of the existing ground immediately adjacent.

13.2.42 *Way Finding* — Descriptive of a system whereby appropriate information is provided to assist a person to pass through the built environment towards a specific destination.

NOTE — Way finding includes orienting oneself, knowing one's destination, following the best route, recognizing one's destination and finding one's way back out. People who are blind or who have a vision impairment benefit from tactile information to facilitate way finding.

13.2.43 *Wheelchair User* — A person who relies on a wheelchair for mobility.

13.2.44 *Water-Closet Compartment/Toilet Cubicle* — A compartment having a water-closet with grab bars installed to assist persons with physical disabilities/ mobility impairments.

13.2.45 *White Cane* — A long rod-like device used by blind or visually impaired travellers to give them information about the environment they are travelling through.

13.3 General Design Considerations

13.3.1 These requirements relate to the principal human abilities that should be considered when designing, constructing and managing the built environment. Some of these abilities are described in **B-1** which gives an overview of concerned design considerations that should be taken into account.

13.3.2 *Design Aspects According to Human Abilities*

Understanding of the human abilities or limitation thereof as described below, and design aspects according to the same, when fully implemented, are expected to benefit all people:

a) *Non-ambulatory disabilities* — Impairments that, regardless of cause or manifestation, for all practical purposes, make an individual a wheelchair user for his mobility. The requirement of non-ambulatory disabilities relates primarily to the design of buildings, so as to meet their independent mobility needs while sitting in the wheelchair with or without assistance, minimum widths and heights, level changes and signage, etc.

b) *Ambulatory disabilities* — Impairments that cause individuals to walk with difficulty or insecurity of balance. Such persons are able to walk on level, either with or without personal assistance, and may depend on prostheses (artificial limbs), orthoses (calipers), sticks, crutches or walking aids or may negotiate suitably graded steps provided that convenient handrails are available. For example elders using walking sticks, ladies in advance stage of pregnancy, temporary disabilities, such as, fracture, individuals using braces or crutches, amputees, persons having arthritis, those with spasticity and those with pulmonary and cardiac ills, etc, may be ambulatory disabled.

c) *Sight disabilities* — Total blindness or impairments affecting sight to the extent that the individual may have to use his other sensory organs such as sense of touch and hearing, use assistive devices for orientation in the environment, such as white cane. Accordingly, building design needs to take in to account means, such as, tactile, Braille and audio-visual, and colour contrasting signage.

d) *Hearing disabilities* — Deafness or hearing impairment may affect an individual's verbal communication or ability to hear warning signals in the environment. The buildings needs to be designed to provide more visual signage, induction loops for hearing enhancement, emergency audio-visual sirens, etc.

e) *Disabilities of incoordination* — Incoordination of motor movements due to cerebral palsy, spinal injury or peripheral nerve injury.

f) *People with allergies* — People with allergies may be sensitive to dust, mildew, pollen, animal hair, formalin, turpentine, etc. Some are sensitive to contact with substances and materials such as nickel, chromium and rubber.

g) *People with heart and lung diseases* — People with heart and lung diseases may only be able to walk short distances and may be unable to climb stairs. The requirements of these people are similar to those with impaired mobility.

h) *People with epilepsy, haemophilia, etc* — The requirements of those with epilepsy, heamophilia, etc, are related primarily to the design of buildings and the need to minimize the risk of injury caused by falling or encountering obstacles.

j) *People with incontinence, enterostomy operations, etc* — The requirements of people with incontinence, enterostomy operations, etc, (colostomies, ileostomies and urostomies) are mainly related to bathroom provision. In certain circumstances, for example in public water-closet compartments, it may be desirable to provide a special sink for emptying urine bags.

k) *People with hidden (such as strength, stamina, dexterity and allergy) impairments*, and

m) *People with diversities in age and stature* (including frail persons).

13.3.3 *Key Accessibility Issues*

Entering, using and evacuating buildings should be safe and easy for individuals, families and groups which include persons with disabilities. The main considerations are as follows:

1) Pedestrian access into site;
2) Designated vehicular parking near the main entrance;
3) Accessible path to the entrance;
4) Appropriate external lighting;
5) Accessible external furniture (seats, bins, etc);
6) Accessible information at the entrance to the site;
7) Suitable drop-off point near main entrance;
8) Reduced travelling distances;
9) Level entrances and exits;
10) Simple and logical layouts;
11) Unobstructed level circulation;
12) Easy access to information desks, lifts and toilet compartments for disabled persons;
13) Intuitive, obvious and accessible means of egress;
14) Spacious lifts;
15) Safe stairs that are easy to use, and facilitate safe assisted evacuation/rescue in emergencies;
16) Slip-resistant walking surfaces;
17) Wide door openings and easy door operation, sufficient space around doors that makes it possible to open and close them when seated in a wheelchair;
18) Adequate manoeuvring space;
19) Adequate height, location and easy operation of controls and switches;
20) Good lighting;
21) Good visual contrast of walls, floors, doors and signage;
22) Good signage;
23) Important information communicated *via* two senses or more (tactile, audible and visual);
24) Good acoustics;
25) Hearing enhancement systems; and
26) Management and maintenance of the built environment.

The key accessibility issues are highlighted in Table 7.

13.4 Various key accessibility issues shall be taken into account for ensuring accessibility in built environment in accordance with the provisions given in Annex B in regard to anthropometrics and specific requirements on site planning and development, designated accessible parking space, approach to the buildings, access at entrance and within the buildings, controls and operating mechanisms, seating spaces, other facilities, level changes, toilet and sanitary facilities, emergency evacuation in buildings, signages, etc. Requirements for accessibility in buildings and built environment as given in other Parts/Sections of the Code shall also be complied with.

13.5 Various accessibility requirements for persons with disabilities and the elderly shall be applied to different building occupancies in accordance with Table 8, unless mentioned otherwise specifically in Annex B. In addition, all building occupancy types shall comply with the following:

a) At least one entrance preferably the main entrance per building shall be accessible. All efforts should be made to make as many/all entrances accessible.

b) All common areas open to public and staff and all facilities provided in a building for

Table 7 Key Accessibility Issues

(*Clause* 13.3.3)

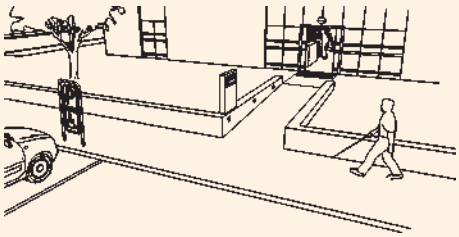
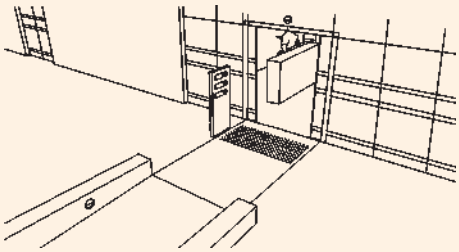
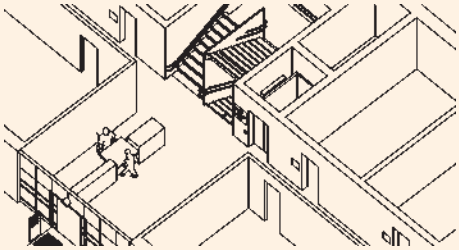
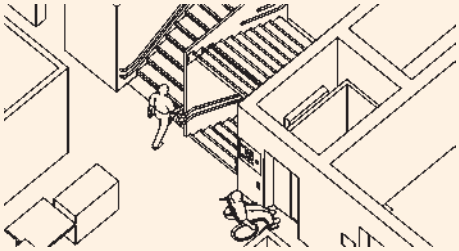
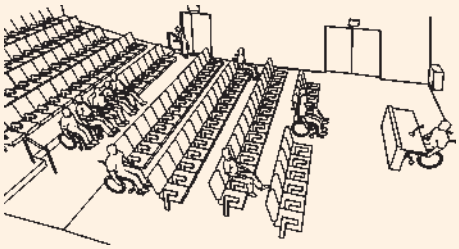
Sl No.	Key Accessibility Issues	Example
(1)	(2)	(3)
i)	Equitable approach to a building, for example designated parking, clear pedestrian routes separate from vehicles and cyclists, no steps or obstacles, short distances from parking and public transport, good signage, good lighting and good contrast	
ii)	Equitable entry *via* the same entrances, for example easy to locate main entrances, no steps or obstacles, wide openings, adequate manoeuvring space in front of the door, low operating forces, good signage, good lighting and good visual contrast	
iii)	Equitable use of the same paths in horizontal circulation, for example no steps or obstacles, adequate manoeuvring space, wide door openings, easy to operate doors, resting places, clear layout, good signage, good lighting and good visual contrast	
iv)	Equitable access to the same paths in vertical circulation, for example safe stairs, spacious lifts with easy operation, good signage, good lighting and good visual contrast	
v)	Equitable use of the same rooms, for example ample circulation space and different seating possibilities, good acoustics and hearing enhancement systems, good lighting and good visual contrast	

Table 7 — (*Concluded*)

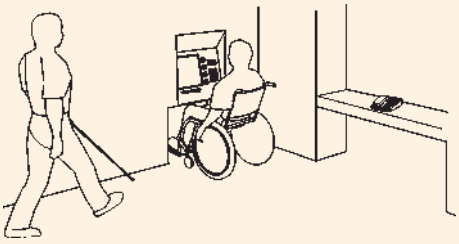
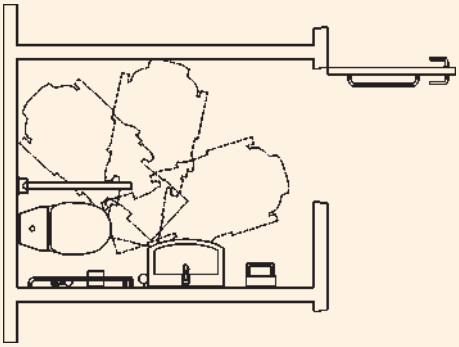
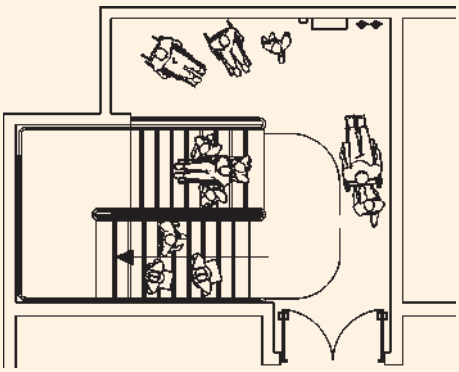
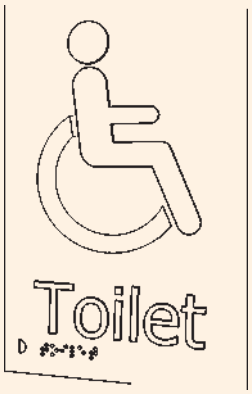
(1)	(2)	(3)
vi)	Equitable use of the same equipment and facilities, for example easy to understand and operate, adequate manoeuvring space and operating height, information *via* two senses	
vii)	Equitable use of toilet and sanitary facilities, for example good signage, adequate manoeuvring space, good transfer options, well-placed equipment, easy operation	
viii)	Equitable means of egress, concepts for emergency planning, for example no steps or obstacles, fire protected lifts, good signage, good lighting, good visual contrast, good fire safety, protection and evacuation, accessible means of egress	
ix)	Important information *via* two senses or more, for example visual, audible and tactile	

Table 8 Minimum Accessibility Provisions in Different Building Occupancies

(*Clause* 13.5)

Sl No.	Category	Type of Built Environment Within the Category	Applicability
(1)	(2)	(3)	(4)
i)	Residential	Public housing including low income housing and housing developed by private developers	a) All common and communal areas, such as, approach, entrances/exits, lifts, stairs, lobbies, clubs, religious facilities, parking, sports facilities/parks and recreation areas, etc, and associated sanitary and other facilities therein. b) 5 percent houses to be accessible meeting accessibility requirements, preferably on ground floor. c) In all other 95 percent houses, minimum universal design features, such as, minimum clear door widths of: main entrance, rooms, kitchen and that of at least one toilet and sanitary room in each house. Such toilet and sanitary room in the house shall be the one having access from the living/drawing room and their size shall comply with those given in **B-9** to allow the occupants to adapt to their needs to facilitate ageing-in-place and disabled friendly environment. NOTE The provisions given in (c) are minimum prescriptions with the objective to progressively move towards universal design of the buildings and the built environment, to be usable by all people, to the greatest extent possible irrespective of their age, situation, abilities, gender or any other diversity.
ii)	Hotels/hospitality centres	Hotels, dormitories, lodging and rooming houses, such as inns, clubs, motels and guest houses	Minimum five percent of the total rooms including their toilet room, shower room, balcony, etc, shall be accessible and preferably be provided on the ground floor for ease of evacuation in case of an emergency. All other rooms shall have universal design features (without specific adaptations like handrails/grab bars, etc). This would include minimum clear door widths of 900 mm of all entrances including those of sanitary rooms and balcony areas; and minimum passage width of 1 200 mm in the rooms and required turning radius. In accommodations having more than one toilet/sanitary room, one such facility shall be accessible. In case of accessible accommodations, a choice of right or left hand transfer to the toilet and shower shall be provided.
iii)	Educational buildings	Schools, colleges, classrooms, libraries, assembly points, halls, staff rooms, laboratories, play grounds	a) All teaching/administrative and common areas frequented by staff/students. b) In libraries all open book stacks. Few enclosed rooms in library for those with hearing and vision impairments who may need assistance while reading. c) In laboratories, equipment and facilities.
iv)	Hospitals/ health facilities	Hospitals/clinics/diagnostic centres/pharmacy, etc	All public areas to be accessible, including OPDs, IPDs, wards, toilets, changing rooms, sample collection rooms, x-ray rooms, patient examination rooms, medical distribution rooms/centres.
v)	Assembly buildings	Stadia, theatres, lecture halls, spectator seating in sports centres and all other type of assembly halls with fix seatings, by whatever name called	To all common areas/facilities open to public and staff. Number of designated seating areas to be as per **B-12.3**.
vi)	Public transit buildings	Bus terminus, airports, railway/metro stations, organized inter-change points/transit junctions, taxi stands	All public areas used by passengers and staff including but not limited to drop off areas, parking, boarding/transfer areas, waiting areas/lounges, custom areas, baggage halls, booking halls, inquiry offices, ticket counters, shops, banks, etc.
vii)	Heritage buildings/ sites	All heritage sites/buildings protected by concerned authorities and open to public, interpretation centres, ancillary services/ facilities	a) Reasonable access to all public areas without affecting the historical character of the building. b) Alternative solutions and innovative methods that do not conflict with conservation/preservation requirements should be explored.

Table 8 — (*Concluded*)

(1)	(2)	(3)	(4)
viii)	Public toilets		To be provided in accordance with **B-9.15**.
ix)	Cafeterias and restaurants		To be provided in accordance with **B-15**.
x)	Sports buildings		a) Sports halls, administration and common areas. b) At least one changing room and shower room to be provided at every place where such facility is provided. c) Spectators seating areas for wheelchair users as per assembly buildings above.
xi)	Mercantile buildings	Shops, malls, large multi-storey department stores and super markets, etc	At least one trial room for each group of such facility. Where only one is provided, it shall be accessible.

public use, such as, waiting areas, seating spaces, coffee shops, display areas, merchandising departments, service areas, ticket counters and refreshment stands shall be accessible to all persons with disabilities. These shall also include facilities like, lobby toilets, lifts, saloons, bars, restaurants, eateries, clubs, swimming pool, parking, fitness centres/gymnasiums, religious facilities, sports facilities/parks and recreation areas, etc, within an occupancy.

c) In all buildings, accessible toilet and sanitary room(s) shall be provided in accordance with **B-9**. Such facility shall be provided in each toilet group in a building.

14 SPECIAL REQUIREMENTS OF LOW INCOME HOUSING IN URBAN AREAS

Special requirements of low income housing shall be as given in Annex C. For detailed information in this regard, reference may be made to the accepted standard [3(3)].

With the exception of requirements given in Annex C, requirements of building shall be governed by the provision of this Code.

15 SPECIAL REQUIREMENTS FOR CLUSTER PLANNING FOR HOUSING

Special requirements for cluster planning for housing shall be as given in Annex D. With the exception of requirements given in Annex D, requirements of building shall be governed by the provision of this Code.

16 SPECIAL REQUIREMENTS FOR LOW INCOME HABITAT PLANNING IN RURAL AREAS

Special requirements for low income habitat planning in rural areas shall be as given in Annex E. With the exception of requirements given in Annex E, requirements of building shall be governed by the provision of this Code.

17 SPECIAL REQUIREMENTS FOR DEVELOPMENT PLANNING IN HILLY AREAS

Special requirements for development planning in hilly areas is given in Annex F. With the exception of requirements given in Annex F, requirements of building shall be governed by the provision of this Code.

18 FIRE AND LIFE SAFETY

For requirements regarding fire and life safety for different occupancies, reference shall be made to Part 4 'Fire and Life Safety' of the Code.

19 DESIGN AND CONSTRUCTION

For requirements regarding structural design, reference shall be made to Part 6 'Structural Design' of the Code. For requirements regarding construction (including management and safety), reference shall be made to Part 7 'Construction Management, Practices and Safety' of the Code.

20 LIGHTING AND VENTILATION

20.1 For requirements regarding lighting and ventilation for different uses and occupancies, reference shall be made to Part 8 'Building Services', Section 1 'Lighting and Natural Ventilation' of the Code.

20.1.1 *Lighting and Ventilation of Rooms*

Rooms shall have, for the admission of light and air, one or more openings, such as windows and ventilators, opening directly to the external air or into an open *Verandah*.

20.1.2 Notwithstanding the area of openings obtained through **20.1**, the minimum aggregate area (*see* Notes 1 to 3) of such openings, excluding doors inclusive of frames, shall be not less than,

a) one-tenth of the floor area for hot-dry climate;

b) one-sixth of the floor area for warm-humid climate;

c) one-eighth of the floor area for temperate and composite climate; and

d) one-twelfth of the floor area for cold climate.

NOTES

1 If a window is partly fixed, the openable area shall be counted.

2 No portion of a room shall be assumed to be lighted, if it is more than 7.5 m away from the opening assumed for lighting that portion.

3 The area of openings as given in (a) to (d) above shall be increased by 25 percent in the case of a kitchen [*see* **12.3.3**(d)].

21 ELECTRICAL AND ALLIED INSTALLATIONS (INCLUDING LIGHTNING PROTECTION OF BUILDINGS AND SOLAR ENERGY UTILIZATION)

21.1 For requirements regarding electrical installations in buildings including lightning protection of buildings, reference shall be made to Part 8 'Building Services Section 2 Electrical and Allied Installations' of the Code.

21.2 Solar Energy Utilization

The solar panels can be provided on roof tops and integrated photovoltaic panels on walls/windows as well as solar photovoltaic (PV) banks on open areas.

21.2.1 *Solar Photovoltaic Power Generation System*

All plots having size 500 m^2 and above shall install solar photovoltaic power generation system. This should also be encouraged for plots smaller than 500 m^2. The power generated may be used for in-house utilization or for transfer to the grid. The Authority shall have required provisions in the building bye-laws and mechanism for required clearances and approvals. The Authority shall also specify minimum generation requirement. The following may be used as a guide:

Sl No.	*Building Type*	*Plot Size*	*Generation Requirement*
(1)	(2)	(3)	(4)
i)	Residential (Plotted houses)	100 m^2 and above	1 kWp or 5 percent of connected load, whichever is higher
ii)	Residential (Group housing)	All sizes	Minimum 5 percent of connected load
iii)	Business, educational buildings having connected load of 30 kW and above	500 m^2 and above	5 kWp or 5 percent of connected load, whichever is higher
iv)	Mercantile, hotels, motels, assembly, industrial and institutional buildings	500 m^2 and above	for buildings having connected load of: a) *50-1 000 kW* — 10 kWp or 5 percent of connected load whichever is higher b) *Above 1 000 kW* — 50 kWp or 5 percent of connected load whichever is higher

21.2.2 *Solar Water Heating System*

The following building occupancy types shall install solar assisted water heating system for supplying hot water:

a) Residential buildings (except hostels of educational buildings and plotted houses) having plot area 4 000 m^2 and above;

b) Plotted houses having plot area of 250 m^2 and above;

c) Hostels for schools, colleges and training centres for more than 100 students;

d) Institutional buildings; and

e) Assembly buildings

The Authority shall have required provisions in the building bye-laws and mechanism for required clearances and approvals. The Authority, considering the availability of solar energy for harnessing, shall decide the minimum capacity be installed subject to a minimum of 25 litre per day hot water yield for each bathroom and kitchen.

For solar water heating system and their installation reference shall be made to accepted standards and good practice [3(4)].

22 AIR CONDITIONING, HEATING AND MECHANICAL VENTILATION

For requirements regarding design, construction and installation of air conditioning, heating and mechanical ventilation systems, reference shall be made to Part 8 'Building Services, Section 3 Air Conditioning, Heating and Mechanical Ventilation' of the Code.

23 ACOUSTICS, SOUND INSULATION AND NOISE CONTROL

For requirements regarding the desired noise levels and sound insulation in different occupancies, reference shall be made to Part 8 'Building Services, Section 4 Acoustics, Sound Insulation and Noise Control' of the Code.

24 HEAT INSULATION

For calculation of solar radiation on buildings and recommended limits of thermal transmittance of roofs and walls for different parts of the country and heat transmission losses due to different constructions, reference may be made to good practice [3(5)].

25 INSTALLATION OF LIFTS, ESCALATORS AND MOVING WALKS

Provision for lifts shall be made for buildings 15 m or more in height. For requirements regarding planning, designing and installation, etc, of lifts and escalators, reference shall be made to Part 8 'Building Services, Section 5 Installation of Lifts, Escalators and Moving Walks' of the Code.

26 INFORMATION AND COMMUNICATION ENABLED INSTALLATIONS

For requirements regarding information and communication enabled installations in buildings, reference shall be made to Part 8 'Building Services, Section 6 Information and Communication Enabled Installations' of the Code.

27 PLUMBING SERVICES (INCLUDING SOLID WASTE MANAGEMENT)

For requirements regarding water supply, drainage and sanitation, solid waste management and gas supply, reference shall be made to Part 9 'Plumbing Services (including Solid Waste Management)' of the Code.

28 SUSTAINABILITY

For requirements regarding sustainable buildings and built environment, reference shall be made to Part 11 'Approach to Sustainability' of the Code.

29 ASSET AND FACILITY MANAGEMENT

For requirements regarding asset and facility management in respect of existing buildings and services thereof, reference shall be made to Part 12 'Asset and Facility Management' of the Code.

ANNEX A

(*Clauses* 10.1 *and* 10.4)

OFF-STREET PARKING SPACES

A-1 The off-street parking spaces shall be as given in Table 9.

Table 9 Norms for Off-Street Parking Spaces

(*Clause* A-1)

Sl No.	Occupancy	One Car Parking Space for Every				
		Population Less than 50 000	Population Between 50 000 and 200 000	Population Between 200 000 and 1 000 000	Population Between 1 000 000 and 5 000 000	Population Above 5 000 000
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Residential a) Multi-family	—	—	a) 2 tenements having built-up area 101 to 200 m^2	1 tenement of 100 m^2 built-up area	a) 1 tenement of 75 m^2 built-up area
				b) 1 tenement of built-up area above 200 m^2		b) ½ tenement of built-up area above75 m^2
	b) Lodging establishments, tourist homes and hotels, with lodging accommodation	12 guest rooms	8 guest rooms	4 guest rooms	3 guest rooms	2 guest rooms
ii)	Educational (*see* Note 1)	—	—	70 m^2 area or fraction thereof of the administrative office area and public service areas	50 m^2 area or fraction thereof of the administrative office area and public service areas	35 m^2 area or fraction thereof of the administrative office area and public service areas
iii)	Institutional (Medical)	20 beds (Private) 30 beds (Public)	15 beds (Private) 25 beds (Public)	10 beds (Private) 15 beds (Public)	5 beds (Private) 10 beds (Public)	2 beds (Private) 5 beds (Public)
iv)	a) Assembly halls, cinema theatres	120 seats	80 seats	25 seats	15 seats	10 seats
	b) Restaurants	60 seats	40 seats	20 seats	10 seats	5 seats
	c) Marriage halls, community halls	600 m^2 plot area	400 m^2 plot area	200 m^2 plot area	50 m^2 plot area	25 m^2 plot area
	d) Stadia and exhibition centre	240 seats	160 seats	50 seats	30 seats	20 seats
	e) Sport complex (without stadium), parks and multipurpose open spaces	—	—	1 000 m^2 plot area	500 m^2 plot area	250 m^2 plot area
v)	a) Business offices and firms for private business	300 m^2 area or fraction thereof	200 m^2 area or fraction thereof	100 m^2 area or fraction thereof	50 m^2 area or fraction thereof	25 m^2 area or fraction thereof
	b) Public or semi-public offices	500 m^2 area or fraction thereof	300 m^2 area or fraction thereof	200 m^2 area or fraction thereof	100 m^2 area or fraction thereof	50 m^2 area or fraction thereof
vi)	Mercantile (*see* Note 2)	300 m^2 area or fraction thereof	200 m^2 area or fraction thereof	100 m^2 area or fraction thereof	50 m^2 area or fraction thereof	25 m^2 area or fraction thereof
vii)	Industrial	400 m^2 area or fraction thereof	300 m^2 area or fraction thereof	200 m^2 area or fraction thereof	100 m^2 area or fraction thereof	50 m^2 area or fraction thereof
viii)	Storage	—	—	500 m^2 floor area or part thereof	250 m^2 area or fraction thereof	125 m^2 area or fraction thereof

NOTES

1 In the case of auditoria for educational buildings, parking space shall be provided as per Sl No. (iv).
2 For plots up to 50 m^2, as in the case of shops, parking spaces need not be insisted upon.
3 For other institutions, transport/communication centre, parking space requirement shall be assessed based on the proposed building.
4 In case of permitted mixed residential-commercial or mixed residential-industrial areas the parking requirements shall be double the number for residential use.
5 The requirements specified in this table shall not be applicable for buildings meant for parking alone, including the multi-level car parking buildings which shall be as decided by the Authority.
6 Designated accessible parking spaces shall be provided in accordance with **B-3** for the occupancies specified in **13**.

ANNEX B

[*Clauses* 4.6.1.3(g), 13.3.1, 13.4 *and* 13.5]

ANTHROPOMETRICS AND REQUIREMENTS FOR ACCESSIBILITY IN BUILT-ENVIRONMENT FOR ELDERS AND PERSONS WITH DISABILITIES

B-1 ANTHROPOMETRICS

Adequate space should be allocated for persons using mobility devices, for example wheelchairs, crutches and walkers, white cane etc, as well as those walking with the assistance of others. The dimensions prescribed in **B-1.1** to **B-1.4** may be used for guidance while designing facilities and equipment to be used by persons with disabilities.

B-1.1 Mobility Devices and Space Allowance

B-1.1.1 *Wheelchair*

The basic elements of wheelchairs (manual, electric and any others) and terms and definitions for these elements are as defined in the accepted standard [3(6)]. Basic elements of a wheelchair (folding, adult size) are also shown in Fig. 12.

Wheelchair requirements are given in the accepted standards [3(7)].

B-1.1.1.1 Some of the dimensions of a standard wheelchair are extremely important and helps to arrive at requirements for space allowance, reach range, etc, of a wheelchair user. Electric wheelchair may be of a large dimension, much heavier and do not have the same manoeuvrability/capability as manual wheelchairs.

B-1.1.1.2 Manual wheelchair dimensions are as follows (*see* Fig. 12):

a) Overall length : 1 000 mm -1 100 mm
b) Overall width, open : 650 mm - 720 mm
c) Overall width, folded : 300 mm - 330 mm
d) Overall height : 910 mm - 950 mm
e) Seat height from floor at the front : 480 mm - 510 mm
f) Distance between seat and footrest : 400 mm - 450 mm
g) Arm rest height from seat : 220 mm - 230 mm
m) Seat depth : 420 mm - 440 mm
n) Clearance of foot-rest from floor : 90 mm - 200 mm
p) Clearance of frame from floor : 90 mm, *Min*
q) Wheelchair footrest : 350 mm (deep)
r) Wheelchair castor width : 12 mm
s) Weight of the wheelchair (basic model) : 25 kg, *Max*

The following form important considerations in deciding various space requirements to ensure functionality for wheelchair users:

1) Arm rest height from floor : 760 mm
2) Lap height : 675 mm

NOTE — The dimensions given above are from the point of view of better understanding and appreciation of various needs emanating therefrom. However, considering various aspects including diversity of population, stature, age, gender, etc, the

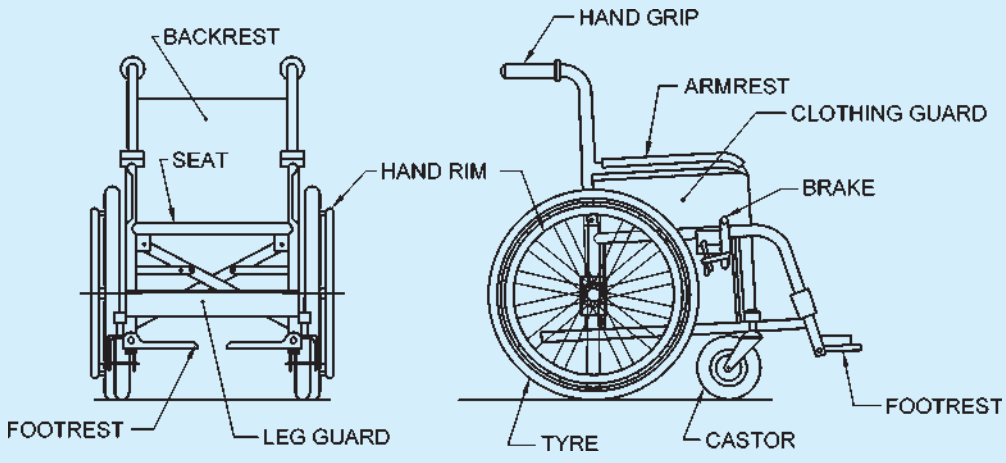


FIG. 12 NOMENCLATURE OF BASIC ELEMENTS OF WHEELCHAIR

dimensions and ranges thereof as may be applicable have been prescribed in these provisions given hereinafter.

B-1.1.1.3 A wheelchair has a footplate and leg rest attached in front of the seat. The footplate extends about 350 mm in front of the knee. The footplate may prevent wheelchair users from getting close enough to an object/site. Hence, at least 350 mm deep and 700 mm high space under a counter, stand, etc, shall be provided (*see* Fig. 13).

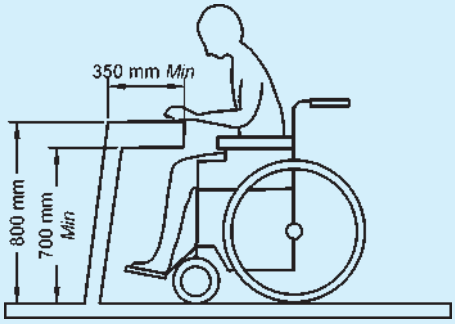


FIG. 13 NECESSARY SPACE UNDER COUNTER OR STAND FOR EASE OF WHEELCHAIR USERS

B-1.1.1.4 *Clear floor space for wheelchair user*

The minimum clear floor or ground area required for accommodating a single, stationary wheel chair and occupant is 900 mm × 1 200 mm (*see* Fig. 14). Where transfer from the wheelchair is involved, the clear space should preferably be 900 mm × 1 350 mm.

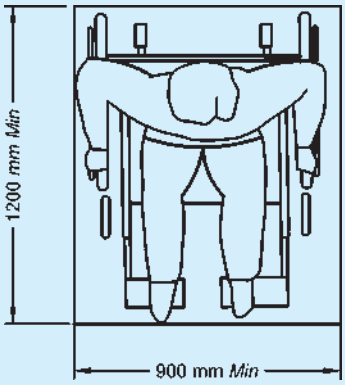


FIG. 14 CLEAR FLOOR SPACE

B-1.1.1.5 *Circulation dimensions*

The minimum clear floor ground area for a wheelchair to turn is 1 500 mm, whereas comfortable is 1 800 mm and it is ideal to provide 2 000 mm (*see* Fig. 15).

B-1.1.2 *Space Allowance for Crutch Users*

Although people who use walking aids can manoeuvre through door openings of 900 mm clear width, they need wider passageways for comfortable gaits as shown in Fig. 16. Crutch tips, often extend down out at a wide angle, and are hazardous in narrow passageways where they might not be seen by other pedestrians.

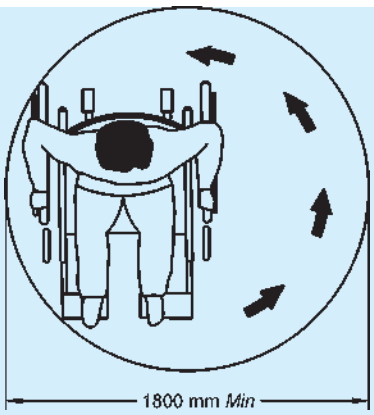


FIG. 15 PREFERRED COMFORTABLE TURNING RADIUS

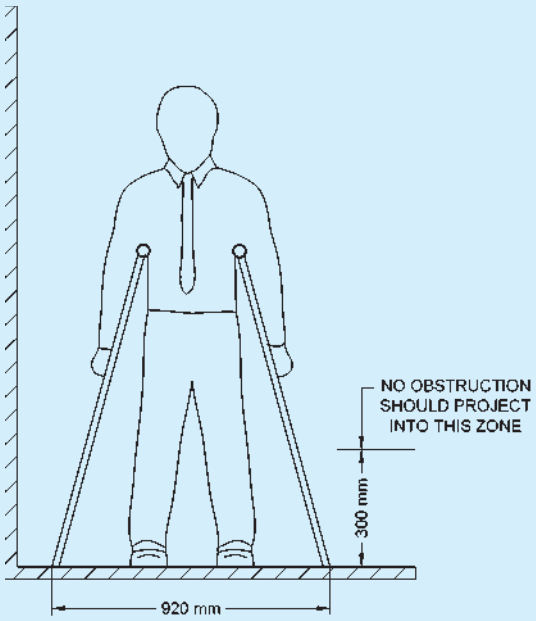


FIG. 16 PASSAGEWAY REQUIRED FOR PEOPLE WHO USES WALKING AIDS

B-1.1.3 *Space Allowance for White Cane Users*

Following shall be ensured for white cane users:

a) Protruding objects, such as directional signs, tree branches, wires, guy ropes, public telephone booths, benches and ornamental fixtures shall be installed with consideration of the range of the white cane of a person with vision impairment.

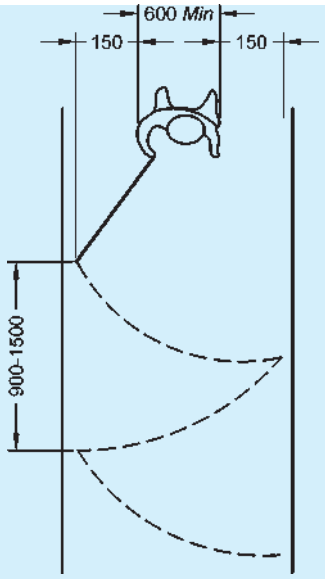
b) A barrier to warn blind or visually impaired person shall be provided under stairways or escalators so that they don't accidently enter

in to them.

c) Walkways, halls, corridors, passage ways, aisles, or other circulations spaces shall have clear headroom to minimize the risk of accidents.

d) Adequate space allowance should be made considering that the radial range of white cane is a band of 900 mm wide (*see* Fig. 17).

e) Any obstacle above 300 mm cannot be detected by the white cane. If there are projections above this height then the same has to be treated in accordance with **B-2.6.2**.



All dimensions in millimetres.

FIG. 17 SPACE ALLOWANCE (RADIAL RANGE) FOR PEOPLE USING WHITE CANES

B-1.2 Reach Range

A wheelchair user's movement pivots around its shoulders (*see* Fig. 18). The range of reach (forward and side; with or without obstruction) of a wheelchair users, as given in **B-1.2.1** to **B-1.2.3** shall be taken in to consideration.

B-1.2.1 *Forward Reach*

The maximum forward reach without obstruction is 1 200 mm from the floor and the minimum forward reach without obstruction is 400 mm from the floor as shown in Fig. 19.

The maximum forward reach over an obstruction is 1 000 mm from the floor as shown in Fig. 20, which also indicates the touch reach and grasp reach.

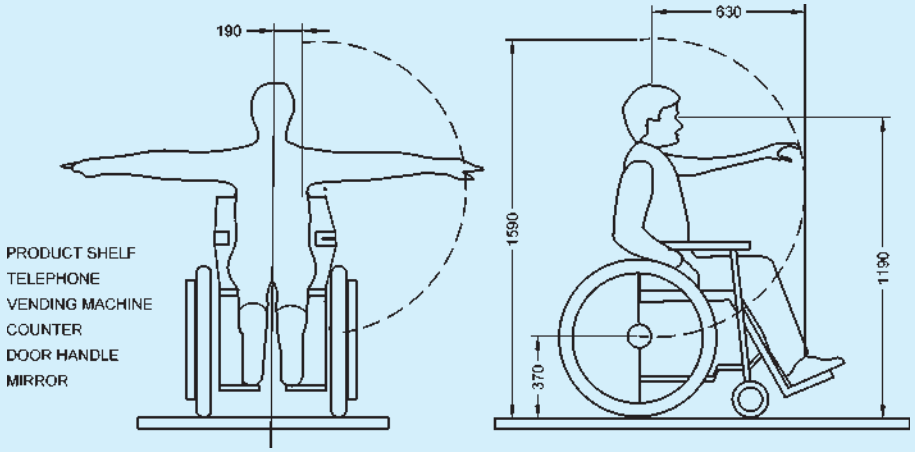
B-1.2.2 *Side Reach*

The maximum side reach without obstruction is 1 300 mm from the floor and the minimum side reach is 250 mm as shown in Fig. 21.

The maximum side reach over an obstruction of size 860 mm high × 500 mm deep is 1 200 mm from the floor as shown in Fig. 22, which also indicates the touch reach and grasp reach.

B-1.2.3 *Common Reach Zone*

As part of the common reach zone, the comfortable reach zone when seated on a wheelchair is between 900 mm and 1 200 mm and the maximum reach zone is between 1 200 mm and 1 400 mm (*see* Fig. 23).



All dimensions in millimetres.

FIG. 18 RANGE OF REACH OF WHEELCHAIR USER

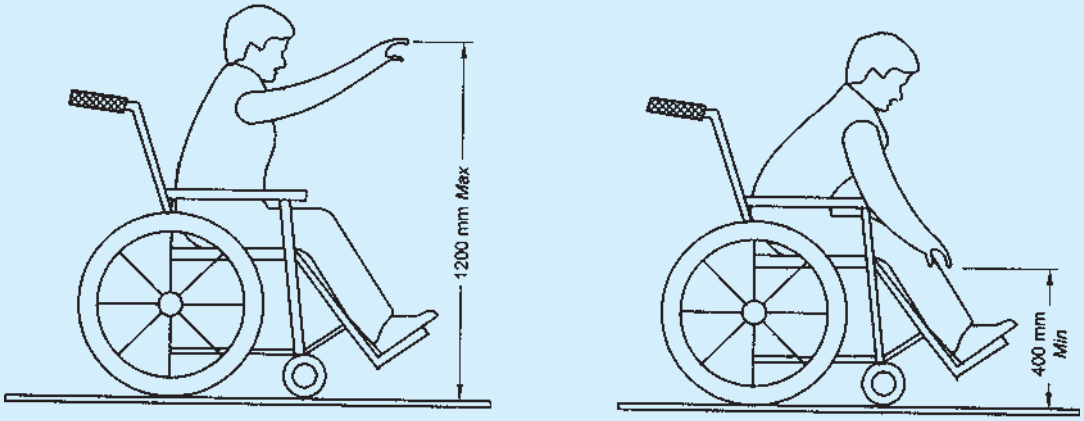


FIG. 19 FORWARD REACH WITHOUT OBSTRUCTION

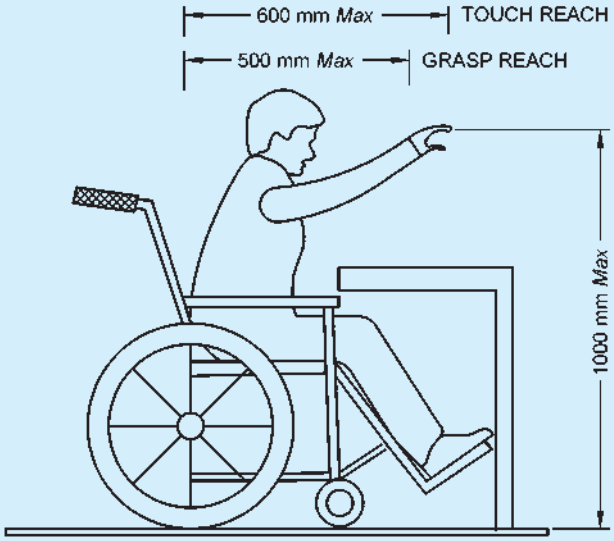


FIG. 20 FORWARD REACH OVER OBSTRUCTION

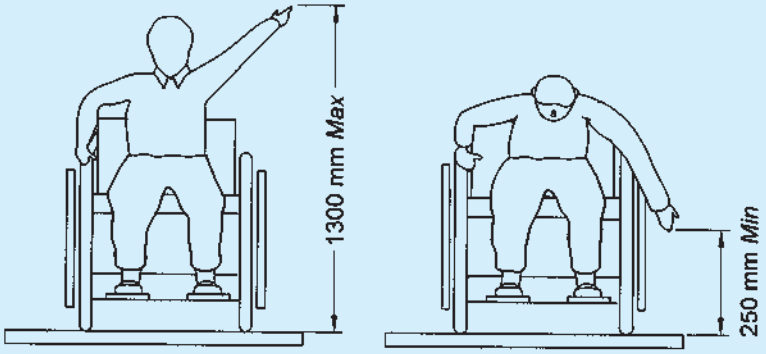
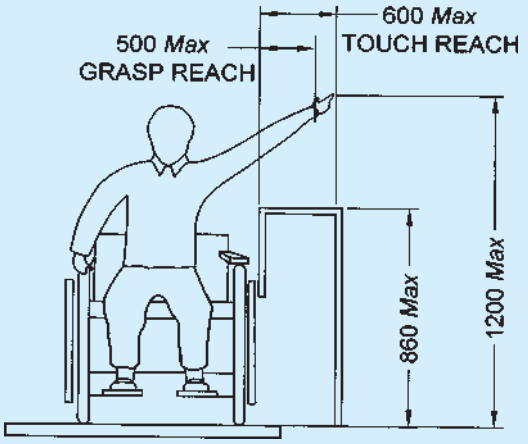


FIG. 21 SIDE REACH WITHOUT OBSTRUCTION



All dimensions in millimetres.

FIG. 22 SIDE REACH OVER OBSTRUCTION

B-1.3 Vision Zone

Different fields of vision are given in Fig. 24. All signage should be designed based on these dimensions.

Map and information panels along pathways shall be placed at a height between 900 mm and 1 800 mm (*see* Fig. 25).The smallest letter shall not be less than 15 mm.

B-1.4 Heights and Widths

B-1.4.1 *Wheelchair Users*

The average height of a person seated on a wheelchair is generally less than 1 200 mm.

B-1.4.2 *Standing Person*

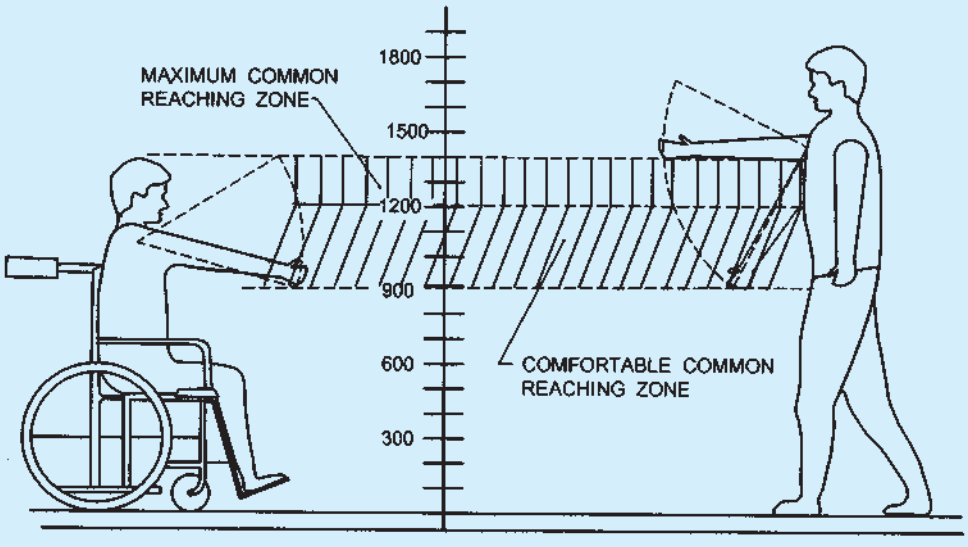
The average height of a standing person is generally less than 2 000 mm.

B-1.4.3 *Height of Controls*

a) Height of controls from floor level : 400 mm - 1 200 mm
b) Height for switches (power) : 400 mm - 500 mm
c) Height for switches (lights) : 800 mm - 1 200 mm
d) Height of door handles : 800 mm - 1 100 mm
e) Opening controls for windows : 800 mm - 1 100 mm
f) Space required under the counter for wheelchair footrest : 350 mm deep

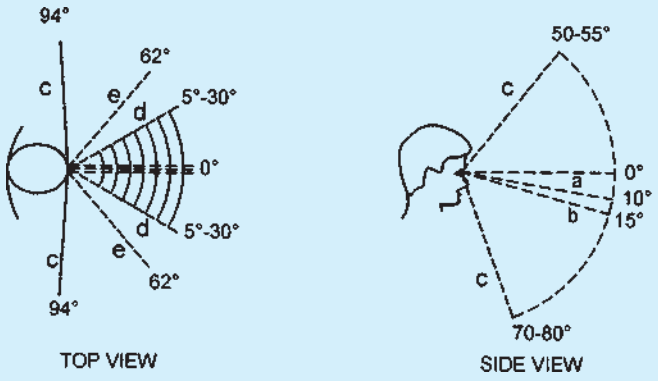
B-1.4.4 *Entrance/Exit Door*

a) Minimum width of entrance/ exit door (*see* Fig. 43) : 900 mm
b) Minimum front approach doorways space (*see* Fig. 44 and Fig. 45) : 600 mm
c) Minimum latch side approach doorways space (*see* Fig. 44) : 1 250 mm



All dimensions in millimetres.

FIG. 23 COMMON REACHING ZONE



Key

a Normal optical axis, standing person
b Normal optical axis, sitting person
c Limit of field of vision
d Normal angle of vision
e Maximum angle of vision

FIG. 24 FIELD OF VISION

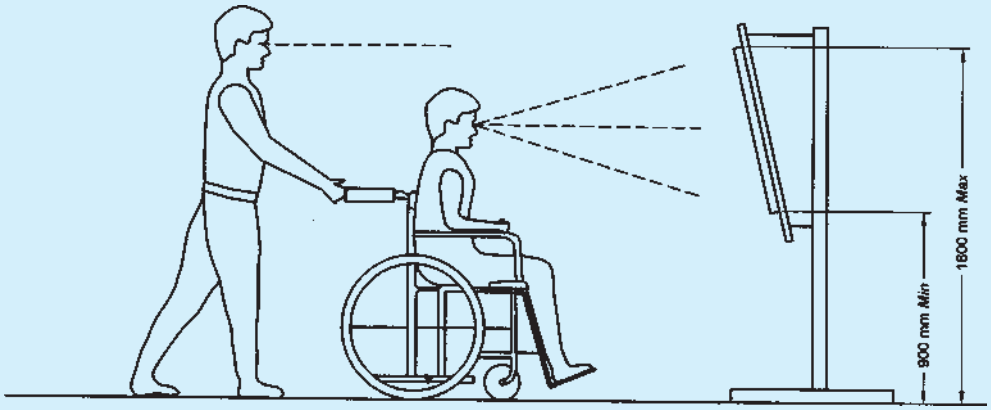


FIG. 25 VISION ZONE

B-2 SITE PLANNING AND DEVELOPMENT

B-2.1 General

Site development is the most effective means to resolve the problems created by topography, definitive architectural designs or concepts, water table, existing streets, and typical problems, singularly or collectively, so that ingress and egress to buildings by persons with disabilities can be facilitated while preserving the desired design and effect of the architecture. Each building and its site shall be planned and designed as an integral unit from the very beginning of the design process. Equipment and materials causing allergic reactions shall as far as possible be avoided in dwellings and buildings.

The provisions of accessibility in outdoor built environment covered herein pertain to the immediate outdoor environment of a building or of a building complex. However, these may be considered by the Authorities and concerned parties for suitably applying the same at township/city level.

B-2.2 Walkways and Pathways

B-2.2.1 *General*

Walkways and pathways (used here interchangeably) shall meet the following general requirements:

a) Walkways shall be smooth, hard and have levelled surface suitable for walking and wheeling. Irregular surfaces as cobble stones, coarsely exposed aggregate concrete, bricks, etc, often cause bumpy rides and shall be avoided.

b) Minimum walkway width shall be provided as per **B-2.2.2**. The width of footpath shall be in accordance with **4.3.2.1.1**.

c) The walkway shall not have a gradient exceeding 1:20. If the slope or any part of a walkway on an accessible route to a building exceeds 1:20, it shall be designed and constructed as a ramp in accordance with **B-6.2**.

d) Where pathway meets the road, a kerb shall be provided; which shall be designed in accordance with **B-2.3.**

e) The cross-fall gradient across an accessible route shall not exceed 1:50 (20 mm/m), except when associated with a dropped kerb.

f) The requirements for drainage of pathways shall be as per **B-2.2.5**.

g) When walkways exceed 60 m in length, it is desirable to provide rest area adjacent to the walk at convenient intervals of 30 m in the form of benches/resting seats. For comfort, seat height shall be between 450 mm and 500 mm, and the seating shall have a back rest and arm rests at 700 mm height. One side of seating may be without arm rest to address the transfer needs of persons with disabilities. A colour contrast should be provided around the seating area for ease of identification by persons with low vision.

h) Texture change in walkways adjacent to seating shall be provided for persons with vision impairment by means of warning blocks (*see* **B-2.5**).

j) Gratings and manholes should be avoided in walks.

k) Walks or driveways shall have a non-slip surface. Care shall be taken to ensure that adjacent surface materials do not display different slip resistance characteristics, particularly at the edges of changes of level or gradients.

m) Such walks shall be of a continuing common surface not interrupted by steps or abrupt changes in level.

n) Wherever walks cross other walks, driveways, or parking lots, they shall blend to a common level.

p) Obstacles, such as objects or signs mounted on walls, columns or free-standing supports along the walking path shall be avoided. These shall however be regulated in accordance with **B-2.6.1**. Bollards along or on the walking pathway shall also be regulated in accordance with **B-2.6.1**. Any protruding object projecting into a walkway shall be treated in accordance with **B-2.6.2**.

B-2.2.2 Width of the Walkway/Pathway

B-2.2.2.1 The unobstructed width of the pathway shall be,

a) not less than 1 800 mm for two-way traffic (*see* key 1 of Fig. 26); which may be reduced to a minimum of 1 500 mm, provided that a passing and turning space of at least 1 800 mm × 2 000 mm should be provided for every 25 m (*see* keys 2 and 5 of Fig. 26); and

b) not less than 1 200 mm for one-way traffic (*see* key 3 of Fig. 26); which may be reduced to a minimum of 1 000 mm, provided that a passing and turning space of at least 1 800 mm × 2 000 mm should be provided for every 25 m (*see* keys 4 and 5 of Fig. 26).

B-2.2.2.1.1 The width of footpath shall be in accordance with **4.3.2.1.1**.

B-2.2.2.2 *Passing space for wheelchair users*

A path whose surface width is less than 1 800 mm (*see* **B-2.2.2.1**) and whose overall length is more than 50 m, shall be provided with a passing place or places. Passing places should be a maximum of 25 m apart. This does not apply to a landing forming part of a sloped path, a ramp, steps or a stair.

Passing place for two people using wheelchairs shall be a minimum width of 1 800 mm for a minimum length of 2 000 mm (*see* examples in Fig. 27).

NOTE — Passage widening can be associated with intersections, turns and doorways so as to appear as integrated design features or enhancements.

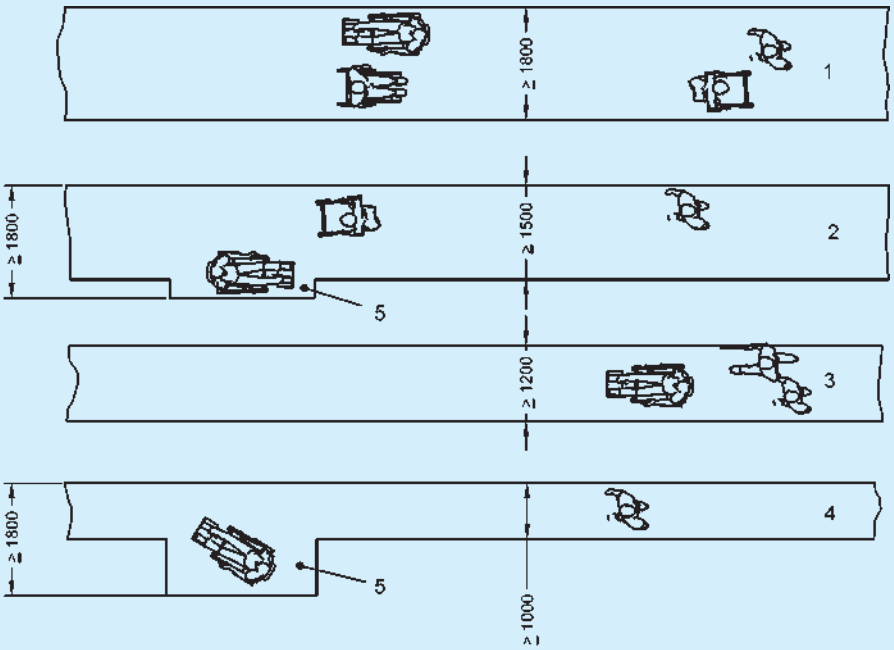
B-2.2.2.3 For wheelchair manoeuvrability at turnings, minimum turning radius shall be required in accordance with **B-5.2.3** and **B-5.2.4**.

B-2.2.3 *Stepped Path and Stair*

For ambulant people, a stepped path can provide a safer and more assuring means of access than a sloped path or a ramp. Wherever the rise of a ramp exceeds 300 mm, an additional flight of steps shall also be provided. An isolated single step is not acceptable. Where required on a continuous accessible path of travel, tactile warning indicators shall be located at both the top and bottom of stairways. The surface width of a stepped path and stair shall be not less than 1 200 mm and it shall meet the other requirements of **B-6.3**.

B-2.2.4 *Support and Guidance by a Handrail on Paths*

Support and guidance by a handrail shall be provided on stepped paths. A handrail shall be provided on each



Key

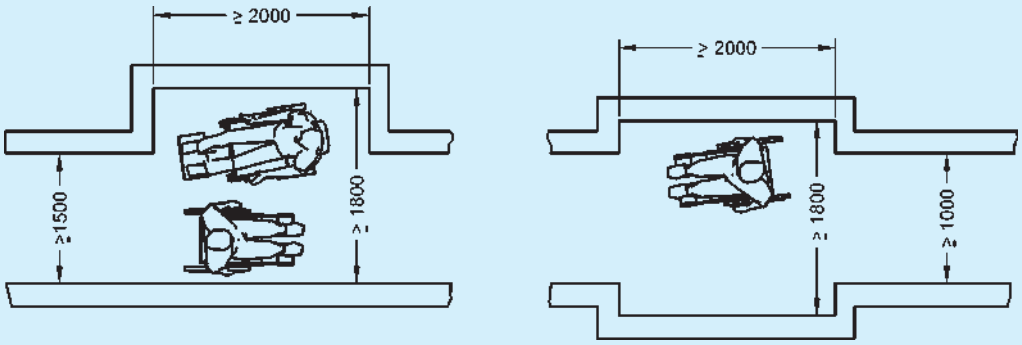
1 and 2 For two-way traffic

3 and 4 For one-way traffic

5 Passing and turning space every 25 m (only acceptable for wheelchair users under exceptional circumstances)

All dimensions in millimetres.

FIG. 26 DIFFERENT SURFACE WIDTHS OF THE PATH DEPENDING ON TRAFFIC



All dimensions in millimetres.

FIG. 27 EXAMPLES FOR PASSING PLACES FOR WHEELCHAIR USERS

side of a flight of steps consisting of two or more risers and each riser shall be not more than 150 mm high. A handrail shall be provided on both sides of a channel that can subdivide a flight of steps. For requirements of handrails, reference shall be made to **B-5.5.2**.

B-2.2.5 *Drainage of Path/Access Routes*

The cross-fall of a level or sloped path, a stepped path, a ramp, or a landing, that is provided to permit drainage of surface water, shall be in accordance with **B-2.2.1**(e).

The top, bottom and landings of steps and ramps shall be properly drained in order to avoid water flowing down steps and ramps.

A dished channel should not be constructed within the boundaries of a path or ramp. Dished channels shall have a maximum width of 150 mm and a maximum drop into gulley of 5 mm.

A drainage grating that is within the boundaries of a path or a ramp shall be set flush with the surface (*see* **B-2.4**).

B-2.2.6 *Guarding along Paths and Ramps*

Providing protection at the side of the path protects people who use wheelchairs and ambulant people from injuring themselves as the result of a fall. Examples of protection against falling are shown in Fig. 28.

a) If a level or sloped path is bounded on one or both sides by terrain that slopes downwards by up to 30° from the horizontal, a firm and level margin of at least 600 mm shall be provided at the relevant side or sides.
b) If a sloped path or ramp is bounded on one or both sides by terrain that slopes downwards by more than 30°, an upstand of minimum height of 150 mm shall be provided at the relevant side or sides. Upstands shall have a minimum difference in LRV of 30 points in relation to the ramp.
c) If a path, or a sloping path, stepped path, ramp, terrace or other unfenced platform rises more than 600 mm above the adjacent ground, it shall be provided with guarding. If the adjacent ground is firm and level with the path for 600 mm, no guard is needed.

Guarding shall be designed to discourage a user, particularly a child, from climbing on it.

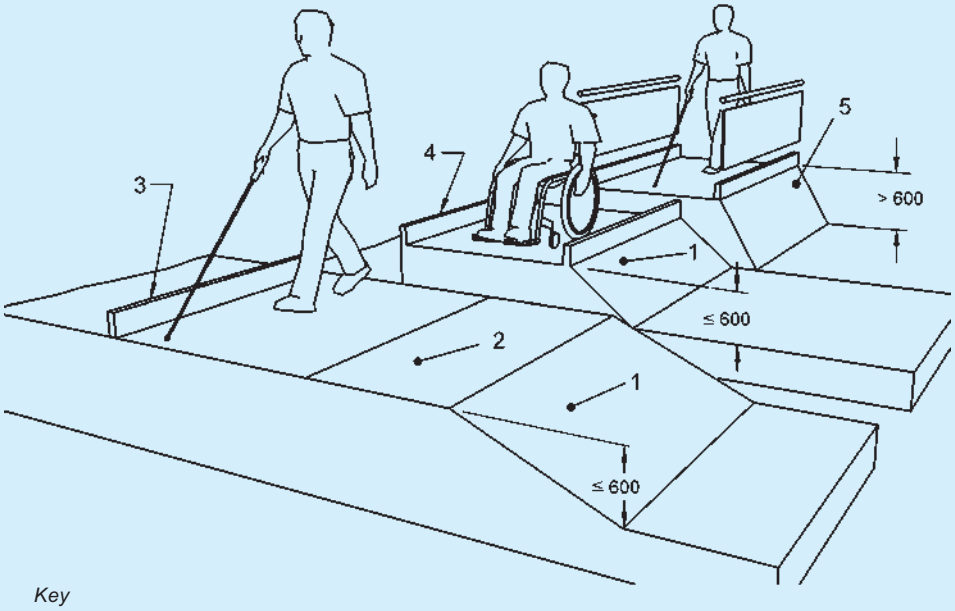
B-2.3 Kerb Ramp/Dropped Kerb

B-2.3.1 *General*

It is a ramp built on a footpath or pavement to accommodate the change in level towards vehicular areas to allow easy and continuous access. Kerb ramps shall be provided at pedestrian crossings and at each end of the footpath of a private street or access road.

Kerb ramps shall be provided where the vertical rise is less than 150 mm. They shall meet the following requirements:

a) They shall have a slip-resistant surface.
b) They shall avoid raised traction strips in order to reduce the hazard to everyone.
c) They shall be designed not to allow water accumulating on the walking surface.
d) Handrails may not be provided with kerb ramps.
e) They shall not project into the road surface.
f) They shall be so located and also protected to prevent obstruction by parked vehicles.
g) They shall be free from any obstruction such as signposts, traffic lights, etc.
h) They shall not encroach into a roadway, as it is dangerous for users and obstructive for vehicles.



Key
1 Downward slope less than 30°
2 Level margin minimum 600 mm wide
3 Upstand where the difference in level is 600 mm or less
4 Upstand with a minimum difference in LRV of 30 points in relation to the path or ramp
5 Upstand with guarding where the difference in level is greater than 600 mm

All dimensions in millimetres.

FIG. 28 EXAMPLES OF PROTECTION AGAINST FALLING

j) They shall be so located to enable users to have an unobstructed view of traffic approaching from any direction.

k) They shall be provided with adequate visual and tactile warning.

m) TGSI (warning type) shall be provided to notify the presence of traffic and shall have a minimum luminous contrast of 70 percent with the adjoining surfaces for the elderly and persons with visual impairment.

Typical kerb ramp requirements and kerb extension at street intersections are shown in Fig. 29 and Fig. 30.

B-2.3.2 *Gradient*

The gradient of a kerb ramp shall not be steeper than 1:12.

B-2.3.3 *Width*

The kerb ramp shall not be less than 1 200 mm in width. It shall provide a clearance of at least 800 mm at the back of the kerb ramp on the footpath (*see* Fig. 29).

B-2.3.4 *Flared Sides*

Kerb ramps shall have flared sides where pedestrians are likely to walk across them as shown in Fig. 29 and the gradient of the flared side shall not be steeper than 1:10.

B-2.4 Levels, Grooves, Gratings and Manholes

B-2.4.1 *Passing over Different Levels and Grooves*

Vertical level changes up to 6 mm may not need edge treatment. Changes in level between 6 mm and 12 mm shall be levelled off with a slope no greater than 1:2. The edge shall be rounded off or bevelled.

B-2.4.2 *Gratings and Manholes*

Gratings and manholes should be avoided on walkways/ pathways. If unavoidable, gratings shall have spaces not greater than 12 mm wide in one direction to prevent a wheelchair from getting its casters caught in a drainage ditch or grating cover. Also, the grating bars shall be perpendicular to the travel path in such a way that its longer dimension is perpendicular to the dominant direction of movement. Grating shall be flushed with finished ground level and shall be treated with a non-slip finish (*see* Fig. 30).

B-2.5 Tactile Ground Surface Indicators (TGSI) — Tactile Guiding and Warning Blocks

Tactile ground surface indicators or tactile guiding and warning tiles/blocks aid blind and vision impaired pedestrians negotiate the built environment, and shall be of the dimensions as given in Fig. 31.

NOTE — Alternatively, other internationally accepted tactile pattern may be accepted by the Authority.

B-2.5.1 Tactile guiding blocks indicate a correct path/ route to follow for a person with visual impairment. It is recommended to install one/two rows of tactile guiding blocks along the entire length of the proposed accessible route. Care shall be taken to ensure that there are no obstacles, such as trees, poles or uneven surfaces, along the route traversed by the guiding blocks. Also, there shall be clear headroom of at least 2 100 mm height above the tactile guiding blocks, free of protruding objects such as overhanging tree branches and signage, along the entire length of the walk.

B-2.5.2 Tactile warning blocks indicate an

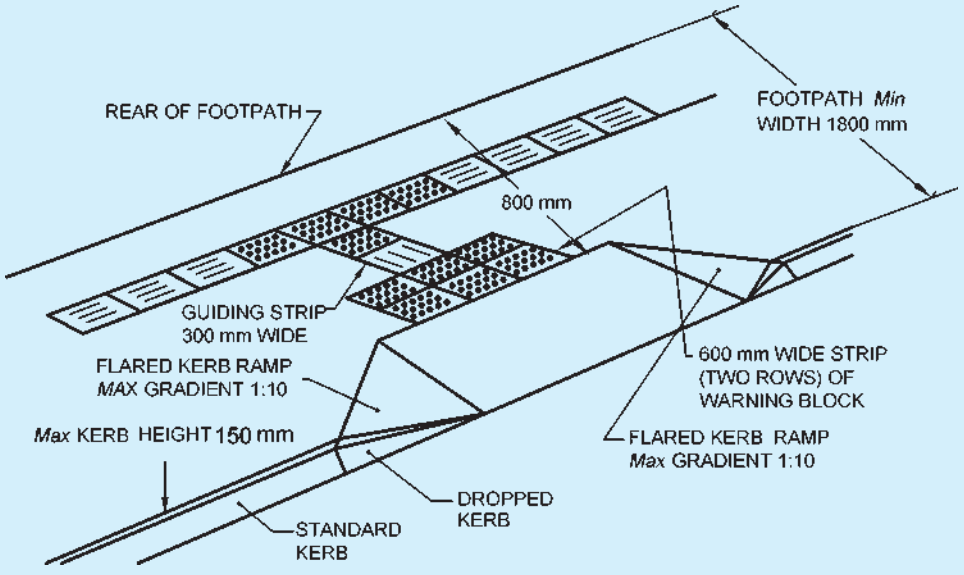


FIG. 29 KERB EXTENSION AT STREET INTERSECTION

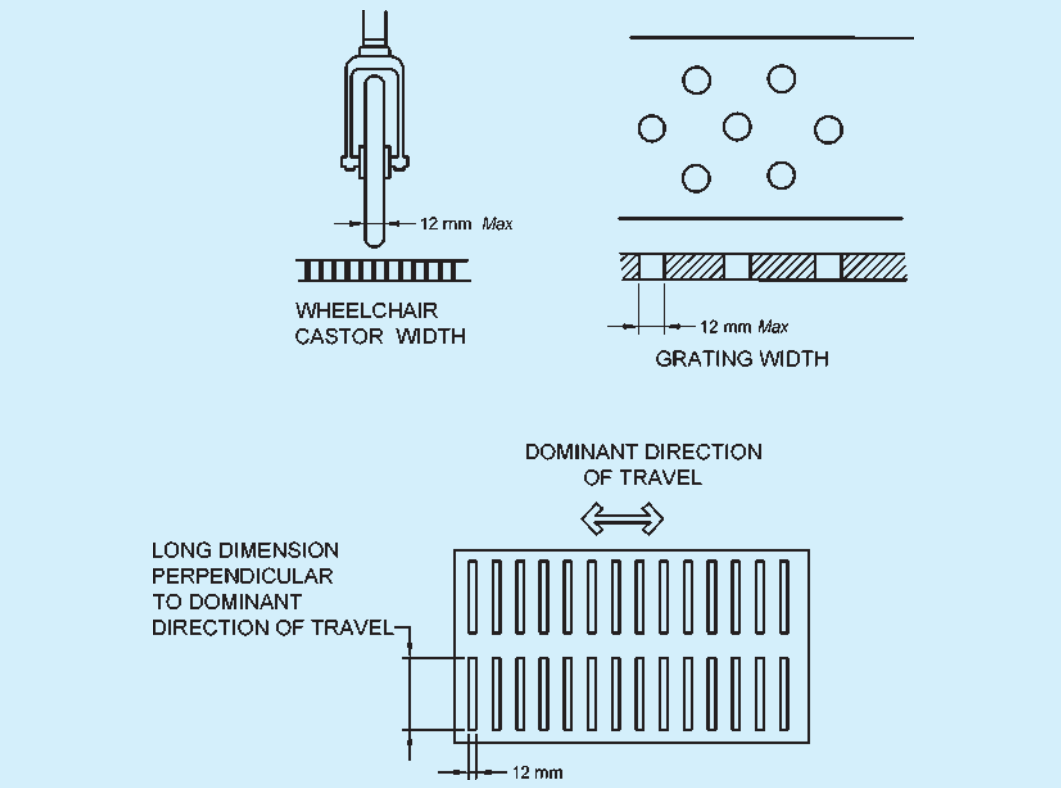
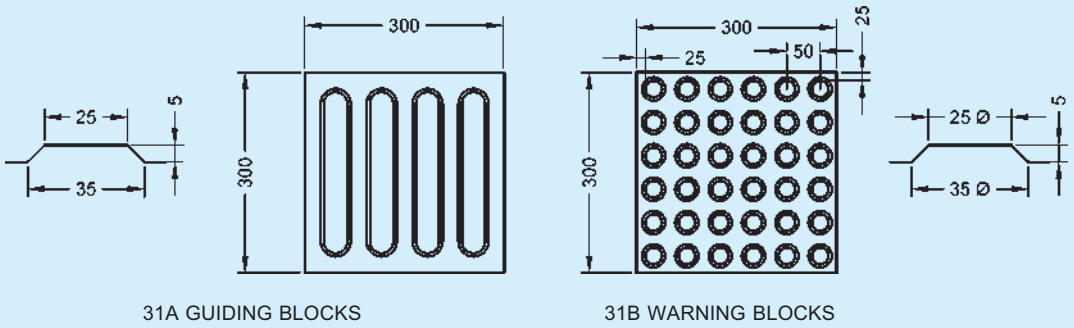


FIG. 30 INSTALLATION OF GRATING



All dimensions in millimetres.

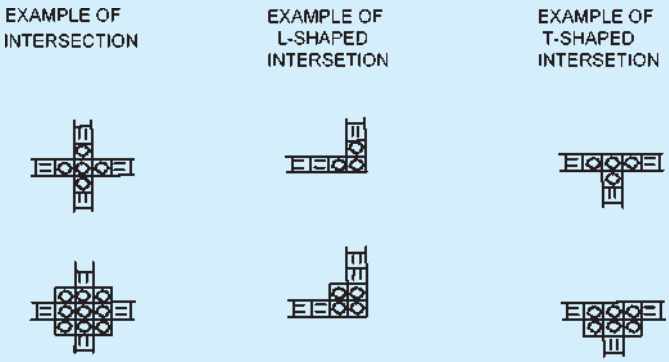
FIG. 31 TACTILE GROUND SURFACE INDICATORS (TGSI)

approaching potential hazard or a change in direction of the walkway, and serve as a warning of the approaching danger to persons with visual impairments, preparing them to tread cautiously and expect obstacles along the travel path, traffic intersections, doorways, etc. They are used to screen off obstacles, drop-offs or other hazards, to discourage movement in an incorrect direction, and to warn of a corner or junction. Two rows of tactile warning tiles shall be installed across the entire width of the designated accessible pathway, before intersections, building entrances, level changes, obstacles such as trees, and each time the walkway changes direction. Warning blocks shall be placed 300 mm from the beginning and end of the ramps and stairs, at landings and entrance to any door.

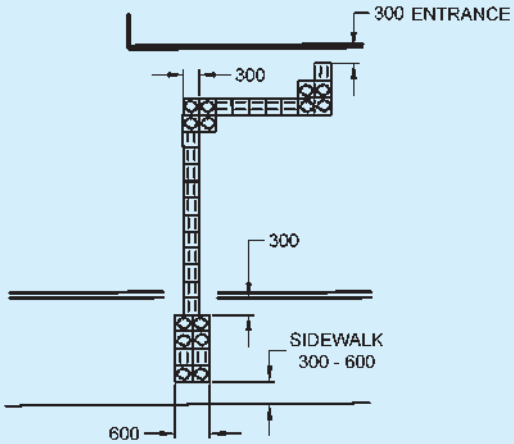
B-2.5.3 *Places to Install TGSI* (*see* Fig. 32 *and* Fig. 33)

TGSI shall be installed at following places:

a) In open space to orient persons with vision impairment;
b) In front of an area where traffic is present;
c) In front of an entrance/exit to and from a ramp, staircase or multi-level crossing facility;
d) Entrances/exits at public transport terminals



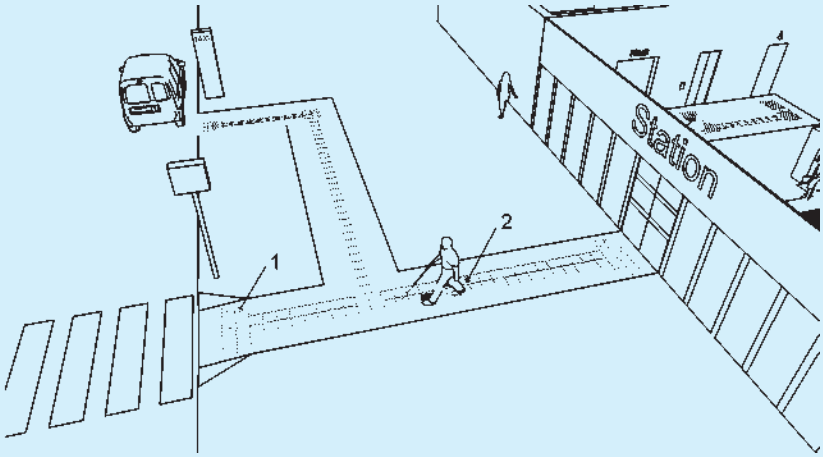
32A ARRANGEMENT OF GUIDING BLOCKS FOR PERSONS WITH VISUAL IMPAIRMENT



All dimensions in millimetres.

32B GUIDING PATH AND APPROACHING SIDEWALK TO THE BUILDING

FIG. 32 INSTALLATION OF TGSI



Key

1 Tactile ground surface indicator as attention pattern for decision points or hazards

2 Tactile ground surface indicator as guiding pattern

FIG. 33 EXAMPLE OF TACTILE GROUND SURFACE INDICATORS USED IN OPEN AREAS

or boarding areas;

e) Sidewalk/footpath section of an approach road to a building; and
f) From a public facility to the nearest public transport station.

B-2.6 Barriers and Hazards

B-2.6.1 Obstacles, such as objects or signs mounted on walls, columns or free-standing supports along the walking path shall be avoided. Unavoidable free standing posts or columns within access routes on pathways shall leave at least unobstructed walking width of 1 000 mm and be clearly marked with visual indicators. Visual indicators at least 75 mm in height with a minimum visual contrast of 30 points difference in the LRV value of the colours to the background shall be placed; one at a height between 800 mm and 1 000 mm above floor level, and the other between 1 400 mm and 1 600 mm above floor level.

Bollards, short vertical posts generally arranged in a line to guide traffic and protect from vehicle intrusions, shall have a maximum height of 1 000 mm. Bollards, where installed within the access route shall have a minimum clear spacing between them of 1 000 mm so as to provide clear passage width for movement of wheelchairs.

B-2.6.2 *Protruding Objects*

Unavoidable protruding objects shall not reduce the minimum clear width of an accessible route or manoeuvring space. Protruding objects in the access route shall contrast visually with the background environment.

Objects with a height lower than 1 000 mm can create a hazard for blind or partially sighted people. Permanent equipment that cannot be located outside the boundaries of a path shall be,

a) designed to be easily seen with a minimum difference in LRVs of 30 points to the background;
b) shielded to protect against impact; and
c) accompanied by a feature that warns of the presence of a potential hazard and is detectable for a person using a white cane or stick (*see* Fig. 34).

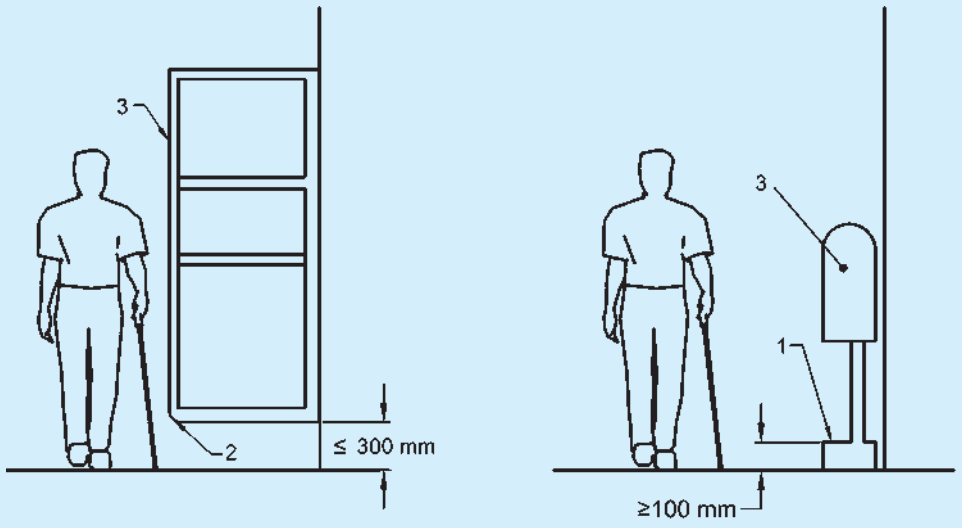
The headroom along a path shall be maintained at a height of not less than 2 100 mm above the surface of the path.

Any objects projecting more than 100 mm between 300 mm and 2 100 mm above ground level into an access route shall be clearly visible and detectable with a cane (*see* Fig. 34).

When a projecting obstacle exists, a protective guard shall be provided at ground level, under the projecting object, such as, a kerb or fixed element at a height of 100 mm-300 mm as cane detection. Cane detection shall not be set back more than 100 mm from the face of the projecting object. Wing walls, side partitions, alcoves or recesses are solutions for projecting elements where free space under the object is needed. Winged protection shall extend continuously between 300 mm and 1 000 mm above the floor and shall contrast visually with the background.

B-2.6.3 *Headroom*

Where headroom is less than 2 100 mm from the



Key

1 Base plinth detectable with cane if a projecting object is more than 100 mm above floor level
2 Winged protection between 300 mm and 1 000 mm above floor level, contrasting visually with the background and detectable with a cane
3 Difference in light reflectance value to background – minimum 30 points

FIG. 34 SOLITARY OBSTACLES

finished floor level, a warning guardrail or other suitable barrier shall be provided for detection, having its leading edge at or below 680 mm above the finished floor level, such as to enable easy detection with a white cane (*see* Fig. 35).

B-2.6.4 *Identification*

Appropriate identification of specific facilities within a building used by the public is particularly essential to the persons with visual impairments. Raised letters or numbers shall be used to identify rooms or offices. Such identification shall be placed on the wall, to the left of the door, preferably at a height of 1 500 mm from the floor and comply with the requirements given in **B-24**.

B-2.6.5 *Warning Signals*

Following requirements with respect to warning signals near barriers shall be complied with:

a) Audible warning signals shall be accompanied by simultaneous visual signals for the benefit of those with hearing disabilities.

b) Visual signals shall be accompanied by simultaneous audible signals for the benefit of the blind and visually impaired people. To assist blind people, lettering and symbols on signs should be raised for tactile reading.

c) Information based on colour codes only should be avoided; colour blind people may find them difficult to understand.

d) Signs should be designed, located and illuminated as per **B-24**.

B-2.6.6 *Hazards*

B-2.6.6.1 Where hazards on the direct line of pedestrian travel such as stairs, escalators and moving walks or ramps with a slope of more than 1:16 cannot be avoided, tactile warning indicators and visual markings shall be provided. Every effort shall be exercized to obviate hazards to persons with disabilities.

B-2.6.6.2 Access panels in walls or manholes in walks, may be extremely hazardous, particularly when in use/ open, and shall be avoided. When manholes or access panels are open and in use, or when an open excavation exists on a site, particularly when it is in proximity of normal pedestrian traffic, barricades shall be placed on all open sides, and warning devices shall be installed.

B-2.7 Lighting for Walkways

Lighting for walkways shall be as given below:

a) Lighting should illuminate the walkway; lighting fixtures not exceeding a height of 4 m from ground level should be provided.

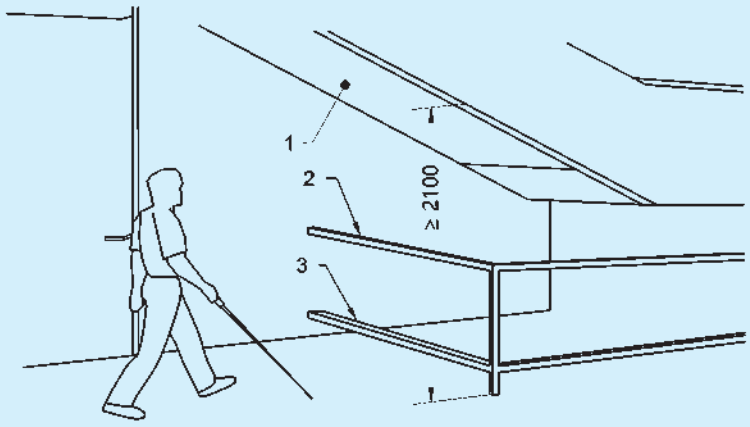
b) Lighting shall be provided every 20 m to 30m, focusing light not on the car lanes, but on the walkways.

c) A white light source, for example high-pressure sodium, is preferable in city and town centres for the aesthetic effect and for better colour definition, which benefits those with poor sight.

d) White lighting at average 35 to 40 lux is recommended to ensure colour contrast of tactile blocks and to ensure visibility at night to persons with low vision.

e) Light pole may preferably be located within the tree-planting zone.

f) Lower level light poles are preferred to avoid shadow where there are high trees.



Key
1 Minimum 2100 mm clear height
2 Guardrail against impact, at a height 680 - 700 mm above floor
3 Guardrail detectable with cane, at a maximum height 300 mm above floor

All dimensions in millimetres.

FIG. 35 WARNING GUARDRAIL IN CASE OF INSUFFICIENT HEADROOM

B-3 DESIGNATED ACCESSIBLE PARKING SPACE

B-3.1 Location of Parking

The designated accessible parking spaces that serve a building shall be located as near as possible to the main entrance, and the distance from the accessible parking space to the main entrance shall not be more than 30 m. In case the access is through lift, the parking shall be located within 30 m of the lift lobby. Kerb ramp from parking space to an adjacent higher pedestrian path shall be provided in accordance with **B-3.6**.

Where indoor parking is provided, a suitable passenger lift or separated pedestrian ramp shall be installed to provide access from the parked vehicle to the principal entrance of the building or buildings served by the car parking.

B-3.2 Number of Designated Accessible Parking Spaces

The following minimum requirements concerning the number of parking places shall apply:

a) A minimum of one accessible designated parking space shall be provided in every parking area;
b) For up to 10 parking spaces, one designated accessible parking space shall be provided;
c) For up to 25 parking spaces, two designated accessible parking space shall be provided;
d) For up to 50 parking spaces, three designated accessible parking spaces shall be provided;
e) For up to 100 parking spaces, four designated accessible parking spaces shall be provided;
f) For up to 200 parking spaces, six designated accessible parking spaces shall be provided; and
g) For over 200 parking spaces, six designated accessible parking spaces for 200 parking spaces and one for each additional 100 parking spaces shall be provided.

In specialized facilities such as health care facilities, shopping areas and recreational facilities, a greater number of designated accessible parking spaces should be considered.

B-3.3 Signage for Parking

Signage for designated accessible parking spaces shall meet the following requirements:

a) International symbol of accessibility shall be displayed at approaches and entrances to car parking to indicate the provision of accessible parking lot for persons with disabilities within the vicinity.
b) Directional signs consisting of arrows combined with the international symbol of accessibility shall be placed along the route leading to the accessible parking lot (*see* Fig. 36).

FIG. 36 DIRECTIONAL SIGNAGE LEADING TO DESIGNATED ACCESSIBLE PARKING SPACES

c) Directional signs shall also be displayed to direct persons with disabilities to the accessible parking lot at points where there is a change of direction, or where the location of the accessible parking lot is not obvious or is distant from the approach viewpoints.
d) Accessible parking lot shall be identifiable by the International Symbol of Accessibility placed vertically. The signs shall not be obscured by a vehicle parked in the designated lot.
e) A vertical sign shall be provided, and to make it easily visible, the sign shall be at a minimum height of 2 100 mm. This height is to ensure that the sign does not get hidden behind large vehicles in the parking (*see* Fig. 37).

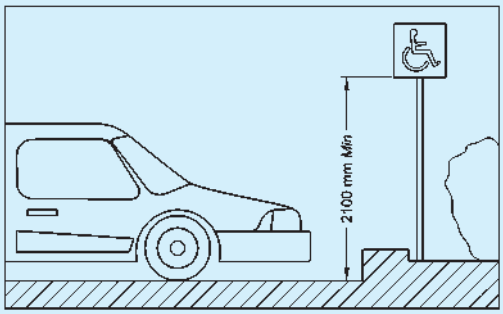


FIG. 37 VERTICAL SIGN AT DESIGNATED ACCESSIBLE PARKING SPACES

f) International symbol of accessibility shall be clearly marked/painted on the floor surface of the designated accessible parking lot for

drivers/riders with disabilities only. The symbol painted on the designated lot shall comply the following:

1) A square with dimensions of at least 1 000 mm but not exceeding 1 500 mm in length;
2) Located at the centre of the parking lot; and
3) Colour of the symbol shall be in contrasting colour scheme of blue and white (*see* **B-24.2.16** and Fig. 105).

B-3.4 Car Park Entrance and Parking Controls

The car park entrance shall have a height clearance of at least 2 600 mm.

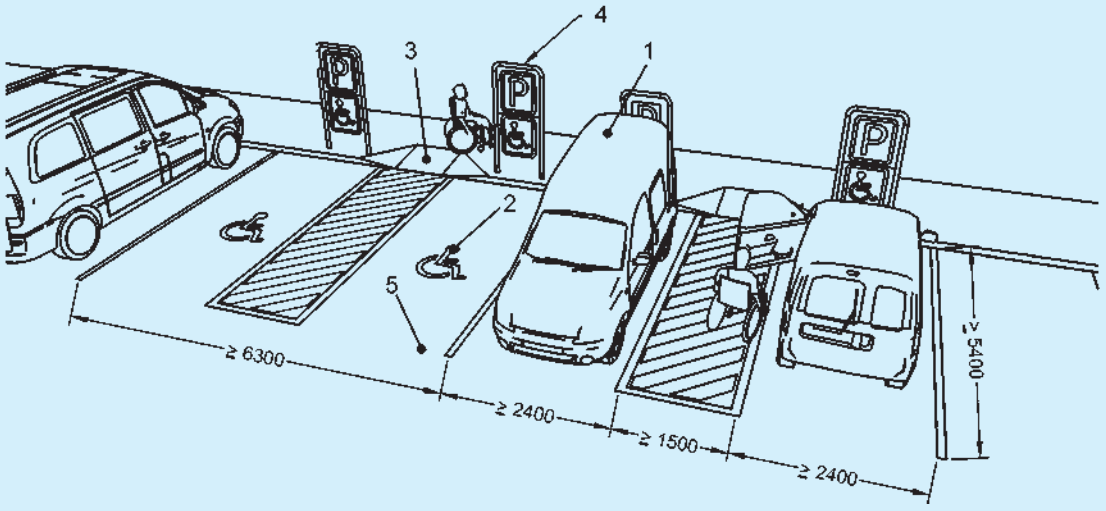
If payment machine is provided, it shall provide all control at the height between 800 mm and 1 000 mm (*see* **B-7**).

Access to the machine shall be level along an accessible route and easy to operate. The machine shall be located so that it does not create a hazard or barrier for persons with disabilities.

B-3.5 Accessible Car Parking Space Dimensions and Surface Requirements

The accessible car parking space shall meet the following requirements:

a) The minimum width of the parking space for a car shall be 3 900 mm and the minimum length shall be 5 400 mm. This minimum width includes the transfer area beside the car with a minimum of 1 500 mm.
b) Two accessible parking spaces with one shared transfer area are widely used and shall have a minimum width of 6 300 mm (*see* Fig. 38).
c) It shall have a firm, level surface without aeration slabs.
d) Wherever possible, it shall be sheltered.
e) The transfer zones, both on the side and the rear should have yellow or white cross-hatch road markings (*see also* Fig. 38).
f) The designated accessible parking spaces shall be located on a gradient not greater than 1:50, throughout its length and its width.
g) The accessible route of 1 200 mm width shall be provided for wheelchair users to pass behind vehicle that may be backing out (*see* Fig. 39).
h) *Parking space along the footpath/sidewalk* — For road side parking of an accessible van, the minimum dimensions shall be 9 000 mm × 2 400 mm with a kerb to access the nearest footpath/sidewalk (*see* Fig. 40).
j) *Van parking with auxiliary movable ramps* — The size and design of accessible vehicles may



Key
1 Minimum unobstructed height for vans 2 600 mm
2 Symbol of accessibility
3 Kerb ramp
4 Signage, including symbol of accessibility
5 Firm ground

All dimensions in millimetres.

FIG. 38 ACCESSIBLE PARKING SPACES ACCESSIBLE PARKING SPACES WITH ONE SHARED TRANSFER AREA

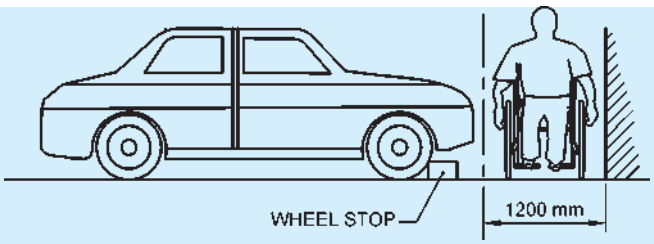
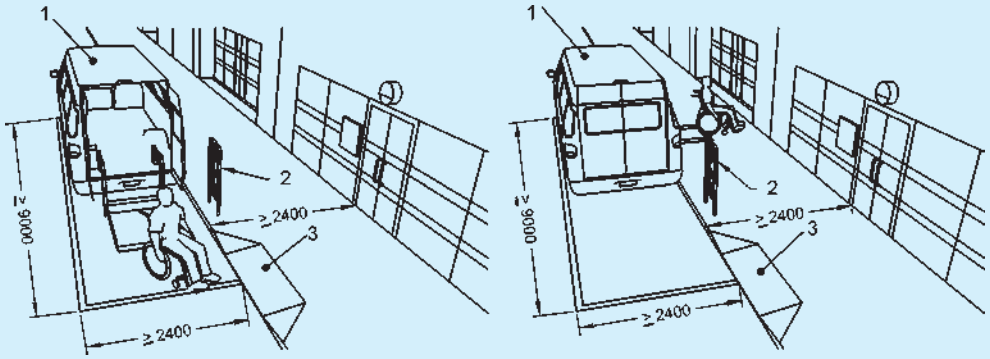


FIG. 39 ACCESSIBLE ROUTE WIDTH FOR WHEELCHAIR USERS TO PASS BEHIND A PARKED VEHICLE



Key

1 Minimum unobstructed height — 2 600 mm
2 Signage, including symbol of accessibility
3 Kerb ramp

All dimensions in millimetres.

FIG. 40 PARKING SPACE ALONG A FOOTPATH/SIDEWALK

vary as some are fitted with ramps or hoists at the side or at the rear. The minimum width of the accessible parking space for a van shall have at least the same dimensions as for car parking spaces (*see* Fig. 37). Transfer areas between spaces may be shared.

For multi-purpose vehicles with hoists or lifts, more space is needed; at least an additional 2 400 mm area beside the van and/or at the rear of the van may be required. The dedicated parking space in this case shall be 4 800 mm wide and 9 000 mm long (*see* Fig. 38 and Fig. 40 for different types of designated parking spaces).

As an alternative, a parking space of 2 400 mm wide × 9 000 mm in length along a footpath may be used, provided the footpath is at least 2 400 mm wide as shown in Fig. 39.

B-3.6 Kerb Ramp from Parking Space to an Adjacent Higher Pedestrian Path

The kerb ramp should be located in close proximity to the designated accessible parking area connecting the accessible path of travel to the main entrance. The kerb ramp width should be a minimum of 1 000 mm. The gradient of the kerb ramp should consider the requirements in **B-2.3**. Kerb ramps shall have a slip-resistant surface. The accessible path to the kerb ramp can be marked with hatching painted on the road surface to prevent people from parking in this area (*see* Fig. 38).

B-4 APPROACH TO THE BUILDING

The entry to the building shall be facilitated by the following:

a) Space should be provided for passenger drop-off points for taxis, public transport and also for large vehicles such as vans, etc, as near as possible to the main accessible entrance. Vehicle drop-off areas should be a minimum of 9 000 mm in length, have a minimum width of 3 600 mm and be served by a kerb ramp.

b) At least one accessible route leading to an accessible entrance of the building shall be provided from the alighting and boarding point of taxi stands and car park lots (*see* **B-3**) for people with disabilities.

c) If there is a difference in level between the carriageway and the footpath, a kerb ramp conforming to **B-2.3** shall be provided to facilitate the setting-down of people close to

the main entrance of a building. This benefits people who need to transfer to and from a wheelchair and others.

An appropriate tactile ground surface indicator (TGSI) should be provided to lead vision impaired persons to the main entrance where no other clues indicate the path to the building.

d) Building shall have all accessible entrance doors complying with **B-5.3**.

e) The accessible entrance, if different from the main entrance, shall be located adjacent to the main entrance and not at the rear of the building. The accessible entrance shall be clearly signed and easy to locate.

f) Symbol shall be displayed at all other non-accessible entrances to direct persons with disabilities to the accessible entrance.

B-5 ACCESS AT ENTRANCE AND WITHIN THE BUILDING

B-5.1 General Requirements

a) Access to the building entrance shall be in accordance with **B-4**.

b) A clear, firm and level landing of at least 1 800 mm × 1 800 mm shall be provided on either side of the entrance door.

c) The width of the accessible entrance door shall not be less than 900 mm and the width of the corridors or passageways leading to and from such access door shall not be less than 1 200 mm.

d) In multi-storey buildings, the accessible entrance shall have an accessible route leading to the lifts.

e) Internal floor surfaces shall be of materials that do not impede the movement of wheelchairs. If mat is provided it shall be in level with the floor finish.

f) Persons with visual impairments find it easier to locate doors if there is a texture difference in the floor around the doorway from the rest of the flooring. It is generally good practice to recess foot mats in the floor on either side of the door but care shall be taken to ensure that the top end of the mats are flush with the rest of the flooring.

g) In addition to the tactile pavers (TGSI) leading to the main entrances, beepers may be put at all main entrances to enable people with visual impairments to locate them.

h) Tactile layout plan of the building should be provided at the entrance for people with visual impairments.

j) Glazed entrance doors shall have manifestations on the glass as per **B-5.3.13**.

B-5.2 Internal Corridors and Accessible Routes

B-5.2.1 *General*

The main horizontal circulation design shall be level on each floor in order to ensure that the building is accessible to all people. Horizontal circulation shall be without steps. Where differences in level cannot be avoided, ramps or lifts shall be provided in accordance with **B-6**.

Buildings should be designed, constructed and managed so that the internal layout is accessible and easily understood. All aspects of horizontal circulation, including corridors, should be designed to facilitate ease of movement for all people.

In order to avoid a tripping hazard (especially during a fire evacuation), where a raised threshold is necessary at a door opening, its maximum height shall be 12 mm, and those exceeding 5 mm shall be bevelled, and shall have a minimum difference in LRV of 30 points compared to the floor.

Routes should preferably intersect at right angles to each other and be easy to follow. To facilitate people with visual impairments, routes should have detectable cues and different visual contrast from the surroundings. For orientation and wayfinding in very complex buildings and across large areas, guidance may be provided by tactile ground surface indicators and visual, audible and tactile information, including egress and evacuation.

NOTE — Handrails can provide support for people with impaired mobility, guidance for people who are blind or have impaired vision, and can also support Braille information or tactile information.

B-5.2.2 *Internal Passages*

Intensity in use of the corridor shall be a criterion when establishing the minimum width and length of the corridor (*see* Fig. 41). The minimum unobstructed width of corridors shall be 1 500 mm, with a preference for a width of 1 800 mm.

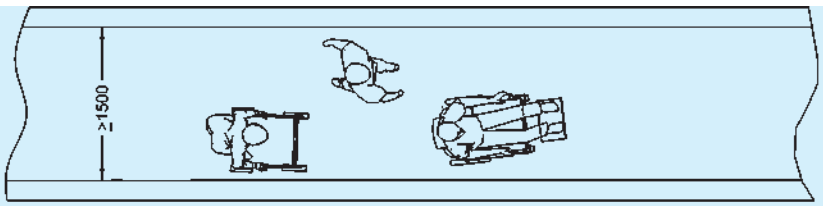
Where less than 1 800 mm wide, a corridor shall be provided with passing places, 1 800 mm wide and at least 1 800 mm in length at reasonable intervals. These dimensions shall be exclusive of handrails and any other projections, for example portable fire extinguishers, notice boards, etc.

Adequate circulation space, where a doorway exists, shall be provided (*see* **B-5.3**).

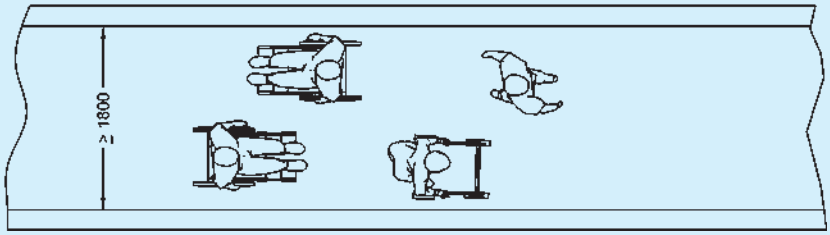
Changes of direction within a corridor shall have a turning circle with a diameter of 1 500 mm or more, clear of any obstructions (*see* Fig. 42).

The minimum clear height of corridors shall be 2 100 mm.

Hanging objects on walls should be avoided, except when they comply with **B-2.6.2**. The minimum unobstructed width shall remain 900 mm.



41A MINIMUM UNOBSTRUCTED WIDTH OF CORRIDOR



41B PREFERRED CORRIDOR WIDTH

All dimensions in millimetres.

FIG. 41 DIFFERENT CORRIDOR WIDTHS DETERMINED BY THE INTENSITY OF USE

B-5.2.3 *Turning Space for 90° Turn of a Wheelchair in Corridors*

The manoeuvring zone required for a wheelchair to make a 90° turn shall be designed according to Fig. 42.

It shall have no gradient, and it shall not be less than 1 500 mm wide and 1 500 mm long in the direction of travel.

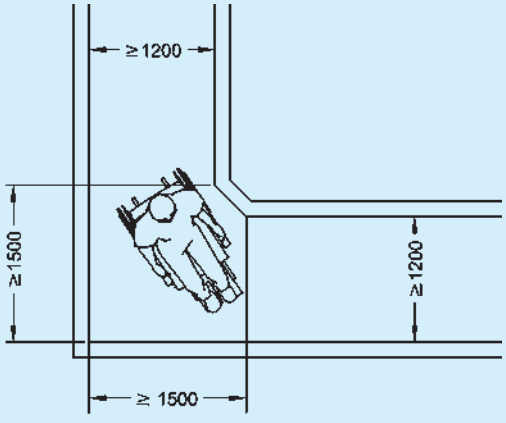
B-5.2.4 *Circulation Space for 180° Wheelchair Turn*

The space required for a wheelchair to make a 180° turn shall be not less than 2 000 mm in the direction of travel and not less than 1 800 mm wide.

For landing dimensions, *see* **B-6.2.6**.

B-5.2.5 *Resting Benches/Seats*

In long paths of travel resting areas shall be provided at frequent intervals not exceeding 30 m complying with **B-2.2.1** (g).



All dimensions in millimetres.

FIG. 42 SPACE REQUIRED FOR 90º TURN

B-5.2.6 *Protruding Object*

Obstacles, projections or other protrusions shall be avoided in corridors, passageways or aisles. Long paths of travel shall be avoided and resting areas shall be provided at frequent intervals not exceeding 30 m. For provision of unavoidable obstacles and protruding objects and protection therefrom, requirements given in **B-2.6** shall be followed.

B-5.2.7 *Floors in Corridors*

B-5.2.7.1 Floor surface shall be stable, firm, level and slip-resistant, preferably of matt finish and shall not have any projections, drops, or unexpected variation in level that may impede the easy access by persons with disabilities. Following requirements shall also be complied with:

a) Complex patterns shall be avoided.

b) Floor patterns that could be mistaken for steps, for examples stripes, shall not be used for floors in corridors.

c) Floors shall be levelled. If this is unavoidable, the slope of floors shall be no greater than 1:20. If greater slope is adopted, floor shall be designed as ramp.

B-5.2.7.2 For people with low vision, lines of brightly coloured fluorescent tape may be placed on the floor surface to assist mobility in poor lighted areas.

B-5.2.7.3 Carpeting should be avoided in circulation areas/accessible routes. In case, Where, carpets are used in circulations areas, they shall,

a) not be deeper than 12 mm;

b) shall be securely fixed;

c) have firm cushion, pad or backing; and

d) exposed edges of carpets be fastened to floor surface and trimmed along the entire length of the exposed edge.

B-5.2.8 *Lighting in Corridors and Manoeuvring Zone*

Lighting in the corridor and manoeuvring zone shall be even, diffused and without glare, reflections or shadows. Minimum illumination level at the corridor and manoeuvring zone shall be 100 lux.

B-5.2.9 *Doors Leading into Corridors*

Doors shall conform to **B-5.3** and shall not open outwards from rooms directly into a frequently used corridor, with the exception of doors to accessible toilets and service ducts. Where a door opens into an infrequently used corridor such as emergency exit, the corridor width shall allow a clear space of 900 mm within the corridor when the door is open. Such doors shall be located clear of any sloping floor surfaces in the corridor. Any door that opens towards a frequently used corridor should be located in a recess at least as deep as the width of the door leaf.

B-5.3 Doors

B-5.3.1 *General*

The doors shall meet the following general requirements:

a) Doorways shall be levelled.

b) Doorways shall be easy for people with vision impairment to locate and identify.

c) Wherever revolving doors or turnstiles are installed, they shall be supplemented with an alternate side-hung (swing type) door with 900 mm minimum clear opening width.

d) Bathroom (toilets/washroom) doors should swing out/should be two way opening type so that the person inside does not fall against the door and block it. In case there is not much space available, consideration should be given to the use of sliding or folding doors, which are easier to operate and require less wheelchair manoeuvring space.

e) Door should not be too heavy to operate and shall not require a force of more than 22 N to operate.

f) Automatic doors shall have a push button system to open them.

g) All external doors shall have warning blocks installed 300 m before the entrances for aid of visually impaired users.

h) The leading edge of any door that is likely to be held open, especially those which are opening into corridors or circulation areas, shall contrast visually with the remaining surfaces of the door and its surroundings on its both sides by a 25 mm wide high-contrast manifestation, to help identification by visually impaired people. The architrave/door frame shall also contrast visually with the wall surfaces surrounding the doorway.

j) Low-hanging door closers that remain within the opening of a doorway, when the door is open or that protrude hazardously into regular corridors or traffic ways when the door is closed, shall be avoided.

k) All glazed doors shall have a highly visible contrasting frame with manifestations in a contrasting colour complying with the requirements given in **B-5.3.13**. Colour should contrast with the background visible through the door, whether on the inside looking out or on the outside looking in.

m) Tactile warning should be provided at approach to automatic doors complying with **B-2.5**.

n) Automatic doors, where provided should have guard rails, power floor mats, push or kick plate, horizontal or vertical sensing device and the doors should remain fully open until area is cleared by user. Sliding automatic doors are safer than swinging automatic doors.

p) Doors which remain ajar are extremely hazardous for vision impaired people. Doors are best fully open or completely closed; therefore, where appropriate, automatic door closure devices should be considered.

q) Entrance shall be well illuminated with even lighting between entrance and reception area.

r) Door hardware shall comply with the requirements in **B-5.3.6**.

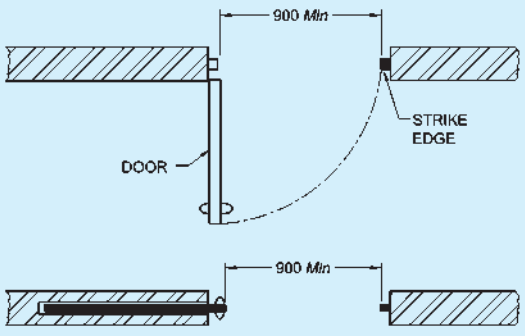
B-5.3.2 *Clear Width*

B-5.3.2.1 The minimum clear opening of doorways shall be 900 mm, measured between the face of the door and the face of the door stop with the door open at 90° as illustrated in Fig. 43.

B-5.3.2.2 In case, the door has two independently operated door leaves, at least one active leaf shall comply with **B-5.3.2.1**.

B-5.3.3 *Thresholds*

There shall be no thresholds (doorsills). If thresholds are unavoidable, they shall not exceed 12 mm and those exceeding 5 mm shall be bevelled and contrast visually



All dimensions in millimetres.

FIG. 43 MINIMUM CLEAR OPENING OF DOORWAYS

with the adjacent floor. A minimum difference in LRV of 30 points compared to the floor shall be provided.

B-5.3.4 *Manoeuvring Space at Doors*

To enable wheelchair users to approach doors, manoeuvring space as given below shall be provided. In narrow spaces, sliding doors may be preferable.

A minimum distance of 600 mm shall be provided beyond the leading edge of door to enable a wheelchair user to manoeuvre and to reach the handle.

Wheelchair manoeuvring spaces shall be free of any obstructions and be provided on the side of the door handle in the following manner (*see also* Figs. 44 and 45):

a) On the pull side, a minimum space of 600 mm;

b) On the push side, a minimum space of 300 mm; and

c) For two-way swing door, a minimum space of 300 mm.

B-5.3.5 *Two Doors in Series*

The minimum space between two hinged or pivoted doors in series, shall be 1 500 mm plus the width of the door swinging into that space, as shown in Fig. 46.

B-5.3.6 *Door Hardware*

Operable devices such as handles, pulls, latches and locks shall meet the following requirements:

a) They shall be operable by one hand.

b) They shall not require fine finger control, tight grasping, pinching or twisting to operate.

c) They shall be mounted at a height of 850 mm to 1 100 mm from the floor (*see* Fig. 47).

d) For easy identification by persons with visual impairment, all door furniture shall contrast visually with the surface of the door;

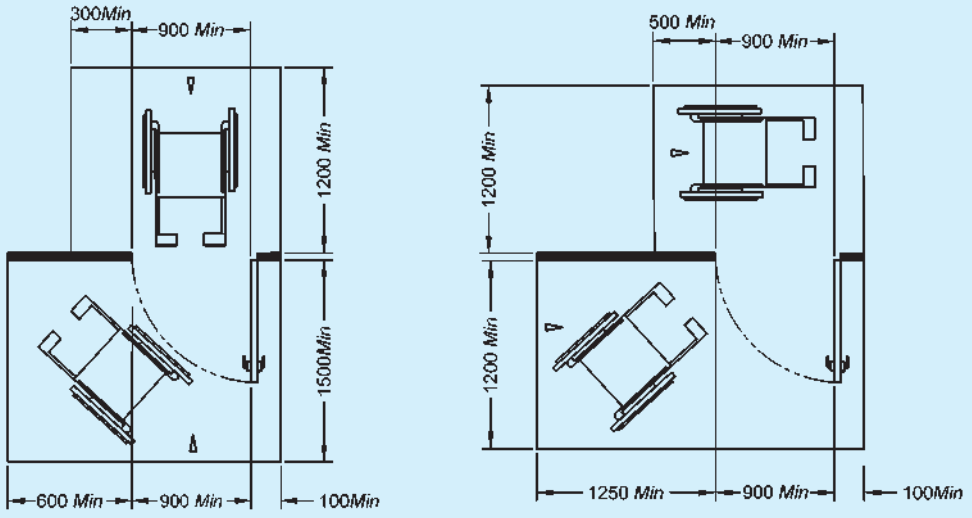
e) The location and design of latch and push/pull handles shall be consistent throughout a building.

f) To facilitate the closing of a door by wheelchair users (for example a water-closet compartment, that does not have a self-closing mechanism), the door shall have a horizontal handle, provided on the closing face of the door, approximately 760 mm from the floor.

B-5.3.7 *Door Handles*

The door handles shall conform to **B-7**. The following are recommended for door handles:

a) Push-pull mechanisms that require no grasping;



44A FRONT APPROACH

44B LATCH SIDE APPROACH

All dimensions in millimetres.

FIG. 44 MANOEUVRING SPACE NEEDED BY WHEELCHAIR USERS TO APPROACH DOORS

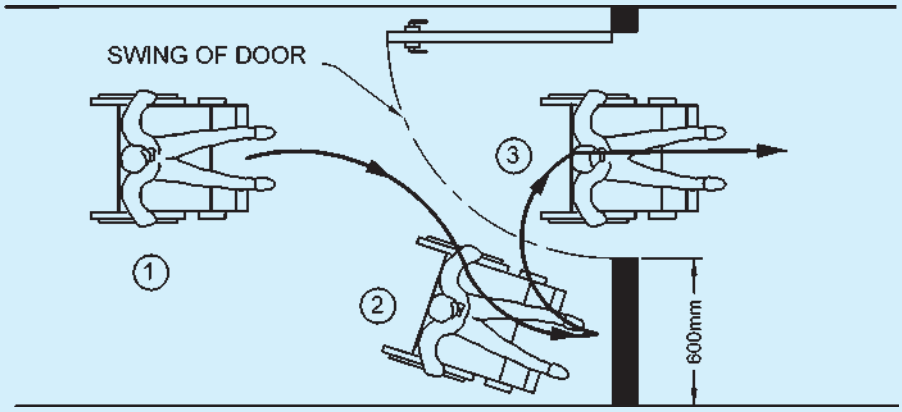
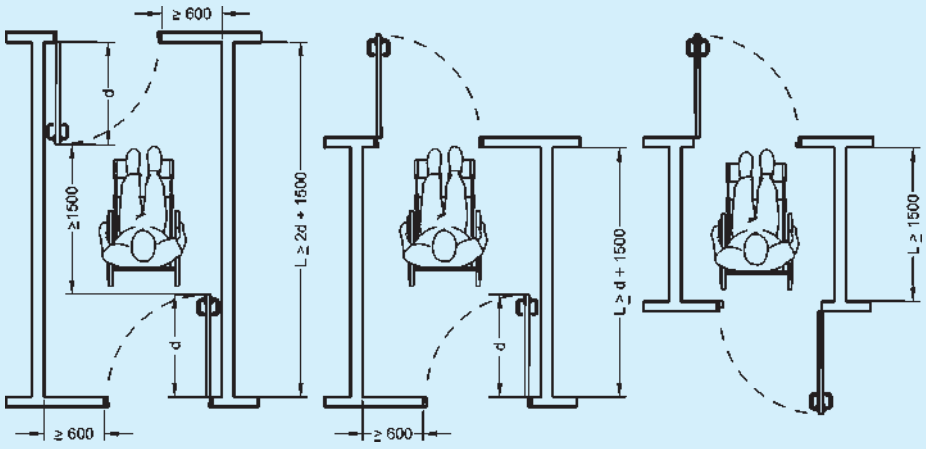
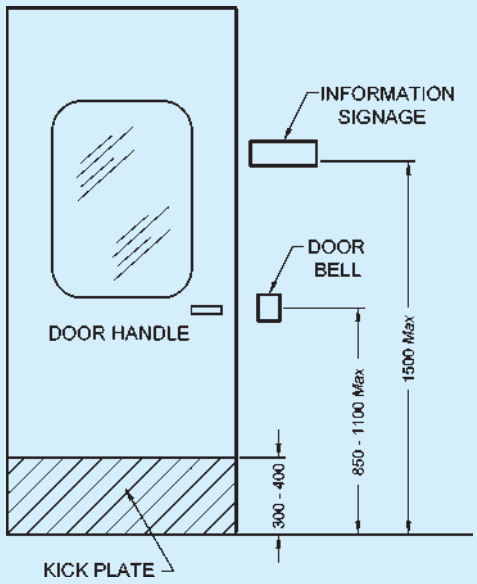


FIG. 45 POSITION TAKEN BY A WHEELCHAIR USER WHEN NEGOTIATING DOOR IN PASSAGE WAY



All dimensions in millimetres.

FIG.46 SPACE BETWEEN TWO HINGED OR PIVOTED DOORS IN SERIES



All dimensions in millimetres.

FIG. 47 DOOR HARDWARE LOCATION

b) Lever handles to be preferred on latched doors;

c) It is safer to use D-shaped handles as they reduce the risk of catching on clothing, or injuring from the exposed lever end; and

d) Doorknob is not recommended, as it does not provide adequate grip for persons with impaired hand functions.

B-5.3.8 *Sliding/Folding Doors*

Operating hardware should be exposed and usable from both the sides when the door is fully open.

B-5.3.9 *Door Closure*

The sweep period of the door should be adjusted, so that from an open position of 90°, the door does not take less than 3 s to move to a semi-closed position.

B-5.3.10 *Vision Panel*

All two-way swing doors or doors in general circulation areas shall be provided with vision panels giving a visibility from a height of 800 mm to 1 500 mm (*see* Fig. 48). This will enable both the wheelchair user and the ambulatory disabled to be noticed by a person on the opposite side in order to prevent him/her from being accidentally struck by the door.

B-5.3.11 *Kick-Plate*

Kick-plates of not less than 300-400 mm height are recommended for doors in high-use in order to protect the push side of doors from damage (*see* Fig. 47 and Fig. 48).

B-5.3.12 *Door Identification*

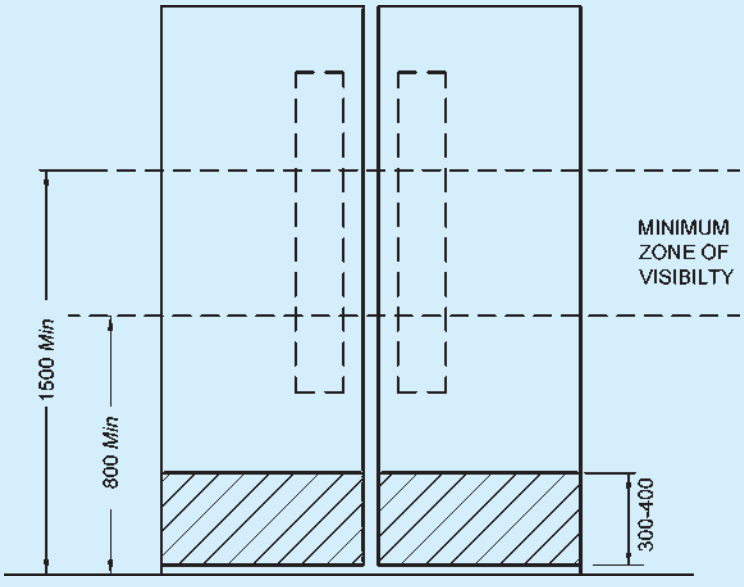
To help people with impaired sight to see doors, the door and frame should be in a colour which contrasts with the adjoining wall. The door shall not be of a highly polished/reflective material such as stainless steel.

B-5.3.13 *Glass Doors*

The presence of a glass door shall be made apparent, with permanent uninterrupted visual manifestation at two levels (hand and eye level), within 800 mm to 1 000 mm from the floor and within 1 400 mm to 1 600 mm from the floor, contrasting visually with the immediate background with a difference in LRV of 30 points seen through the glass in all light conditions (*see* Fig. 49). The width of the manifestation shall be minimum 75 mm. The edges of a glass door shall also be apparent when the door is open. An additional visual manifestation placed at a height of 100 mm to 300 mm is recommended (*see* Fig. 49). Visual manifestation consisting of two separate colours with a minimum difference in LRV of 60 points are recommended to enable lighting conditions and backgrounds to be taken into account.

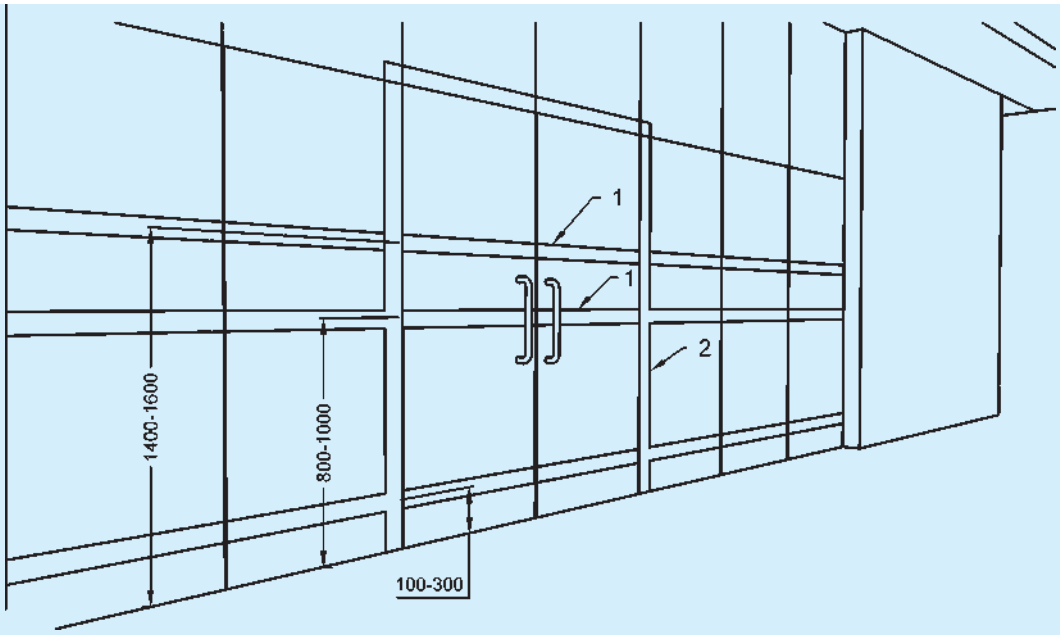
If a glass door is adjacent to, or is incorporated within, a fully glazed wall, the door and wall shall be clearly differentiated from one another, with the door more prominent. To achieve this, the door may be framed on both sides and also on the top by an opaque high-contrast strip at least 25 mm wide.

Glass that is silvered or highly reflective should be avoided and any free-standing edges of glazed screens should have a strip contrasting visually with the surroundings against which they are seen.



All dimensions in millimetres.

FIG. 48 VISION PANEL



Key

1 Visual marking (manifestations), minimum width 75 mm, two separate colours with a minimum difference in LRV of 30 points

2 Visual marking on door frame, minimum width 50 mm

All dimensions in millimetres.

FIG. 49 PERMANENT MANIFESTATION ON GLASS DOOR

B-5.4 Windows

The windows shall meet the following general requirements (*see* Fig. 50):

a) Windows shall have handles/controls in accordance with **B-7** and **B-5.3.7**.

b) They shall provide an unobstructed viewing zone for wheelchair users between 600 mm and 1 400 mm.

c) Curtain or venetian blind controls/ropes shall be at 800-1 000 mm height from the finished floor level for wheelchair users/short stature persons.

B-5.5 Handrails and Grab Bars

B-5.5.1 *General*

Handrails/grab bars are extremely important features and shall be designed to be easy to grasp and to provide a firm and comfortable grip so that the hand can slide along the rail without obstruction. Many persons with disabilities rely upon handrails/grab bars to maintain balance or to prevent serious falls. Handrails are used as a locational and mobility aid by persons with visual impairments and as a support for persons with mobility impairments. The handrail/grab bars shall be securely fixed to the wall. To aid identification, the colour of the handrail/grab bar shall contrast with the wall behind.

B-5.5.2 *Specific Requirements for Handrail*

B-5.5.2.1 Handrails shall (*see also* Fig. 51),

a) be securely fixed and rigid; the fastenings and the materials shall be able to withstand a minimum point load, both vertical and horizontal of 1.7 kN;

b) be slip-resistant with round ends;

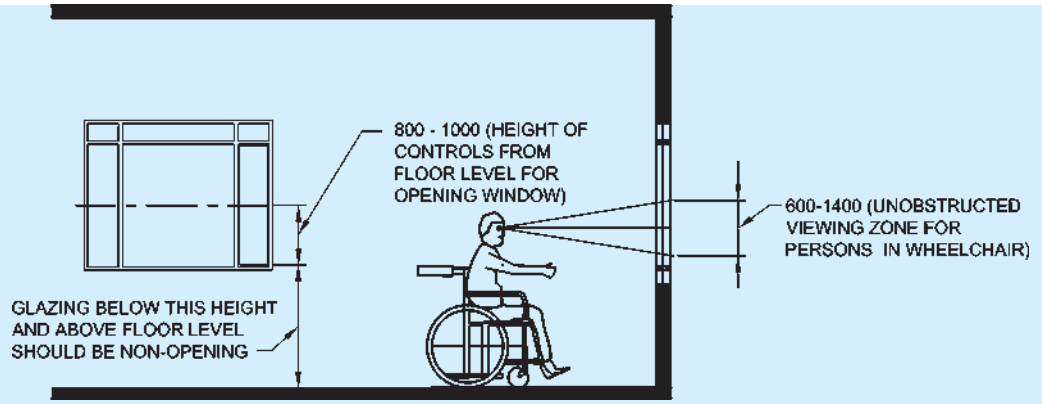
c) have a circular section of 38-45 mm in diameter;

d) be free of any sharp or abrasive elements;

e) have continuous gripping surfaces, without interruptions or obstructions that may break a hand hold;

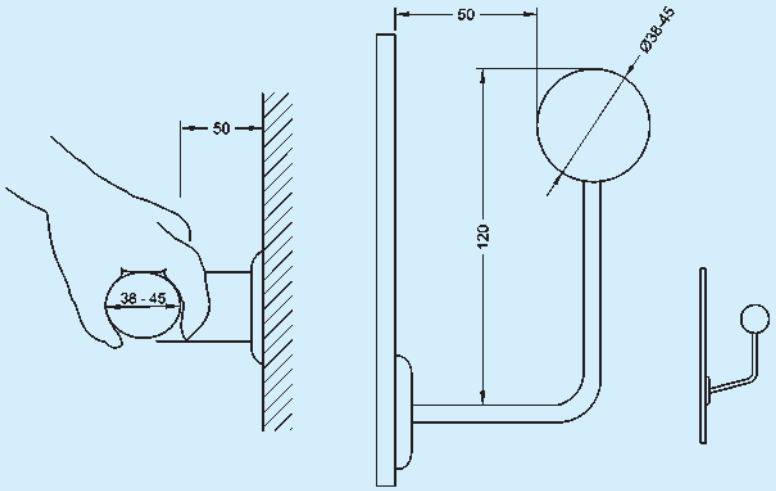
f) contrast with the wall behind; and

g) may be provided with Braille/tactile markings at the beginning and at the end to give information to people with visual impairment.



All dimensions in millimetres.

FIG. 50 REQUIREMENTS FOR WINDOWS



All dimensions in millimetres.

FIG. 51 HANDRAILS

B-5.5.2.2 For stepped path, stairs and ramps, handrails shall meet the following requirements (*see* Figs. 52, 53 and 54):

a) They shall be provided on both the sides;
b) They shall be continuous, even at the landings;
c) They shall extend at least 300 mm beyond the first and last nosing. A handrail shall not project into a transverse circulation path unless it is continuous and intended to form part of the guidance along that path. The end of the horizontal extension should be turned towards the wall on the closed side of the ramp or stairs, or be turned down and terminate at the floor or ground level.
d) They shall have a minimum clear space of 50 mm from the walls; and
e) The height to the top of a handrail shall be between 850 mm and 950 mm above the surface of a ramp, the pitch line of a stair, and the surface of a landing. A second handrail, with a lower profile than the first one, shall be provided. The height to the top of the second handrail should be between 650 mm and 750 mm above the surface of a ramp, the pitch line of a stair, and the surface of a landing. There shall be sufficient distance between the two handrails (say, 200 mm).
f) In case the handrail is enclosed in a recess, the recess shall extend at least 450 mm above the top of the rail.

B-5.5.3 *Grab Bars*

Grab bars shall,

a) be securely fixed and rigid;
b) be slip-resistant with round ends;
c) Preferably have knurled surfaces;
d) have a circular section of 38-45 mm in diameter;

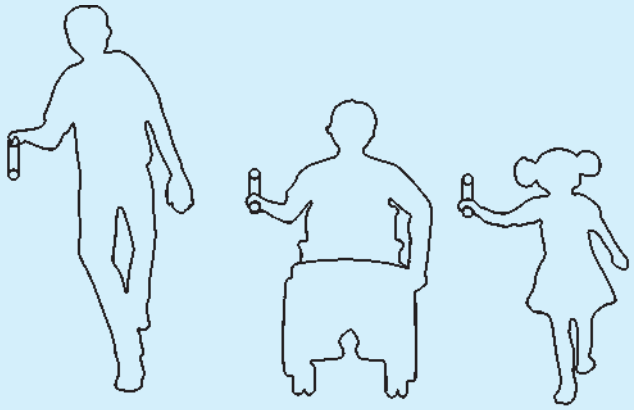
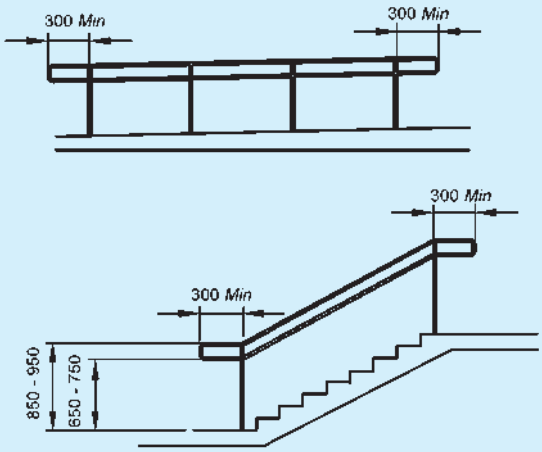
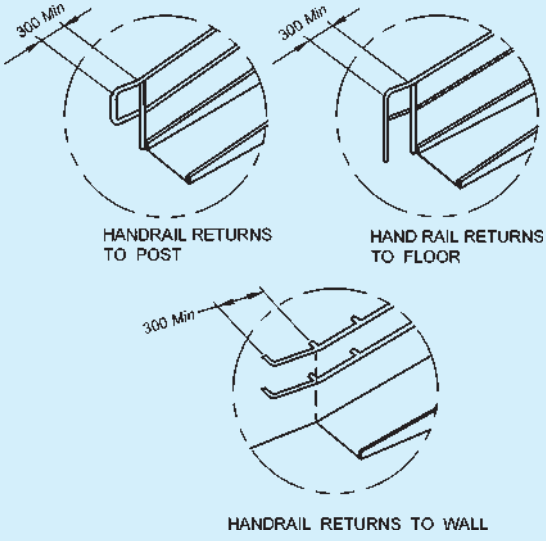


FIG. 52 HANDRAILS AT TWO LEVELS TO HELP CHILDREN AND PEOPLE WITH SHORT STATURE



All dimensions in millimetres.

FIG. 53 HANDRAILS FOR STEPS AND STAIRS



All dimensions in millimetres.

FIG. 54 TYPICAL HANDRAIL EXTENSIONS

e) be free of any sharp or abrasive elements;
f) have a minimum clear space of 50 mm to 65 mm from the wall;
g) be installed at a height of 700 mm to 900 mm;
h) be able to bear a weight of 1.7 kN; and
j) contrast with the wall/surface behind.

B-6 LEVEL CHANGES

B-6.1 General

Vertical circulation and level changes shall be designed, constructed and managed so that they can easily be understood and used by all people. Vertical circulation includes the provision of ramps, stairs and lifts, as well as escalators, moving walks and lifting platforms.

B-6.2 Ramps

A ramp is a sloping pathway leading from one level to another. Ramps of an appropriate design shall be provided at all changes in level other than those served by an accessible lift or accessible lifting mechanism accommodating the specific requirements of persons with disabilities.

B-6.2.1 *General*

Ramps allow persons with reduced mobility to move from one level to another. However, many ambulant persons with disabilities negotiate steps more easily and safely. Hence it is preferable to provide accessibility by both steps and ramps.

Ramps shall meet the following general requirements:

a) Wherever the rise of a ramp exceeds 300 mm, an additional flight of steps shall also be provided as described in **B-6.3**, shall be provided for ambulant persons. An isolated single step is not acceptable hence; a ramp is preferred to a single step.
b) Where there is a large change in elevation that requires multiple ramps and landing combination, other solutions such as lifts should be considered.
c) Ramps should not ideally connect straight to doors as wheelchair users need a levelled platform at the end of the ramp to manoeuvre and negotiate opening the door.
d) A curved ramp is not a preferred design solution. Similarly, a cross fall may put a wheelchair user at risk and may adversely affect steering, particularly on manually propelled chair.
e) Shiny, polished surface materials that cause glare shall not be used for ramps.
f) Single row of tactile warning blocks (TGSI) shall be placed as per **B-2.5** at the beginning and end of each ramp. This shall be placed 300 mm before the beginning and end of each ramp run to indicate the level change to visually impaired persons.

B-6.2.2 *Gradient*

The gradient shall be constant between landings. The minimum specifications for ramp gradients addressing different level differences are given in Table 10 (*see also* Fig. 55).

B-6.2.3 *Width*

The minimum clear width of a ramp (exclusive of handrails) shall be 1 200 mm and shall increase correspondingly as the level difference addressed by the ramp increases as per Table 10.

B-6.2.4 *Surface*

Ramps and landing surfaces shall be non-glary, smooth, level, even and slip resistant even when wet. Outdoor ramps and their surface shall be designed to prevent water from accumulating on the walking surfaces. The surface finish shall be hard and suitable for the volume of traffic that the ramp is likely to experience.

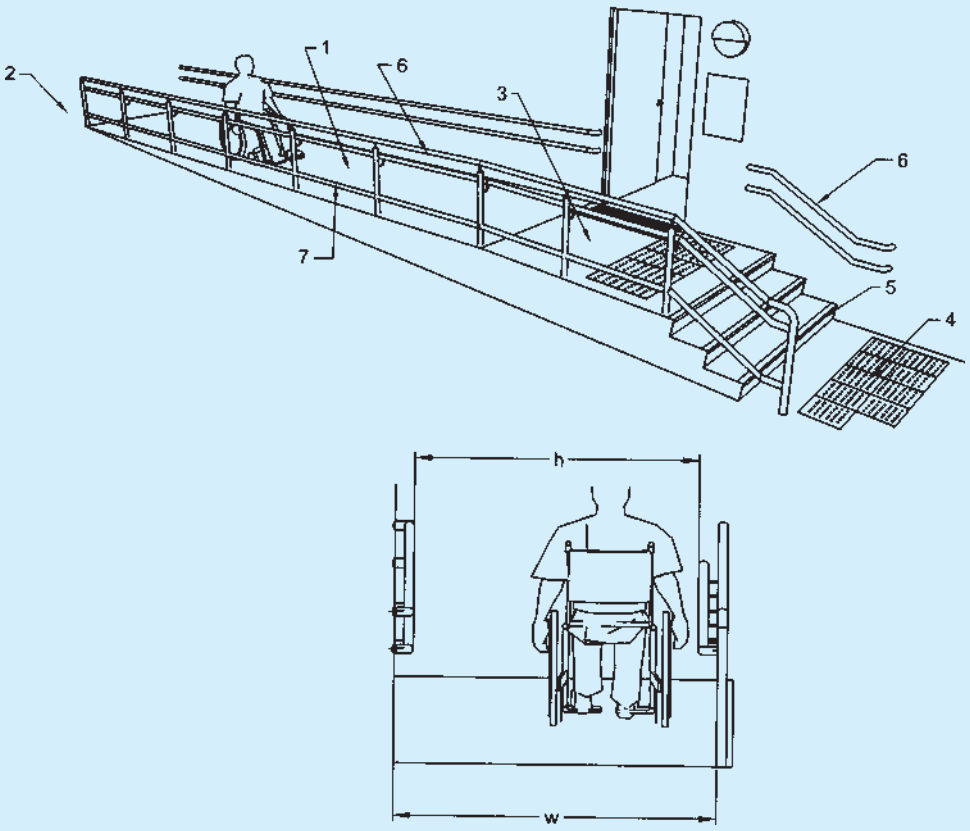
B-6.2.5 Internal ramps should, if possible, be avoided. Where required, internal ramps shall be designed in accordance with the following additional criteria:

a) No series of ramps should rise more than 2 000 mm in total. If this is the case, an alternative should be provided, for example a lift.

Table 10 Requirements for Ramp

(*Clause* B-6.2.2)

Sl No.	Level Difference	Maximum Gradient of Ramp	Ramp Width mm	Handrail on Both Sides	Other Requirements
(1)	(2)	(3)	(4)	(5)	(6)
i)	150 mm to 300 mm	1:12	1 200	√	—
ii)	301 mm to 750 mm	1:12	1 500	√	Landings after every 5 m of ramp run
iii)	751 mm to 3 000mm	1:15	1 800	√	Landings after every 9 m of ramp run
iv)	More than 3 000 mm	1:20	1 800	√	Landings after every 9 m of ramp run



Key
1 Ramp surface (*see* Table 10 for maximum slope and length)
2 Horizontal landing
3 Horizontal landing
4 Tactile ground surface indicator in front of stairs
5 Complementary stairs with markings
6 Handrails on both sides of ramp and stairs
7 Upstand, *Min* 150 mm
h Width between handrails
w Width of ramp surface

FIG. 55 EXAMPLES OF RAMP WITH SLOPE 1:20 AND HORIZONTAL LANDINGS AT BEGINNING AND END

b) An internal ramp should have the lowest practical gradient. In order to avoid trips and falls during a fire evacuation, a gradient of 1:15 should be the maximum permissible gradient within a building.

c) The minimum illumination at the top and bottom of the ramp should be 200 lux and 150 lux in between the bottom and top.

B-6.2.6 *Landings*

An end landing shall be provided at the bottom and the top of a sloped path, a stepped path, or a ramp and also where the run changes direction. The area of the end landing may be a part of the continuing path (*see* Fig. 56). The length of an end landing and an intermediate landing shall be not less than 1 500 mm. Where the ramp run changes direction, the minimum landing dimensions shall be 1 500 mm × 1 500 mm. The area of a landing shall be clear of any obstruction including the path of swing of a door or a gate.

Landings shall also be provided at regular intervals of not more than 9 000 mm of every horizontal run. It shall conform to other provisions of this annex if served by a doorway. If the end landing follows or precedes a turn for a pathway or an entrance, the minimum dimension of the landing shall be minimum 1 500 mm × 1 500 mm.

The width of ramp and consequently the dimension of landing in the direction perpendicular to the direction of ramp shall also be governed by the provisions of Table 10.

B-6.2.7 *Handrails for Ramps*

A ramp run with a vertical rise greater than 150 mm shall have handrails that are on both the sides and comply with **B-5.5.2**.

B-6.2.8 *Edge Protection/Guarding Along Ramps*

Ramps and landings not adjacent to a wall should have an edge protection in form of a 75 mm kerb. Guarding along ramps in pathway shall also meet the requirements in **B-2.2.6**.

B-6.3 Stairs

B-6.3.1 *General*

Steps and staircases are intended as an alternative to lift access in buildings and shall be of adequate design to allow all persons, with or without a disability, to travel safely and independently.

Stairs shall not be the only means of moving between floors. They shall be supplemented by lifts (*see* **B-6.4**) and/or ramps (*see* **B-6.2**). Staircases shall comply with the following general requirements:

a) The materials selected for the surface finish of the stairs shall be firm and slip resistant, especially if surfaces are likely to become wet due to location or use, or if spillage occurs. Slippery surfaces like granite, glazed tiles shall be avoided.

b) Shiny, polished surface materials that cause glare shall not be used for stairs or ramps.

c) Risers, treads, maximum number of risers per flight and minimum width of stairs shall be in accordance with **12.18**.

d) The riser of a step shall not be open.

e) The stairs landing shall be minimum 1 500 mm deep (*see also* **B-6.2.6)**. In case of one or two family dwelling units, it may be reduced to 1 200 mm.

f) Steps shall be of a consistent height and depth throughout the staircase.

g) Projecting nosing and open stairs shall not be provided to minimize the risk of stumbling.

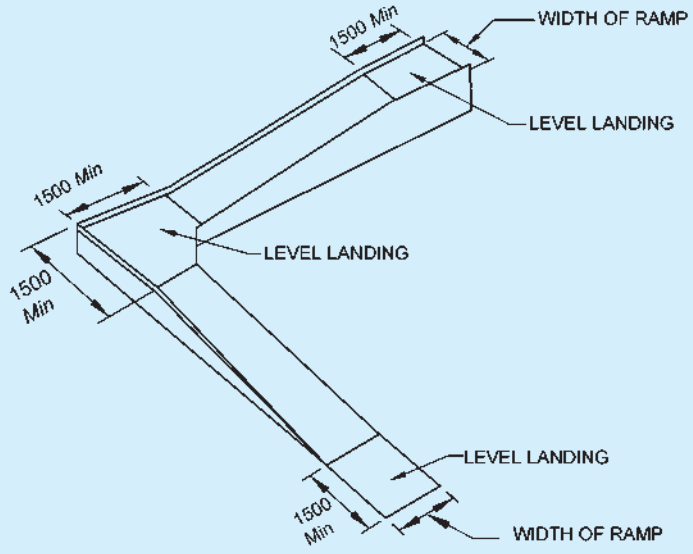
h) Spiral stairs shall be avoided.

j) Stairs shall have handrails comply with the requirements given in **B-5.5.2**.

B-6.3.2 *Tactile Warning Blocks (TGSI) for Stairs*

Tactile ground surface indicators (warning type) shall be installed 300 mm before the beginning and 300 mm after the end of each flight of steps to aid people with visual impairments. It shall be in accordance with **B-2.5**.

Tactile warning strips shall also be provided at landings. For landings leading to a floor or those enclosed by wall, railing or balustrade, tactile warning strips of 300 mm in width shall be provided; for those leading to an open space or the entrance/exit of a building, the tactile warning strips shall be 600 mm in width. In this case, Braille and tactile information signs shall be provided on the adjacent wall to indicate the presence



All dimensions in millimetres.

FIG. 56 LANDING DETAILS FOR RAMPS

of an opening. For a staircase with intermediate steps between two flights, the provision of tactile warning strips shall follow the same arrangement.

B-6.3.3 *Avoidance of Projection in the Stairs*

No appliances, fixtures or fittings shall project beyond 90 mm from the surface of any wall in a staircase below a level of 2 000 mm, measured above the treads of the staircase. If such a projection is unavoidable, the same shall also be extended downwards to the level of the treads. However, in no case the width of the staircase shall be less than that prescribed in **12.18**.

B-6.3.4 *Colour Contrasting and Illumination*

There shall be colour contrast between landings, and the steps. Step edges shall contrast in colour to the risers and the treads. Contrast colour bands 50 mm wide shall be provided on edge of the tread. Illumination level of minimum 150 lux shall be maintained on the stairs.

B-6.3.5 *Soffit*

Soffit of the stairs, shall be cordoned off either by building a wall in front of it or by putting handrails to guide persons around the space. It shall comply with the requirements of **B-2.6.3** related to headroom in circulations spaces (*see also* Fig. 35).

B-6.4 Lifts

B-6.4.1 *General*

It is recommended that in multi-storeyed buildings there be at least one lift accessible to transport persons with disabilities at all usable levels. Such lifts shall meet the following general requirements:

a) Lift shall be located on accessible routes.

b) Accessible landings at lift entrance shall be provided on each eligible floors.

c) Lifts shall be marked with the international symbol of accessibility.

d) Directional signs indicating the location of an accessible lift shall be provided at a location that is clearly visible from the accessible building entrance. The directional signs shall incorporate a representation of the International symbol of accessibility (*see* Fig. 57).

e) A sign indicating the number of the floor arrived shall be provided on each lift landing on the wall opposite the lift in big fonts with good colour contrast.

f) It is recommended to install a floor directory of the main facilities and services available on the lift landing, along with an accessible emergency egress route that clearly indicates the location of the nearest refuge area for persons with disabilities.

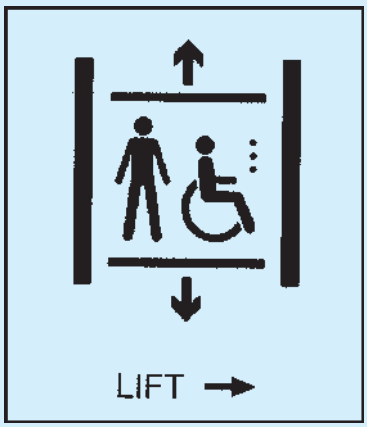


FIG. 57 WAY FINDING SIGNAGE FOR LIFT LOCATION

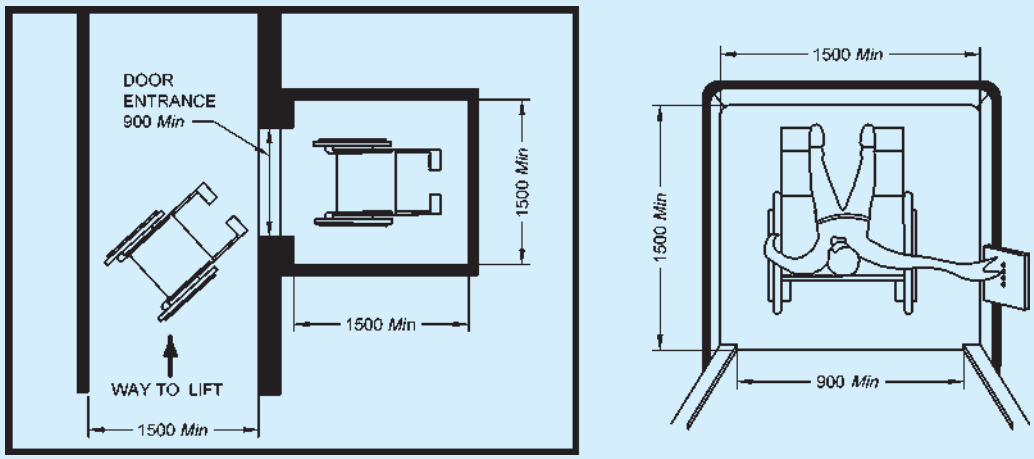
B-6.4.2 *Lift Size*

The minimum size of the lift shall be 1 500 mm wide by 1 500 mm deep, that allows easy manoeuvrability of wheelchair users (*see* Fig. 58).

B-6.4.3 *Lift Door*

The clear opening of entrance to the lift car shall be at least 900 mm. The doors shall be constructed as automatic horizontal sliding doors. The lift door shall be contrasting in colour from the adjoining wall. 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 building floor shall not be more than 12 mm.

A non-contact sensor device shall be provided in the door opening to detect an entering or exiting passenger or an assistive device and prevent the risk of the passenger or assistive device from being hit by the leading door panel(s). The sensor device shall cover at least 2/3 of the door height measured from a distance of 25 mm above the door sill. Time of closing of an automatic door shall be more than 5 s and the closing speed shall not exceed 0.25 m/s. The door opening time shall be adjustable to suit the conditions where the lift is installed. A mechanism to increase this time shall be installed to be customized by a user with mobility impairments (for example by means of a button outside the car to call the lift to the floor for it to arrive with extended door opening time, and a button marked with a wheelchair symbol inside the car with the same purpose). Under normal operation the levelling accuracy of the lift car shall be ±12 mm.

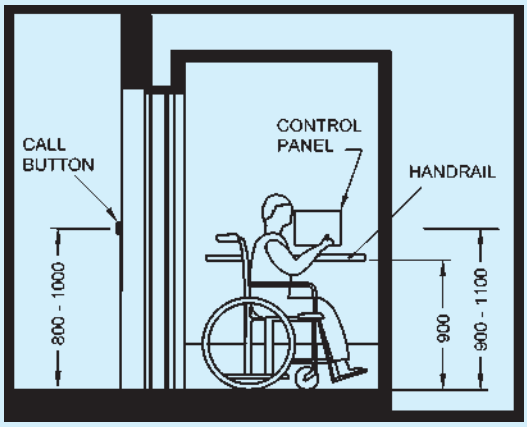


All dimensions in millimetres.

FIG. 58 LIFT SIZE

B-6.4.4 *Call Button*

The call button located outside the lift shall have a clear floor space of at least 900 mm × 1 200 mm with no obstruction placed to prevent a wheelchair user from reaching the call button and shall be installed at a height between 800 mm and 1 000 mm (*see* Fig. 59).



All dimensions in millimetres.

FIG. 59 PLACEMENT OF LIFT ACCESSORIES

B-6.4.5 *Control Panel*

Touch control panels shall not be used in any case as they are not accessible to visually impaired persons. The control panel inside the lift shall meet the following requirements (*see* Fig. 59):

a) It shall be placed at a height of between 900 mm and 1 100 mm from the floor level.

b) The control buttons may be placed either horizontally or vertically within this space.

c) It shall have buttons with Braille/raised letters and in sharp contrast from the background to aid people with visual impairments.

B-6.4.6 *Handrails*

Handrails shall comply with **B-5.5.2** and shall be placed at a height of 900 mm from the floor level. These shall be fixed on both sides and at the rear of the lift.

B-6.4.7 *Audio and Visual Indicators*

The lift shall have a voice announcement system along with a visual display to indicate the floor level and also the information that the door of the cage is open or closed for entrance or exit. The announcement system shall be clearly audible, that is, the announcement shall be of the order of 50 dB.

B-6.4.8 *Other Requirements*

In addition to the requirements given in **B-6.4.1** to **B-6.4.7**, following requirements shall also be complied with:

a) Internal walls shall have a non-reflective matte finish in a colour and tone contrasting with the floor.

b) The floor of the lift car shall be rigid and have a non-reflective matte finish and shall be slip resistant having similar frictional qualities to the floor of the lift landing to decrease the risk of stumbling.

NOTE — A lift floor with a high LVR reassures blind and partially sighted people that they are not stepping in to an open lift shaft.

c) The provision of a mirror on the wall of the lift car opposite the lift door is a positive aid to navigation for wheelchair users. It allows

the wheelchair user to see if anyone is behind them and also to see the floor indicator panel. The mirror should not extend below 900 mm from the lift floor to avoid confusing people with impaired sight.

d) Internal car lighting should provide minimum level of illumination of 100 lux at floor level, uniformly distributed, and avoiding the spotlights.

e) *Emergency warning* — The car shall have an alarm device (two-way communication system) permanently connected to a manned security point according to the following:

1) The device shall ensure voice communication in both directions with an organization in charge of passenger rescue or with the person in charge of the safety of the building.

2) The operating force for alarm button shall be minimum 2.5 N and maximum 5 N.

3) The device shall provide visual and audible information feedback for passengers confirming that, the alarm has been sent, using a yellow enlightened bell-shaped symbol; and the alarm has been received, voice communication established, using the green enlightened symbol consisting of two heads.

For other requirements, reference shall be made to good practice [3(8)].

B-6.4.9 *Use of Lifts for Fire Evacuation*

A fundamental objective of fire engineering design for egress is that there shall be alternative, safe and intuitive means of egress from the scene of a fire; these routes shall be available to all building users.

NOTE — Manual handling of wheelchairs occupied by their users in a fire evacuation staircase, even with adequate training for everyone directly and indirectly involved, is hazardous for the person in the wheelchair and for those people giving assistance. The weight of an average unoccupied powered wheelchair, alone, makes manual handling impractical. Evacuation chair devices can allow vertical movement on stairs of people with mobility impairments. Some evacuation chairs require a wheelchair user to transfer out of their own chair into the evacuation chair. This transfer operation requires manual handling (for example handling of one work colleague by others), and there is a risk of injury during the transfer process or if the wheelchair user uses an oxygen tube, or has a catheter or a colostomy bag. The transfer can also infringe the independence and dignity of the individual concerned.

Evacuation of occupants through assisted evacuation by use of fireman's lift should be planned while evacuation through designated lifts suitably planned and installed for use of occupants for safe evacuation are desirous to be provided.

Such lifts used for evacuation should be easily accessible, clearly identifiable and be suitably protected from the increase of smoke, heat and flame. The controls for the lift shall be located in the areas where users must wait and this area shall be designed to ensure a tenable environment provided during the entire time that the evacuation is taking place.

Such lifts should not be used for evacuation unless built for this purpose and suitably protected by the building design.

The fire evacuation shall comply with the requirements given in Part 4 'Fire and Life Safety' of the Code and lifts for evacuation including fireman's lift shall comply with the requirements given in Part 8 'Building Services, Section 5 Lifts, Escalators and Moving Walks: 5A Lifts' of the Code.

B-6.5 Escalators and Moving Walks

Escalators and moving walks are very common in public buildings. They can greatly facilitate circulation for all building users in large, extensive and complex modern building types.

However, the location of escalators and moving walks should always be considered in relation to the position of adjacent fire protected lift shafts and lobbies, staircases and their associated areas of rescue assistance.

During normal periods of maintenance and servicing, escalators and moving walks will not be operational.

In the event of a fire emergency, building users attempting to evacuate usually tend to re-trace their routes of entry, whatever the nature of the hazard and wherever it is located. It should be assumed that the electrical supply to escalators and moving walks is terminated or turned off during such emergencies.

For important reasons of safety, therefore, inclined moving walks should comply with the requirements for ramps in buildings with respect to slope and length.

For important reasons of safety, special warning notices and indicators shall be provided at the top and bottom of escalators where step rises reduce suddenly and dramatically when not operational.

Some individuals, in particular older people, might have more than one impairment. Some individuals are not able to use an escalator or moving walk independently and rely on assistance/support being provided by a companion.

Safety shall be the prime consideration when choosing or installing escalators and moving walks.

Lifts are the preferred method of vertical travel for most people with disabilities and in particular wheelchair users.

Persons with a wheelchair generally cannot use horizontal moving walks. An inclination of up to 6° will exclude a majority of wheelchair users from using a horizontal walkway independently. Hence, alternative, like an accessible battery carts, may be provided to them in appropriate cases. Moving walks shall be free of projecting objects and obstacles up to a height of 2 100 mm. A minimum level of illumination of 100 lux shall be provided on moving walks.

A surface of the escalator that contrasts visually with the approach and the use of audible signals or pre-recorded messages that indicate the start and finish of the escalator help blind and partially sighted people. Such signals or recording are not normally provided by the escalator manufacturer as standard.

Signs should be provided to indicate the location of other facilities, such as lifts, and these facilities should be in close proximity to the escalators and moving walks and be easy to find.

Reference shall also be made to other requirements given in **5.2** of Part 8 'Building Services, Section 5 Lifts, Escalators and Moving Walks: 5B 'Escalators and Moving Walks' of the Code.

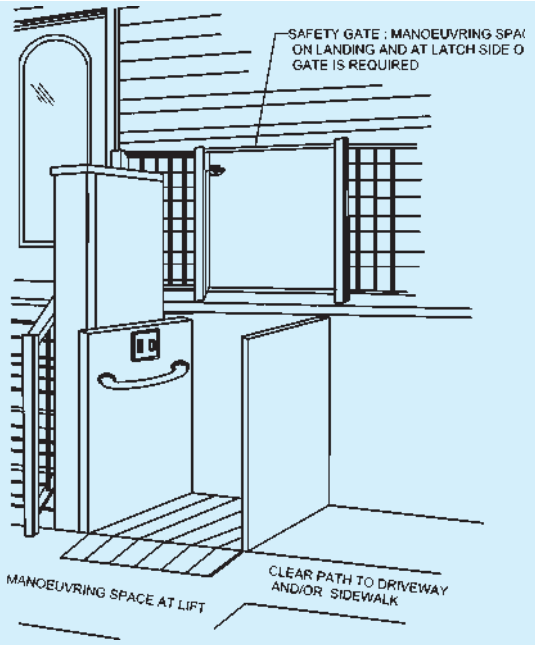


FIG. 60 VERTICAL LIFTING PLATFORMS

B-6.6 Vertical and Inclined Lifting Platforms

B-6.6.1 *General*

Where it is impracticable or impossible to provide an accessible lift or a ramp in an existing building, vertical or inclined lifting platforms should be provided as a reasonable alternative for vertical circulation within the building. These are special passenger elevating devices for persons with disabilities. These may have either vertical or an inclined movement. These shall be able to be used safely, independently and also with an accompanying person. All control devices shall also be accessible and usable for powered wheelchair and walking aids users. If driving, guiding or lifting mechanisms present hazards at the sides of a platform, the mechanisms shall be guarded to protect the users. The guarding shall be smooth, hard and continuous.

B-6.6.2 *Vertical Lifting Platforms* (*see* Fig. 60)

For maximum level changes of 2 500 mm, vertical lifting platforms may be installed. For level changes of more than 1 200 mm, the lift shall be placed in a closed structure with doors at different accessible levels. Vertical lifting platforms may have a variety of openings for entry and exit.

B-6.6.3 *Inclined Lifting Platforms* (*see* Fig. 61)

Inclined lifting platforms consist of three elements; a railing, an electric generator and a moving platform. The operating system of the lift may be lateral or suspended. Inclined lifting platforms may be installed along the stair wall as long as they do not obstruct the required width of the exit. The platform may be folded when not in use.

Platform lifts may be installed on all types of stairs including switch back stairs, that is, those with a rotation of 180° and spiral staircases. Inclined lifting platforms are usually used to connect one or more floors or to overcome split levels in existing buildings.

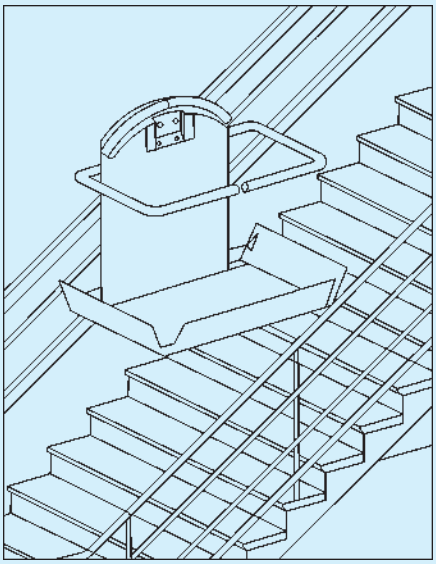


FIG. 61 INCLINED LIFTING PLATFORMS

B-6.6.4 *Platform Lift Dimensions*

The minimum width of the platform lift shall be 1 100 mm and the minimum length shall be 1 400 mm for the use of manual and powered wheelchairs with assistance.

In existing buildings of minor public importance and with few visitors, where sufficient space is not available, other dimensions may be considered, for example 900 mm × 1 250 mm.

B-7 OPERATING CONTROLS AND DEVICES

B-7.1 General

The design and construction of operating controls and devices should be such as to enable them to be operated safely and independently by everybody.

Operating controls and devices include, but are not limited to,

a) door handles and locks;
b) lever, mixer or cross-head taps;
c) activation devices;
d) window openers and locks; and
e) electric outlets and switches.

The operable part of controls shall be located adjacent to the clear floor space. Controls should be easy to use, for example by hands-free operation or by a closed fist or using the elbow. Minimum manual effort should be required, as for opening and closing doors.

All switches and controls should be easy to understand without requiring specialist knowledge.

Sufficient lighting of the control devices and all relevant information should be provided.

Round or oval type door knobs are not suitable for people with mobility impairment, for people of small stature or less strength, and for children.

The use of photoluminiscent pictogram signs shall be provided, where appropriate.

B-7.2 Location, Heights and Distances

Devices, controls (fuse boxes, switches, push-buttons, intercoms, etc), etc, shall be installed at an accessible height for reaching and operating, between 800 mm and 1 100 mm above floor level and shall be located at a minimum of 600 mm with a preference of minimum 700 mm, from any internal corner.

NOTE — As an exception, electrical wall socket outlets, telephone points and TV sockets can be located at a minimum height of 400 mm above floor level.

Requirements and recommendations on lifts landing controls and car controls shall be as per **B-6.4.4**, **B-6.4.5** and good practice [3(8)].

Control devices placed on a horizontal surface should be placed at a height between 800 mm and 900 mm and within 300 mm from the edge of the surface.

Reading metres should be located between 1 200 mm and 1 400 mm from the floor.

Heights of switches, socket outlets, reading controls and controls on a horizontal surface are illustrated in Fig. 62.

Safety provisions as given in Part 8 'Building Services', Section 2 'Electrical and Allied Installations' of the Code shall be followed.

Door handles should be placed according to Fig. 63. In Fig. 63, the figure on the left shows the height of a handle for pushing or pulling the door, the middle figure shows a vertical door handle, and the figure on the right shows an example of a pull rail that may allow a wheelchair user to close the door behind him, for example in a toilet.

If fire and safety related, all controls should be intuitive and obvious to use. Wherever, fire extinguishers are provided, one fire extinguisher should have a maximum weight of 5 kg or 6 litre or even less.

Fire alarm calls should be located between 1 000 mm and 1 100 mm above floor level.

B-7.3 Location of Controls from Walls, Corners and Opening Doors

The minimum distance of the centre of switches and devices to control doors or windows, etc, shall be 600 mm from any internal corner or any projecting element (*see* Fig. 64) and the recommended distance is 700 mm.

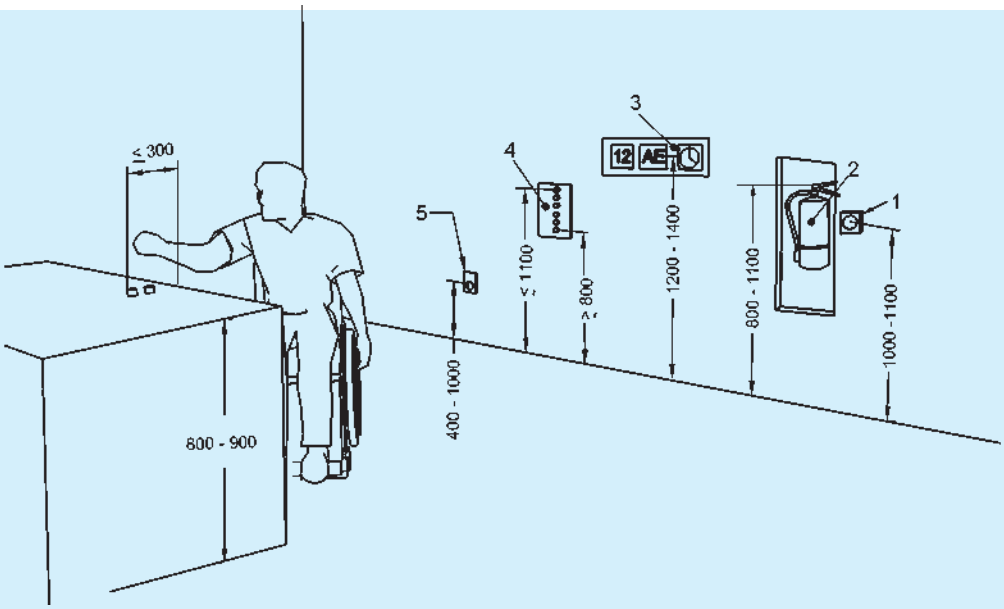
Controls for powered door openers to hinged doors should be located so that the doors do not interfere with wheelchairs, canes, mobility aids, etc. Controls for powered door openers to hinged doors should be located at a minimum of 1 000 mm from the swing of the arc of the door so that the door is clear of people in wheelchairs, scooters or other assistive devices (*see* Fig. 65). The opening time shall be sufficient for a person using wheelchair or assisting devices to pass through the door safely before it closes.

B-7.4 Operation

To help people with diverse abilities, the controls as far as possible shall be operable by one hand and require no tight grasping, pinching or twisting of the wrist.

For persons with reduced dexterity or impaired vision, electrical switches should have large push plates.

Grab bars and door or window handles should be at least 80 mm long. Lever handles should be

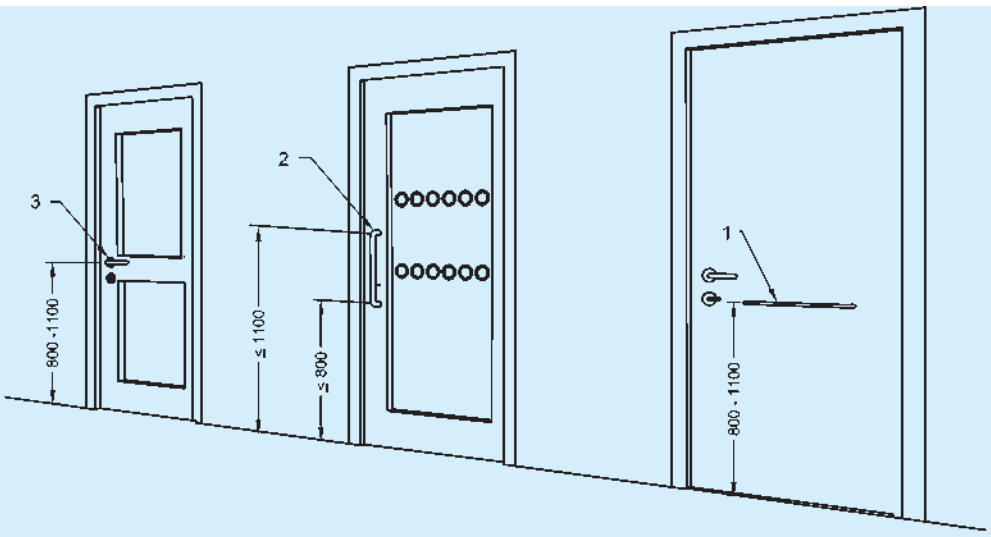


Key

1 Fire alarm, call point
2 Fire extinguisher
3 Meter indicators
4 Control devices
5 Socket outlets

All dimensions in millimetres.

FIG. 62 HEIGHTS OF SWITCHES, SOCKET OUTLETS, READING CONTROLS AND CONTROLS ON A HORIZONTAL SURFACE

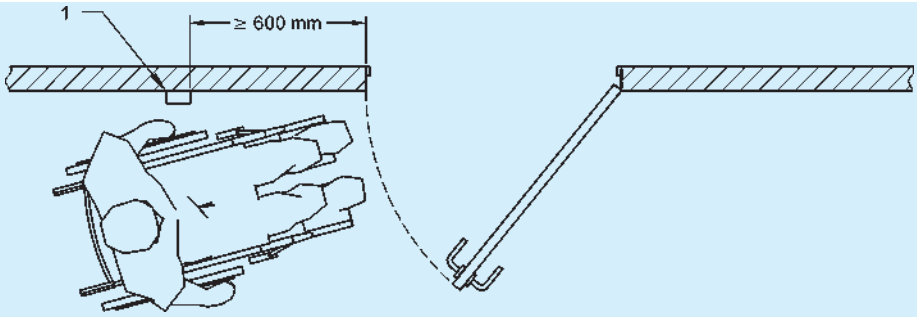


Key

1 Horizontal pull bar, toilet room door
2 Vertical handle
3 Lever type handle

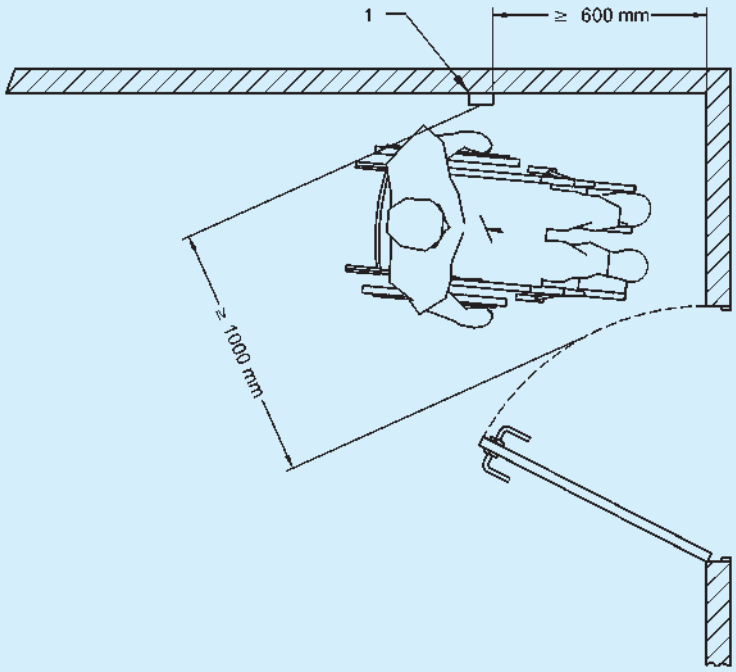
All dimensions in millimetres.

FIG. 63 DOOR HANDLE TYPES AND HEIGHTS



Key
1 Door control, access control

FIG. 64 POSITION OF DOOR AND ACCESS CONTROLS



Key
1 Door control, access control

FIG. 65 DISTANCE OF CONTROLS FOR POWERED DOOR OPENERS

between 19 mm and 25 mm in diameter; 'D-Lever' handles are preferred (*see* Fig. 66). A vertical bar for sliding doors should be 30 mm to 50 mm in diameter. The clearance between the bar and the wall should be 45 mm to 65 mm. The backset of a latch/lock should be a minimum of 30 mm. Other door furniture should be 30 mm from the door edge. Suitable clearance should be provided between adjacent fixtures and fittings to prevent accidental operation.

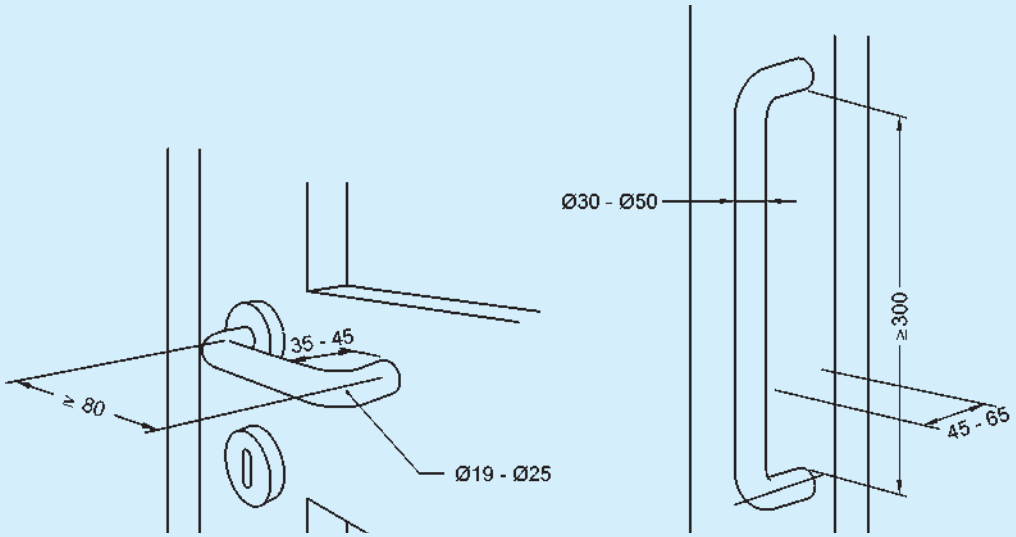
Operating force on control buttons and push plates should be 2.5 N to 5.0 N. Control for drinking water fountains shall be operable with one hand with an operative force of not more than 20 N.

B-7.5 Identification

Buttons and devices should be identified by visual contrast. Information should be in raised tactile and Braille signage. All important controls should have an integral Braille indication.

B-7.6 Usability

Control devices for different functions should be



All dimensions in millimetres.

FIG. 66 EXAMPLES OF D-LEVER AND VERTICAL DOOR HANDLES

different. Control devices for similar functions should have a similar design and activation mechanism and be the same for identical functions throughout the facility.

B-7.7 Telephones

B-7.7.1 Telephones shall be on a clear accessible route with approach from the front or the side (*see* Fig. 67). All information should be provided in at least two of visual, oral and tactile forms. The telephone keypad shall have a tactile point on the number five (*see also* **B-7.9**).

B-7.7.2 *Public Telephones*

Public telephones shall be located beside the access route and shall be easily detected by people with vision impairments.

Where more than one public telephones are provided, at least one phone shall be accessible.

A clear knee space of minimum 700 mm in height and minimum 600 mm in depth and 900 mm in width shall be provided underneath to accommodate wheelchair user's knee (*see* Fig. 68).

Counter tops, where provided, shall be between 750 mm and 800 mm from the floor. The depth of the counter top shall be not less than 480 mm.

Side protection shall be considered according to **B-2.6.2.**

The height of all operable parts of the telephone shall be between 800 mm and 1 100 mm. The minimum length of the telephone cord shall be 900 mm.

The international symbol of accessibility shall be displayed to identify the location of such telephones.

If a public telephone is provided in an enclosed booth, the opening of the booth shall have a clear width of at least 900 mm. The enclosed space shall have clear unobstructed dimensions of at least 900 mm × 1 200 mm, which should not be restricted by fixed seats.

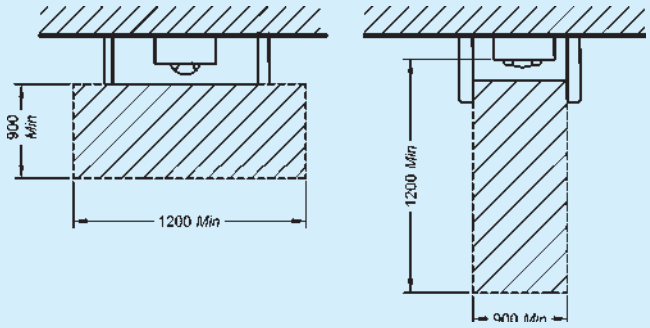
B-7.8 Mailbox/Dropbox

The mail/drop box slot should be located at the height of maximum 1 200 mm. It should have a clear floor space of 900 mm × 1 200 mm.

B-7.9 Vending Machine, Card Access, Dispensing Machines and Automatic Teller Machines (ATMs), etc

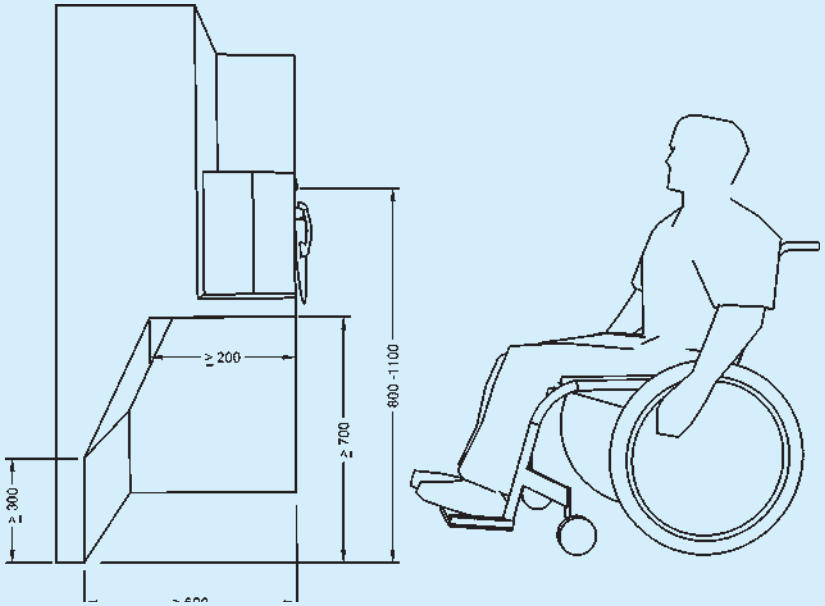
Machines for dispensing money, tickets or small goods should be accessible and should be located on an accessible level. The approach to dispensers should be clear and unobstructed, at least 900 mm wide. A knee space of minimum 700 mm in height and minimum 600 mm in depth and 900 mm in width should be provided to ease access for wheelchair users (*see* Fig. 69). The clear area immediately in front of the machine should be at least 1 500 mm × 1 500 mm, to allow a wheelchair user to approach the controls sideways, and to turn around after use and to provide some privacy.

Touch screen ticket dispensers at train/bus stations, etc, should not be the only type of ticket dispenser, as they are inaccessible to people with impaired vision. A numeric keypad should also be provided to make it



All dimensions in millimetres.

FIG. 67 SPACE ALLOWANCE FOR A WHEELCHAIR USER FOR USING TELEPHONE



All dimensions in millimetres.

FIG. 68 HEIGHT OF TELEPHONE CONTROLS FOR WHEELCHAIR USERS

accessible for visually impaired users.

Glare from sun, artificial lighting and street lighting on the screen should be avoided.

The operation of the machine should be easy to understand.

Where card access or coin slot is provided, they shall,

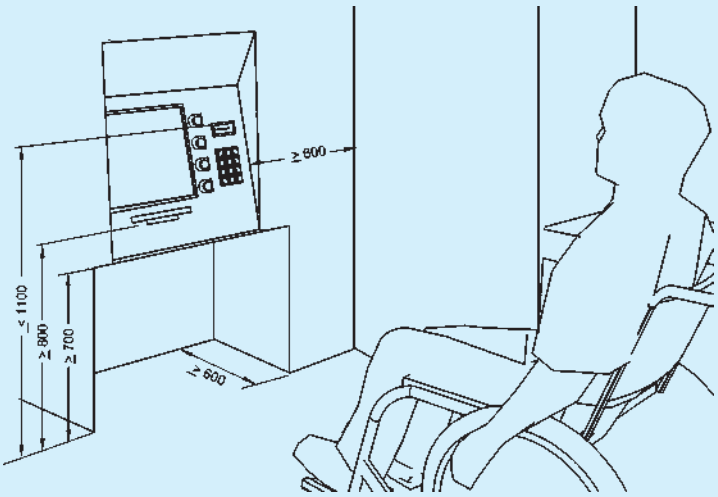
a) have a slot located at a height of between 800 mm and 1 000 mm above the floor, preferably between 800 mm and 900 mm,
   1) with its edge bevelled, and
   2) colour-contrasted with the surrounding surface;

b) include tactile graphic symbols on the surrounding surface that,
   1) represent the card, and
   2) identify the orientation of the card/coin insertion; and

c) have both audible (beep) and visual (light) signals to indicate that access has been granted.

Where a keypad is provided, it shall,

1) be located at a height between 800 mm and 1 000 mm from the floor;
2) be colour-contrasted with the background;
3) have characters and symbols on key surfaces



All dimensions in millimetres.

FIG. 69 EXAMPLE OF A VENDING MACHINE

that are colour-contrasted with the key surfaces;

d) where numeric,
   1) the keys shall be arranged in a 12-key ascending or descending telephone keypad layout,
   2) the number five key shall be tactilely distinct from the other keys; the raised dot on number five shall be 0.7 ± 0.1 mm high and shall have a base 1.5 mm in diameter, and
   3) function key surfaces shall have tactile symbols as follows: enter or proceed key: raised circle [o]; clear or correct key: raised left arrow [ ]; cancel key: raised letter × [x]; add value key: raised plus [+] sign; decrease value key: raised minus [–] sign; and
e) have both audible (beep) and visual (light) signals to indicate that access has been granted; and
f) have the keys readable from both a standing and a seated position.

NOTE — For ATMs and similar facilities, other requirements as laid down by the concerned authorities shall be followed.

B-7.10 Security Access Systems

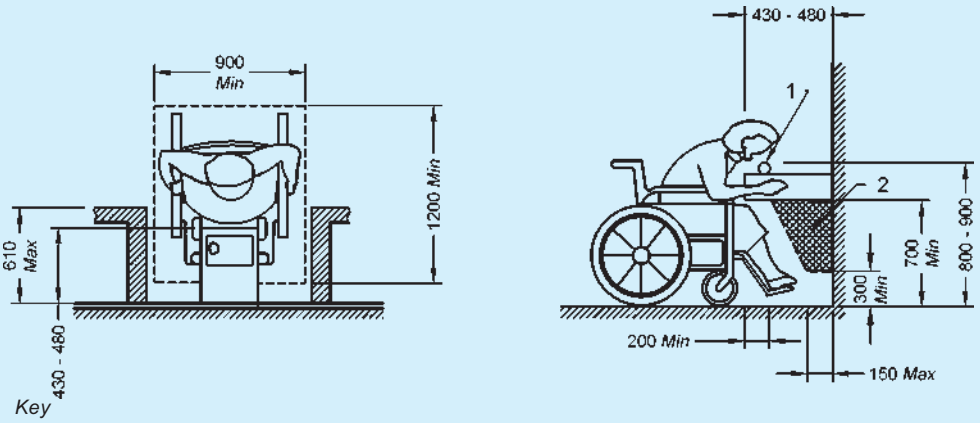
Security access systems shall be designed so as to meet the needs of everyone. This includes the requirements for manoeuvring space and for controls which can be reached comfortably. *See* **B-7.9** for requirements relating to card access and keypads. Security access systems should be usable by everyone. Biometric systems (for example retinal or palm scanners) cannot accommodate all users. To negotiate the security access systems placed at building entrances, such as, airports, railway stations, metro stations, and shopping malls, relevant rules and regulations laid down by the concerned authorities shall be followed.

NOTE — The requirements relating to card access and keypads shall be similar to those for ATMs as laid down by the concerned authorities.

B-7.11 Drinking Water Facility

The drinking water facility (fountains, coolers, taps, etc) shall comply with the following:

a) Wall/Post-mounted cantilevered units shall have a clear floor space of at least 900 mm × 1 200 mm as shown in Fig. 70.
b) The front edge of the unit shall extend 430-480 mm from the wall. It shall have a clear knee space between the bottom of the apron/ equipment and floor or ground of at least 900 mm wide, 200 mm deep extending from the front edge of the equipment to back towards the wall, and 700 mm high. It shall have a toe space not less than 900 mm wide, 300 mm high, extending from the back wall to a maximum of 150 mm (*see* Fig. 70).
c) Freestanding or built-in-drinking water units not having a clear space under them shall have a clear floor space of at least 1 200 mm wide × 900 mm in front of the unit as shown in Fig. 71.
d) Spout heights should be between 800-900 mm, measured from the floor to the spout outlet. The maximum distance of the spout from the front edge of the drinking water facility shall be 125 mm. There shall be water glass provision; a minimum 100 mm space below the spout outlet shall be provided to allow for the insertion of a cup or glass.
e) Wall-mounted drinking water provision in an alcove is preferred, because it does not create

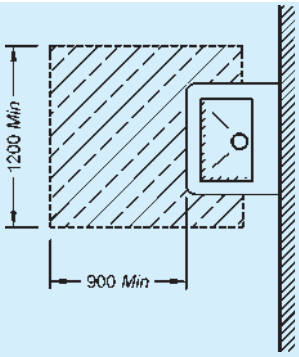


All dimensions in millimetres.

FIG. 70 CLEAR FLOOR SPACE AND KNEE SPACE REQUIREMENT FOR A WALL/POST-MOUNTED DRINKING WATER UNIT

a hazard for persons with visual impairments. The provision of two drinking facilities at different heights is very convenient for standing adults, people in wheelchairs and children. Where only one is provided, it shall be at a height of 700 mm above floor level

4) Controls shall be centrally positioned at the front of the unit or, if at the side, on both sides, not more than 180 mm from the front and shall comply with **B-7**. Control shall be easily operable with one hand with an operative force as given in **B-7**.



All dimensions in millimetres.

FIG. 71 CLEAR FLOOR SPACE FOR FREESTANDING OR BUILT-IN DRINKING WATER UNIT NOT HAVING CLEAR SPACE UNDER THE UNIT

B-7.12 Dust Bins

Dust bins should be fully accessible and easy to use for everybody.

B-8 SEATING SPACES

B-8.1 General

Seating facilities should be provided in public buildings to provide people with a place to wait and to rest. The location of seats (including reserved areas for wheelchairs) should not disturb the general circulation.

Seating facilities shall have a clear and level floor space of not less than 900 mm × 1 200 mm.

Seats should be designed with armrests to facilitate sitting down and standing up. The seats should also have back rests (*see* Fig. 72).

B-8.2 Seating in Waiting Areas

A range of different types of seating should be provided complying with the following (*see* Fig. 72):

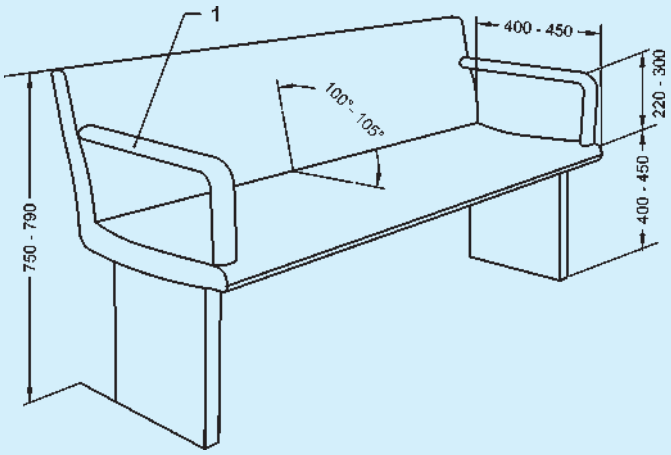
a) Seat height 400 mm to 450 mm,
b) Back support height 750 mm to 790 mm,
c) Seat depth 400 mm to 450 mm,
d) Angle of seat to backrest 100° to 105°,
e) Armrest height 220 mm to 300 mm above seat,
f) Armrest set back from front of seat ≤ 75 mm, and
g) A minimum 150 mm set back under the seat for feet when standing up.

B-8.3 Seating at Desks, Tables, etc

To allow a frontal approach with a wheelchair to a table, desk, counter, telephone, etc, an unobstructed space shall be provided with a minimum free height of 700 mm, minimum free depth of 600 mm (*see* Note) and minimum width of 900 mm to accommodate knees underneath. For footrests, a minimum height of 300 mm is required (*see* Fig. 73).

NOTE — This may overlap the clear floor space by a maximum of 480 mm.

If tables with fixed seats are used, there shall be a place for at least one person in a wheelchair at the table.

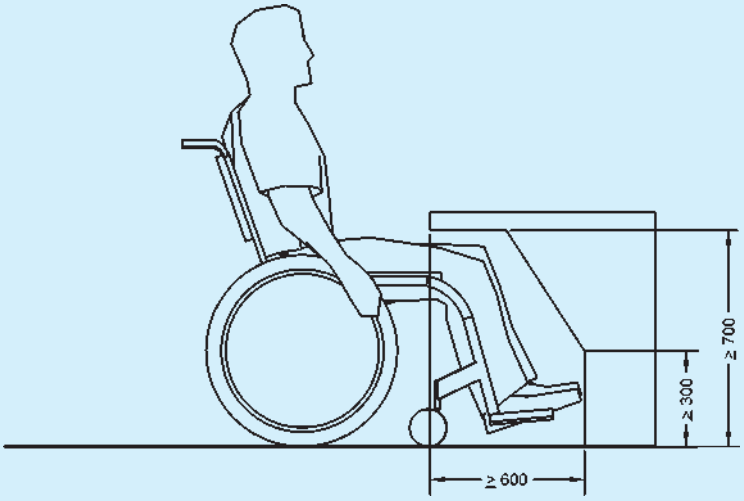


Key

1 Armrests omitted on some benches to allow lateral transfer

All dimensions in millimetres.

FIG. 72 EXAMPLE OF A BENCH WITH ARMRESTS AND BACK SUPPORT



All dimensions in millimetres.

FIG. 73 TABLE AND DESK HEIGHT FOR WHEELCHAIR USERS

B-9 TOILET ROOMS AND SANITARY ROOMS

B-9.1 General

Sanitary facilities shall be designed to accommodate a variety of users. Accessible toilets that can be used by both sexes (unisex accessible toilets) allow the greatest flexibility for people who require assistance hence is the preferred option. Wheelchair accessible unisex toilets should always be provided in addition to wheelchair accessible separate sex toilets. Similarly, a provision of an enlarged cubicle for ambulant disabled people in a separate sex toilet room can also benefit parents with children and people who need an enlarged space (for example those with luggage).

The accessible toilet room shall be located as close as possible to the entrance/reception/waiting area of the building and should be easy to find. It should not be so located that it compromises the privacy of users.

If only one toilet is decided to be provided considering the estimated requirement as per this Code, it shall be Type A unisex accessible toilet (*see* **B-9.2** for types of toilets). Where, more than one accessible toilet is provided, different options exist.

Where sanitary facilities are provided, the following shall also apply:

a) At least one unisex wheelchair user accessible toilet room of Type A, with central placement

of WC, shall be provided, which shall always contain a washbasin.

b) One accessible toilet (Type A or Type B) in single sex toilet block (male and female section of toilet block) shall be provided depending on the footfall and space.

c) When more than one accessible corner toilet of Type B is planned, a choice of layouts suitable for left hand and right hand transfer shall be provided. In case such toilets are located in similar position on each floor of a multi-storey building, it should allow for right and left hand transfer on alternate floors. In any case, a unisex accessible toilet of Type A shall be provided on the ground floor so as to be able to meet the need for both left and right side transfers.

d) In all separate sex toilet/sanitary rooms there shall be provision for one cubicle suitable for use by ambulant disabled.

e) Where urinals are provided, there shall be urinals for wheelchair users and ambulant disabled people.

f) Where there is requirement for only one toilet or sanitary room in a building, a wheelchair accessible unisex toilet of Type A shall be provided but of a greater width to accommodate a standing height washbasin and a urinal.

g) The provision of the accessible toilets shall be such that any wheelchair user/ambulant disabled person doesn't have to travel more than 30 m on the same floor.

h) The design of toilet facilities shall incorporate ease of use for all people and location of fittings should follow a logical sequence.

j) Care shall be taken in placing mirrors and lights to avoid confusion and dazzling for visually impaired users.

k) Soap dispensers and hand towels or driers shall be placed in a convenient and logical position so that they are easy to locate, identify and use.

m) Visual contrast and lighting shall be in accordance with **B-9.16**.

n) An emergency assistance alarm according to **B-9.12**, including a reset control, should be provided in all accessible toilets and sanitary rooms.

p) If facilities are provided such as buttons or taps which operate by use of sensors, accessible signage shall be provided to explain the same.

q) Signage at accessible toilet entrance shall be as per **B-9.18**.

r) Tactile signs should be used beside rather than on doors to indicate 'Ladies' or 'Gents';

s) For the benefit of the persons with vision impairments, all general toilets shall have marked on plates with raised alphabets and braille put on the wall next to the door latch, preferably on the left side. An additional signage shall also be provided on the door at 1 500 mm height. *See also* **B-24** for other requirements of signage.

t) Many persons with visual impairments find it convenient to use the toilets where internal dimensions, accessories and fixtures placement are standardized. A tactile layout of the toilet should be provided on the wall, near the latch side at 900 mm height.

u) A distinct audio sound (beeper/clapper) may be installed above the entrance door for the identification of the toilets by persons with visual impairments.

B-9.2 Wheelchair User Accessible Toilet Rooms

B-9.2.1 This Part gives the characteristics and requirements for the two types of wheelchair user accessible toilet rooms, namely, Type A and Type B.

The clear manoeuvring space of the toilet room shall allow frontal, oblique and lateral transfer. Type A toilet with a central placement of WC allows right and left lateral transfer, and may be more suitable when assistance is needed. Types B only allow one side transfer.

The clear manoeuvring space at floor level in front of the water-closet and the washbasin in case of Type A toilets shall be 1 800 mm × 1 800 mm, except for Type B where it shall be 1 500 mm × 1 500 mm by using the 300 mm space under the washbasin as part of the total manoeuvring space.

The minimum free clearance beside the water-closet shall be 900 mm, whereas 1 200 mm is preferred for lateral transfer and assistance.

NOTE — Minimum clearance of 900 mm accommodates only 65 percent of the wheelchair users, clearance of 1 200 mm accommodates 90 percent of all wheelchair users especially also those who use powered wheelchairs.

The minimum dimensions for a Type A accessible toilet room are 2 200 mm width and 2 300 mm depth, and the minimum dimensions for a Type B accessible toilet room are 1 700 mm width and 2 200 mm depth.

NOTE — In case of existing buildings, as part of exceptional considerations, the measures given above cannot be achieved due to technical reasons, the manoeuvring space at floor level may be reduced, but it should be recognized that such a reduction limits the number of people who can use these toilet rooms.

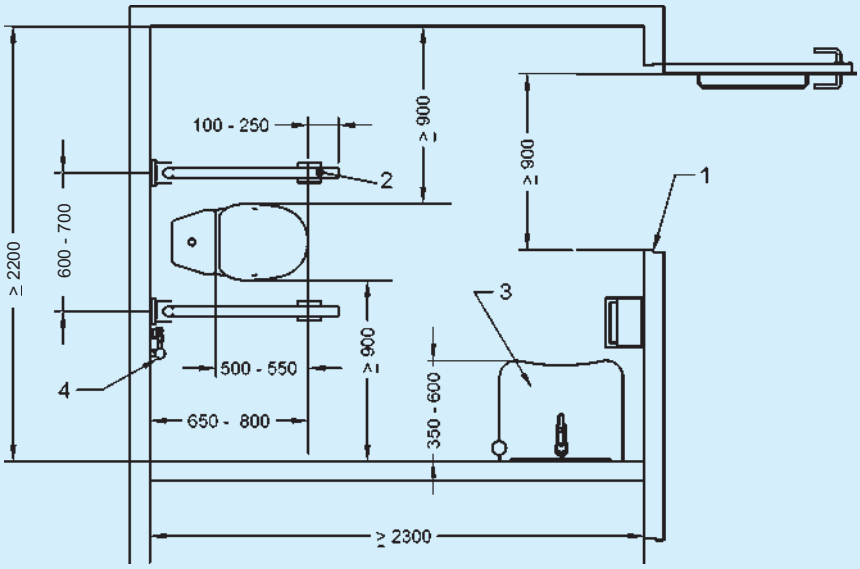
B-9.2.2 *Type A Toilet Room with Lateral Transfer from Both Sides*

B-9.2.2.1 Type A accessible toilet room has the following characteristics (*see* Fig. 74 and Fig. 75):

a) Lateral transfer from both sides,
b) Manoeuvring space uninterrupted by washbasin and pan,
c) Independent water supply beside water-closet,
d) Horizontal grab rails at both sides, and
e) Toilet paper dispensers on both folding grab rails.

B-9.2.2.2 Type A accessible toilet room shall meet the following requirements (*see* Fig. 74):

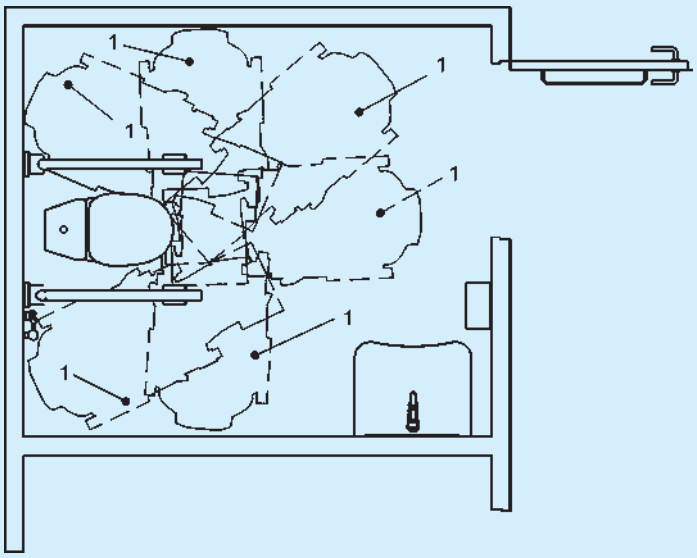
a) It shall have minimum internal dimensions 2 200 mm × 2 300 mm.
b) The layout of the fixtures in the toilet shall be such that there is a clear manoeuvring space that provides a wheelchair turning radius of 1 800 mm in front of the water-closet and washbasin in the accessible toilet unit.
c) It shall have all fixtures and utilities arranged in a manner to provide a clear space of 900 mm × 1 350 mm for wheelchair users to access them.
d) It shall have clear space of not less than 900 mm wide next to the water-closet.
e) It shall be equipped with a door complying with **B-9.4**.
f) It shall have a water-closet complying with **B-9.5**, grab bars complying with **B-9.6** and washbasin complying with **B-9.7**.
g) It shall have essential washroom accessories complying with **B-9.8**.
h) It shall have an alarm to seek emergency help, complying with **B-9.12.**
j) It shall have the toilet roll dispenser and hand water faucet mounted below the grab bars and at not more than 300 mm from the front edge of the seat and at a height between 50 mm and 200 mm from the top of the water-closet seat.
k) Cloth hooks should be set at different heights, 900 mm to 1 100 mm, and additionally at least one hook at 1 400 mm; and projecting not more than 40 mm from the wall.
m) Where possible, be equipped with a shelf of dimensions 400 mm × 200 mm fixed at a height of between 900 mm and 1 000 mm from the floor**.**



Key
1 Minimum 900 mm
2 Foldable grab bars, both sides
3 Washbasin
4 Independent water supply

All dimensions in millimetres.

FIG. 74 EXAMPLE OF TYPE A TOILET ROOM — LATERAL TRANSFER FROM BOTH SIDES



Key
1 Possible transfer positions

FIG. 75 TYPE A TOILET ROOM TRANSFER OPTIONS

B-9.2.3 *Type B Toilet Room with Lateral Transfer from One Side Only*

B-9.2.3.1 Type B toilet has the following characteristics (*see* Fig. 76 and Fig. 77):

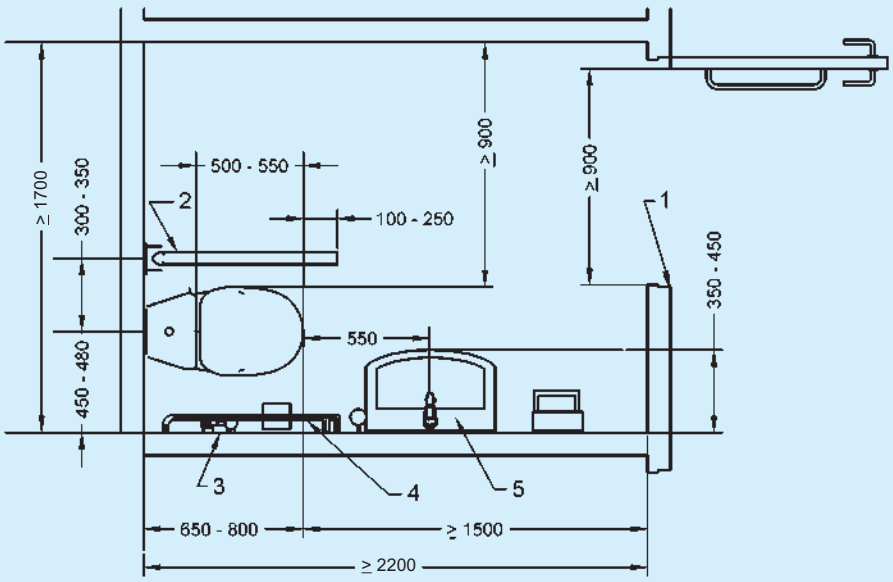
a) Lateral transfer only from one side;
b) Manoeuvring space reduced by washbasin;
c) Independent water supply beside water-closet, with floor drain where necessary;
d) Ability to reach small wash hand basin when seated on toilet;
e) Horizontal grab rail on wall beside the water-closet;
f) Vertical grab rail on wall beside the water-closet for getting up and sitting down (slanted grab bars are not preferred);
g) Foldable grab rail; and
h) Toilet paper dispenser fixed on the wall beside the water-closet.

B-9.2.3.2 Type B accessible toilet room shall meet the following requirements (*see* Fig. 76):

a) It shall have minimum internal dimensions of 1 700 mm × 2 200 mm.
b) It shall have all fixtures and utilities arranged in a manner to provide a clear space of 900 mm × 1 350 mm for wheelchair users to access them.
c) It shall have clear space of not less than 900 mm wide next to the water-closet.
d) It shall be equipped with a door complying with **B-9.4**.
e) It shall have a water-closet complying with **B-9.5**, grab bars complying with **B-9.6** and washbasin complying with **B-9.7**.
f) It shall have essential washroom accessories complying with **B-9.8**.
g) It shall have an alarm to seek emergency help, complying with **B-9.12.**
h) It shall have the toilet roll dispenser and hand water faucet mounted below the grab bars and at not more than 300 mm from the front edge of the seat and at a height between 50 mm and 200 mm from the top of the water-closet seat.
j) Cloth hooks should be set at different heights, 900 mm to 1 100 mm, and additionally at least one hook at 1 400 mm; and projecting not more than 40 mm from the wall.
k) Where possible, be equipped with a shelf of dimensions 400 mm × 200 mm fixed at a height of between 900 mm and 1 000 mm from the floor**.**

B-9.3 WC Compartments for Ambulant Disabled People

These compartments meet the needs of ambulant disabled people who require support (*see* Fig. 78 and Fig. 79).

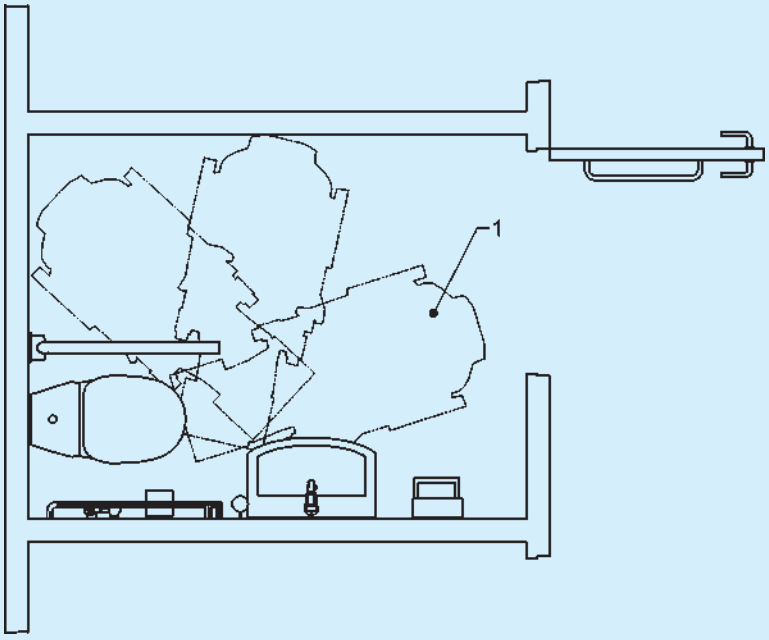


Key

1 Minimum 900 mm
2 Foldable grab bar
3 Independent water supply
4 Grab bar on wall
5 Washbasin

All dimensions in millimetres.

FIG. 76 EXAMPLE OF TYPE B CORNER TOILET ROOM — LATERAL TRANSFER FROM ONE SIDE ONLY



Key

1 Possible transfer positions

FIG. 77 TYPE B TOILET ROOM TRANSFER OPTIONS

This type of compartment is not for the majority of people who use wheelchairs. When located in a single-sex washroom, hand washing facilities will be available communally. Where this is a standalone facility, hand washing facilities shall be provided either in a space adjacent to the WC compartment or in a compartment suitably enlarged to accommodate a wash hand basin.

Such WC compartments shall meet the following requirements:

a) It shall have a clear manoeuvring space of minimum 900 mm × 900 mm in front of the toilet.
b) It shall be equipped with a door complying with **B-9.4** and opening outwards.
c) Water-closet shall comply with **B-9.5**.
d) Grab rails complying with **B-9.6**, horizontal and vertical shall be provided on both sides of toilet.
e) It shall have other toilet accessories and fittings complying with **B-9.8**.
f) It shall have independent water supply beside water-closet, preferably a hand held toilet spray and floor drain, where necessary (*see* **B-9.9**).

B-9.4 Toilet or Sanitary Room Doors

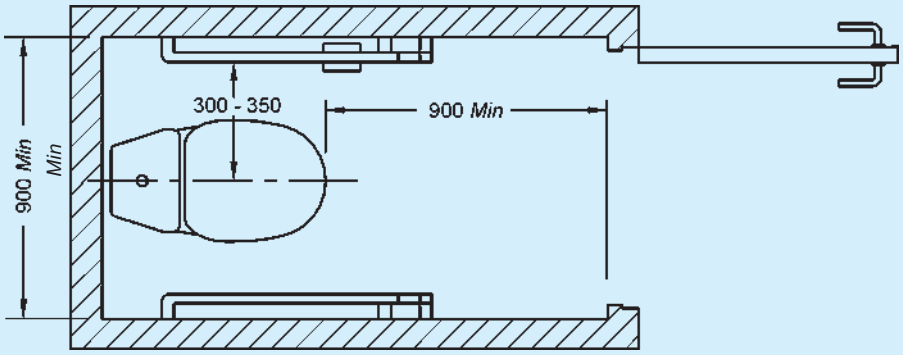
Toilet or sanitary room doors shall comply with **B-5.3**. The toilet door shall either be an outward opening door or two way opening door or a sliding type and shall provide an unobstructed and clear opening width of at least 900 mm; it shall be easy to open and close. There should be no openings under or above the door that compromises on privacy. Doors should be positioned so as not to constitute a hazard.

The toilet door shall be provided with a horizontal pull-bar, at least 600 mm long, on the inside of the door, located so that it is 130 mm from the hinged side of the door and at a height of 900 mm to 1 000 mm. A horizontal pull handle on the inside of the outward opening doors shall be provided at a height of 700 mm above the floor. The door shall be capable of being locked from the inside by a device that is operable by one hand, activated by a force not more than 22 N and which does not require fine finger control, tight grasping, pinching or twisting of the wrist.

B-9.5 Water-Closet

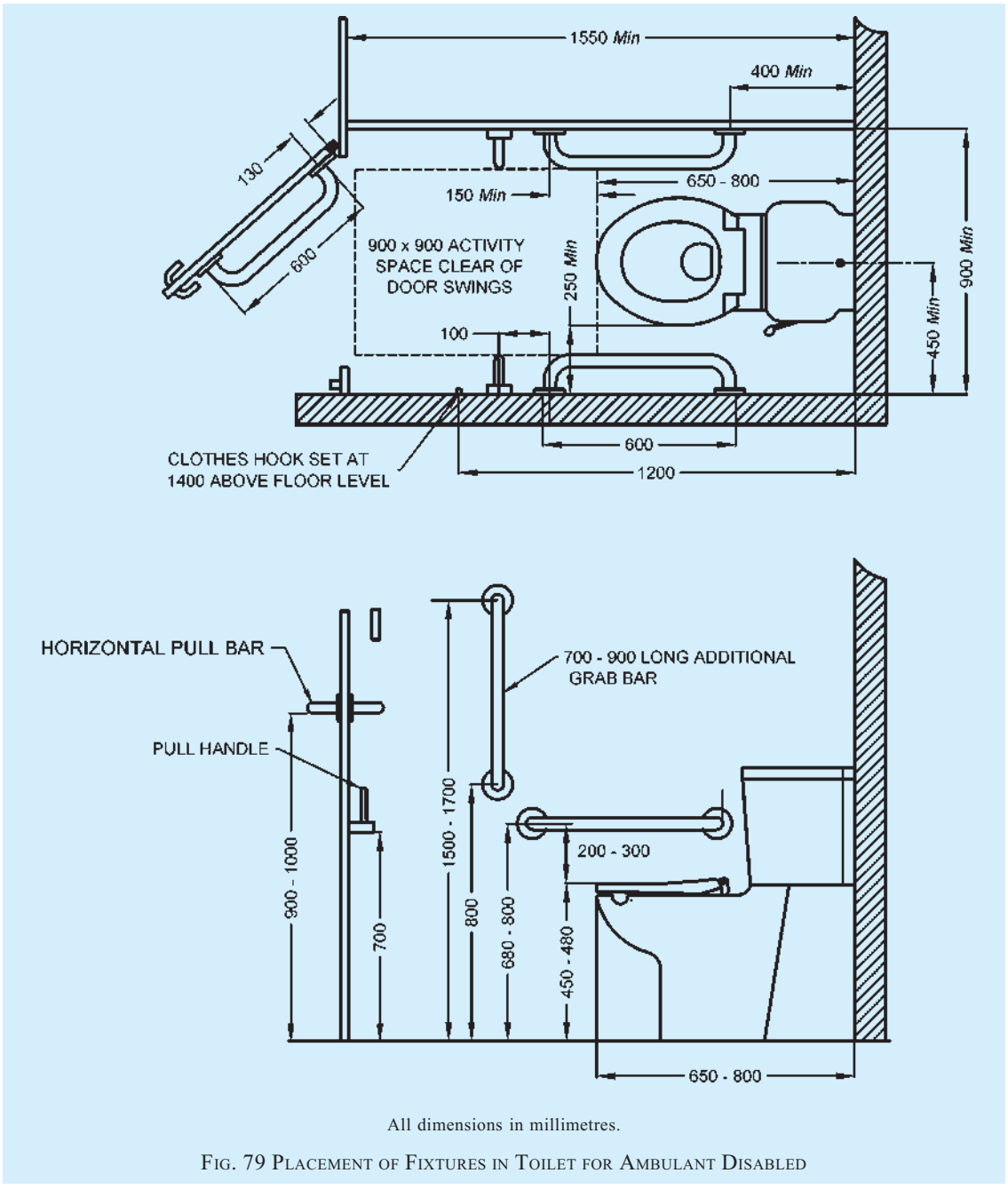
Water-closet shall comply with the following requirements:

a) It shall be so located that the distance between centreline of the water-closet to the adjacent wall in case of corner toilets (Type B) be between 450 mm and 480 mm. The minimum distance of a corner toilet from the edge of the WC seat to the adjacent wall should be 250 mm. In case of Type A toilet, the distance from the edge of the WC seat to the adjacent wall shall be 900 mm, minimum on both sides to allow ease of transfer.
b) The top of the water-closet shall be between 450 mm and 480 mm from the floor.
c) The minimum distance from the front edge of the water-closet to the rear wall should be between 650 mm and 800 mm.
d) There shall be an adequate clear floor space of at least 1 300 mm depth and 900 mm width, both in front and on the transfer side, adjacent to the water-closet.
e) There shall be a suitable back support to reduce the chance of imbalance or injury



All dimensions in millimetres.

FIG. 78 TOILET FOR AMBULANT DISABLED WITH L-SHAPED GRAB BAR



All dimensions in millimetres.

FIG. 79 PLACEMENT OF FIXTURES IN TOILET FOR AMBULANT DISABLED

caused by leaning against exposed valves or pipes. The distance from the seat to the backrest should range between 500 mm and 550 mm.

f) The water-closet shall preferably be of wall-hung or corbel type as it provides additional space at the toe level.

g) Where water cistern is used, the cover shall be securely attached and the flush control shall either be lever type or automatic, and located on the transfer side of the water-closet. The flush control shall not be located more than 1 000 mm from the floor.

h) Toilets for children should have a distance from the centre line to the adjacent wall between 305 mm and 380 mm and the water-closet height shall be between 205 mm and 380 mm.

B-9.6 Grab Bars

Grab bars complying with **B-5.5.3** shall be provided in toilet or sanitary rooms in accordance with this clause.

On both sides of a toilet, a grab bar (whether drop-down or fixed to the wall) shall be provided at a distance between 300 mm and 350 mm from the centre line of the toilet.

On the sides where a lateral transfer is possible, a foldable grab bar (drop-down support bar) shall be provided at a height of 200 mm to 300 mm above the water-closet. The length of the foldable grab bar should overlap the front edge of the water-closet in between 100 mm and 250 mm. The positioning of a foldable grab bar should allow access from a wheelchair when folded up.

Where a wall is beside the toilet, a horizontal grab bar shall be provided at a height of 200 mm to 300 mm above the water-closet, and a vertical grab bar shall exceed from the horizontal grab bar to a height of 1 500-1 700 mm above floor level. The grab bar shall extend a distance of minimum 150 mm to the front edge of the water-closet.

Alternatively, one L-shape grab bar, 600 mm long horizontal and 700-900 mm long vertical shall be mounted on the side wall closest to the water-closet, as illustrated in Fig. 80.

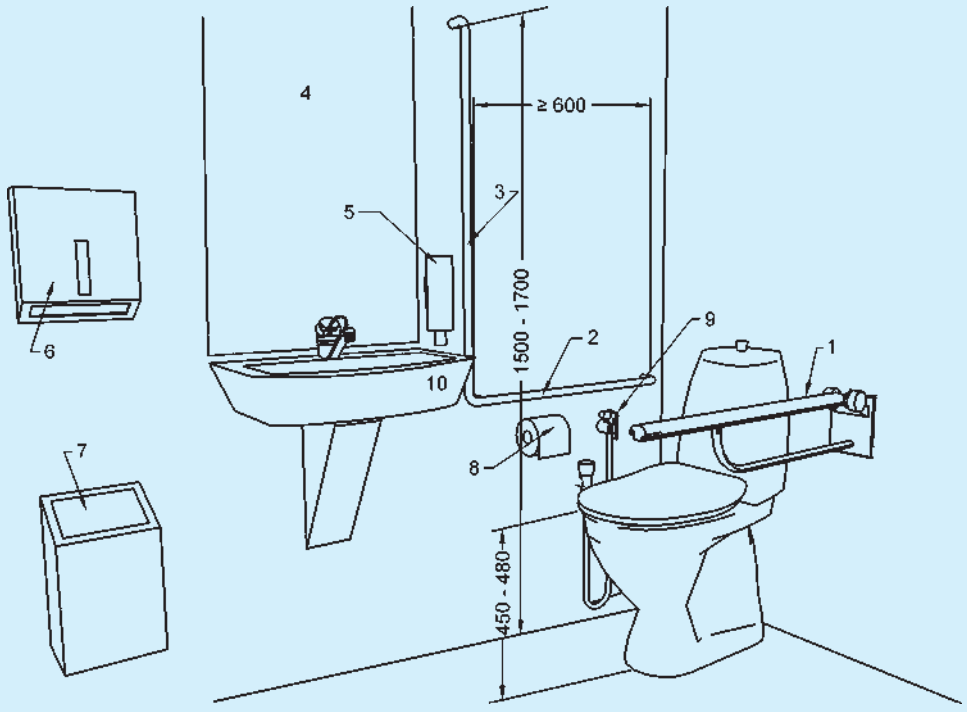
The horizontal grab bar shall be uninterrupted for its full length.

The positioning of accessories such as hand towel, soap, waste bin, etc, should not hamper the use of the grab bar.

The grab bar height for toilets for children should be between 510 mm and 635 mm.

B-9.7 Washbasin

A washbasin complying with following requirements shall be provided within an accessible toilet room (*see* Fig. 81):



Key

1 Drop down support grab bar at seat height plus 200 to 300 mm
2 Wall mounted horizontal grab bar at seat height plus 200 to 300 mm
3 Wall mounted vertical grab bar
4 Mirror, top height minimum 900 mm, bottom height maximum 900 mm above floor
5 Soap dispenser 800 to 1 000 mm above floor
6 Towels or dryer 800 to 1 100 mm above floor
7 Waste bin
8 Toilet paper dispenser 600 to 700 mm above floor
9 Independent water supply
10 Small finger rinse basin 350 mm maximum projection

All dimensions in millimetres.

FIG. 80 POSITIONING OF GRAB BARS, WATER SUPPLY AND OTHER TOILET ACCESSORIES IN TYPE B CORNER TOILET

a) The positioning of a washbasin should allow access from a wheelchair. It shall provide a minimum clear floor space of 900 mm wide by 1 200 mm deep, of which a maximum of 480 mm in depth may be under the washbasin.

b) It shall be mounted such that the minimum distance between the centreline of the fixture and the side wall is 460 mm; and the top edge of the washbasin is between 750 mm and 850 mm from the floor.

c) The differences in stature may require lower or higher heights of washbasins and it may be advisable to have an inbuilt flexibility to increase or decrease height.

d) The space under the washbasin shall be unobstructed with a knee clearance centred on the washbasin between 680 mm and 700 mm high, and 200 mm deep. In addition, a toe clearance of at least 300 mm high shall be provided (*see* Fig. 82). The front edge of the washbasin shall be located within a distance of 350 mm to 600 mm from the wall, according to Fig. 74.

e) The hot water and drain pipes within the knee space or toe space shall be properly insulated.

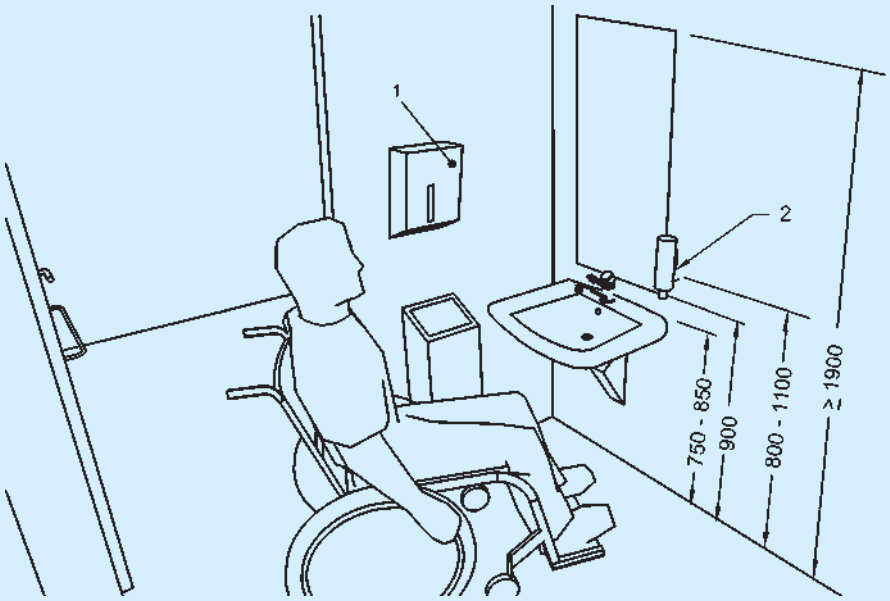
f) Automatic or lever type faucets/taps shall be provided complying with **B-9.10**.

g) In front of the washbasin, space should allow for a frontal or oblique approach by a wheelchair. The reaching distance to the tap control shall be a maximum of 300 mm, according to Fig. 82.

h) Edges on washbasins should be rounded.

j) The mirror above the washbasin shall be positioned to have the bottom edge at a height of not more than 900 mm above the floor, up to a height of 1 900 mm (*see* Fig. 81). If a second mirror is provided, the maximum height above the floor should be 600 mm, up to 1 850 mm. The mirror shall be tilted at an angle of 30° for better visibility of wheelchair user. Care shall be taken in placing mirrors and lights to avoid confusion and dazzling for visually impaired users.

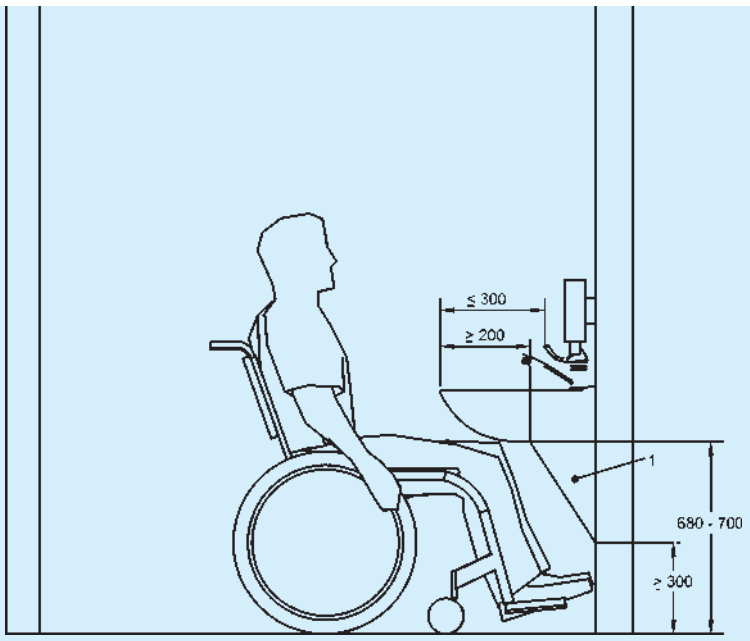
k) A shelf with minimum dimensions of 200 mm × 400 mm should be provided near the washbasin at a height of 850 mm, or combined with the washbasin.



Key
1 Paper towels, 800 to 1 100 above floor
2 Soap dispenser

All dimensions in millimetres.

FIG. 81 PLACEMENT OF WASHBASIN AND MIRROR ABOVE THE WASHBASIN WITH DISTANCE OF SANITARY APPLIANCES



Key
1 Concealed piping

All dimensions in millimetres.

FIG. 82 WASHBASIN WITH KNEE/TOE CLEARANCE

B-9.8 Other Toilet Accessories and Fittings

All other fittings, for example the water tank, hand dryer, towel, soap dispensers, waste bins, hand-held shower, etc, should be set at a height between 800 mm and 1 100 mm from the floor (*see* Fig. 80). Coat hooks should be set at different heights, 900 mm to 1 100 mm, and additionally at least one hook at 1 400 mm. Accessories shall be placed in close proximity to the basin, to avoid a person with wet hands wheeling a chair.

Dispensers for toilet paper shall be reachable from the water-closet, either under the grab bar or on the side-wall of a corner toilet at a height between 600 mm and 700 mm from the floor (*see* Fig. 80).

Light switches should be fixed inside all accessible toilet cubicles or the lighting should automatically switch on when someone enters the room. Timed light switches should not be installed or used.

Needle boxes to safely dispose of needles (for example from diabetes patients) should be provided.

If a sanitary bin is supplied, it should be reachable from the water-closet. Sanitary bins with non-touch opening devices are preferred.

Non-touch soap dispensers are preferred.

B-9.9 Water Supply

An independent water supply (hand-held shower) shall be provided next to the toilet. An alternative such as a combination bidet and rear side pan/built-in bidet can be installed.

B-9.10 Taps

Taps should be mixer, lever or sensor operated to aid operation, complying with requirements given in **B-7**. The tap controls should be set no more than 300 mm from the front of the washbasin. It is recommended that a thermostat be installed to limit the temperature of the hot water to a maximum of 40°C in order to prevent scalding. Hot and cold water taps should be identifiable by both colour and tactile markings.

B-9.11 Urinals

Wheelchair users may be able to pull themselves to a standing position to use a urinal, or they may be able to use a urinal from their wheelchair. Ambulant persons with disabilities, for example crutch users, may need support in front of urinals. Bowl urinals are preferable to slab urinals for the benefit of visually impaired.

When wall hung urinals are fitted in the washroom, it is recommended that at least one of these have its rim set at a height of 380 mm for wheelchair users and at least one have its rim set at a height of 500 mm for standing users/ambulant disabled. When installed, both should be equipped with a vertical grab rail. Urinals shall be minimum 360 mm deep measured from the outer face of the urinal rim to the back of the fixture.

The lower urinal position as shown in Fig. 83 is also beneficial to a person of lower stature. Where an

accessible urinal is provided, the accessible approach to the same shall be ensured. This wall hung urinal should be set clear above the floor level, without any raised access platform and with a clear floor area in front of the urinal of at least 760 mm wide and 1 220 mm deep to allow forward approach for ambulant disabled and minimum of 900 mm × 1 350 mm for wheelchair users to use the urinals (*see* Fig. 84). Urinals should contrast visually with the wall to which they are attached.

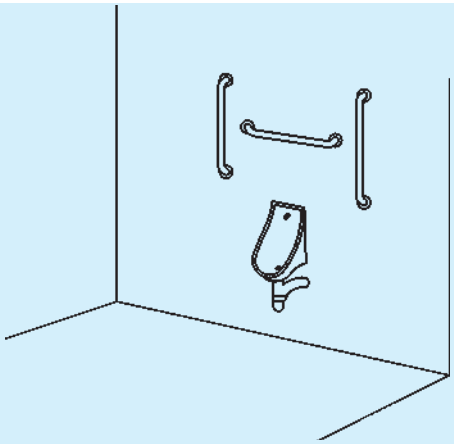
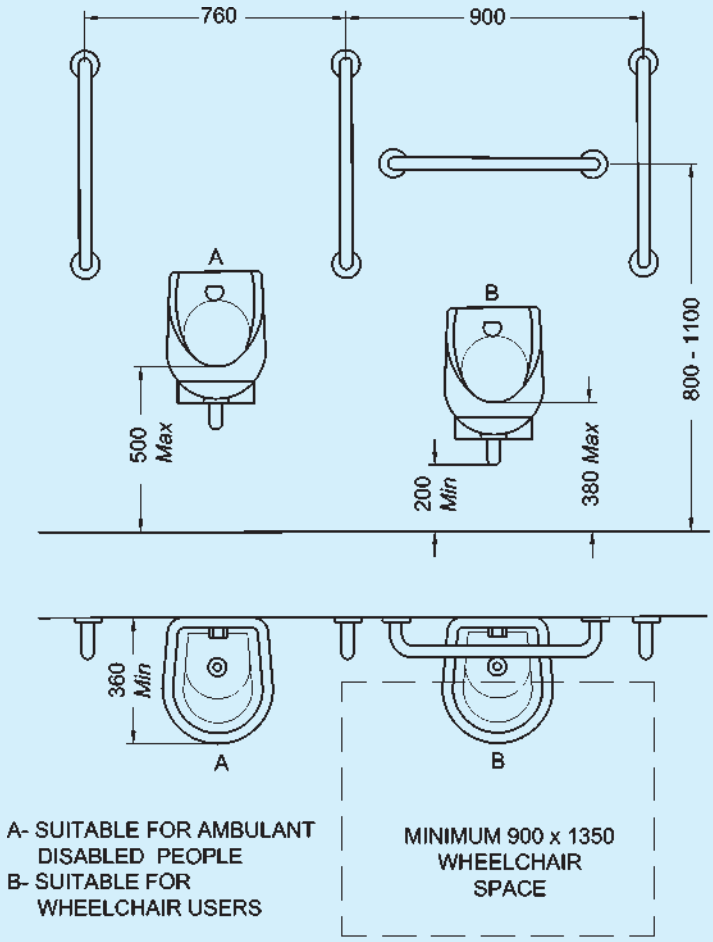


FIG. 83 URINAL FOR WHEELCHAIR USERS

B-9.12 Alarm

An assistance alarm, which can be reached from changing or shower seats, from the WC and by a person lying on the floor, shall be provided in all accessible toilets and accessible sanitary rooms. This alarm should



NOTE — Urinals shall be minimum 360 mm deep measured from the outer face of the urinal rim to the back of the fixture. Space below the urinal set for wheelchair users should be kept free of pipework up to a height of 200 mm above floor and up to a depth of 360 mm from the outer face of the urinal rim.

All dimensions in millimetres.

FIG. 84 CLEAR FLOOR SPACE AND MOUNTING HEIGHTS FOR URINALS

be connected to an emergency help point, or where a member of staff can assist.

Visual and audible feedback should be provided to indicate that, when the alarm has been operated, the emergency assistance call has been acknowledged and action has been taken.

It should take the form of a pull cord, coloured red, with two red bangles of 50 mm diameter, one set at a height between 800 mm and 1 100 mm and the other set at 100 mm above floor level.

A reset control shall be provided for use if the alarm is activated by mistake. It shall be reachable from a wheelchair and, where relevant, from the WC, the tip-up seat in a shower or changing facility, or the bed in an accessible bedroom. The reset control shall be easy to operate and located with its bottom edge between 800 mm and 1 100 mm above floor level.

For a corner toilet room, the reset button should be above the fixed horizontal grab rail beside the toilet paper holder.

The marking of the reset control shall be both visible and tactile.

B-9.13 Emergency Warning Alarm

A visual emergency alarm shall be provided to alert people who are deaf or hard of hearing in the event of an emergency.

B-9.14 Shower and Changing Rooms

Showers and changing rooms can be used by people with different disabilities and different supporting aids, for instance, wheelchair users, ambulant disabled people, etc, using their own wheelchairs or special shower chairs.

B-9.14.1 *Shower/Changing Room Size and Space*

The shower/change area shall have level entry and have no fixed elements that prevent front and side access.

A self-contained individual shower room or changing room shall have minimum interior dimensions of 2 000 mm × 2 200 mm (*see* Fig. 85 and Fig. 86). *See* **B-9.14.6** for other requirements of individual shower room.

A shower room incorporating a corner accessible toilet room shall have minimum interior dimensions of 2 400 mm × 2 500 mm (*see* Fig. 87). In such cases, the manoeuvring areas may overlap, as shown in Fig. 87.

The minimum clear floor space or wet showering area should be 900 mm × 1 350 mm, with a transfer area of also 900 mm × 1 350 mm in the shower room (*see* Fig. 88).

If two or more shower recesses are provided, at least one shall have the seat on the opposite side.

B-9.14.2 *Shower Floor and Drainage*

The floor in the shower recess shall have a gradient between 1:50 and 1:60 sloping to a floor drain. The area outside the shower recess shall have a gradient between 1:70 and 1:80 draining towards the shower recess.

The floor of the shower shall be slip-resistant even when wet.

The transition into the shower recess shall be level without a step down or a kerb. Where unavoidable the kerb shall not be more than 12 mm high bevelled at a slope of 1:2.

The waste outlet should be centrally located and be a round type outlet, not a channel type, to ensure the stability of the shower chair.

B-9.14.3 *Shower Seat*

The shower should be fitted with a wall mounted, easily operable foldable seat that folds in an upward direction. If a foldable seat is provided, its minimum size shall be 450 mm × 450 mm, and, when folded down, have its top surface set between 450 mm and 480 mm above finished floor and spaced a maximum of 45-50 mm from the rear wall.

The shower seat shall be positioned such that the distance between the centerline of the shower seat and the adjacent wall is 450 mm to 480 mm, and the distance between front edge of the shower seat and the rear wall is 650 mm.

Enclosures for the shower cubicle shall not obstruct transfer from wheelchair onto shower seat.

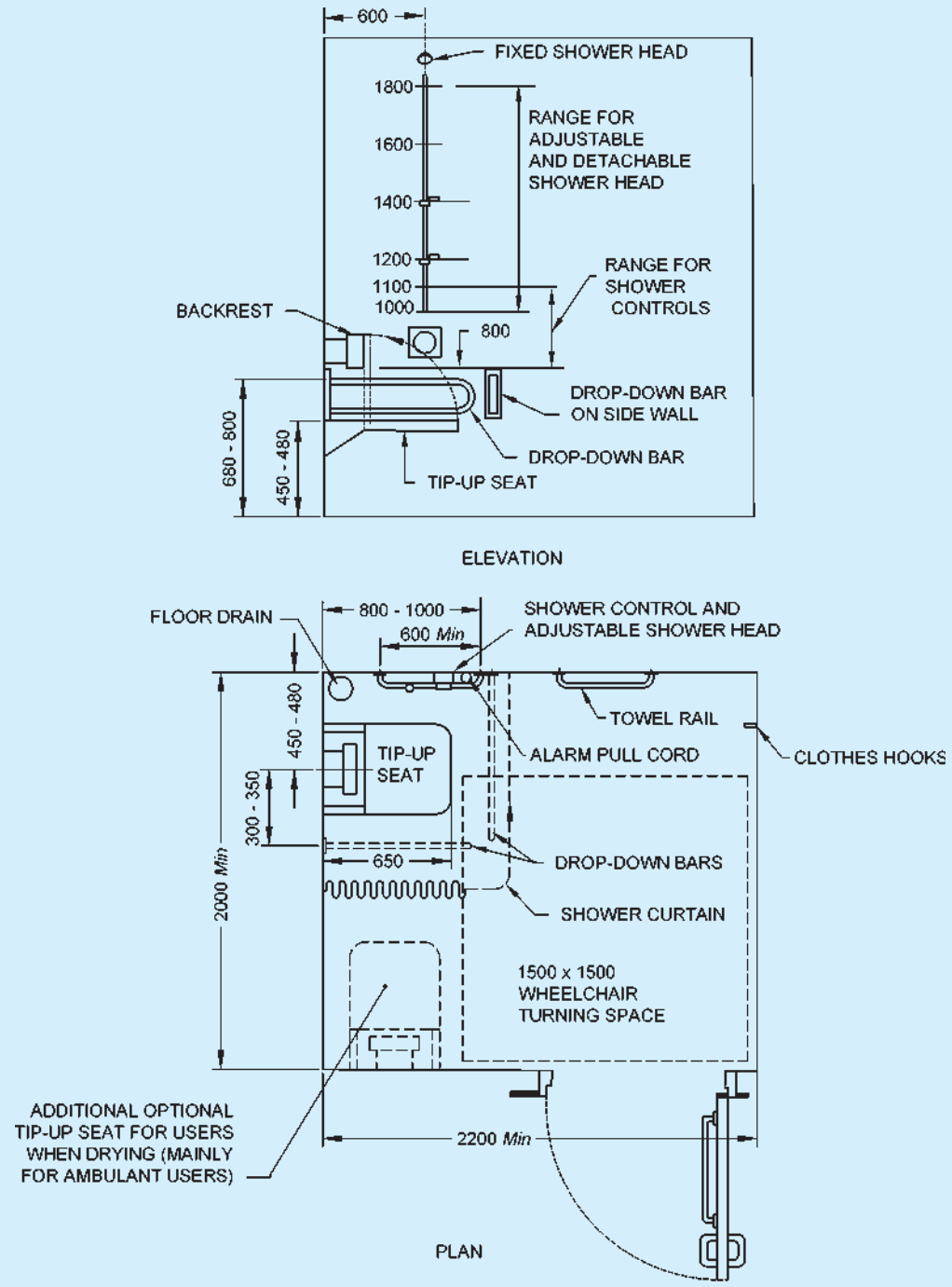
The fastenings for grab bars and the construction of the foldable seat shall be able to withstand a force of 1.1 kN applied at any position and in any direction.

NOTE — Shower wheelchairs are sometimes used instead of shower seats.

The foldable seat shall have the following features:

a) Self-draining;
b) Slip-resistant and stable;
c) Foldable in an upwards direction; when folded, it shall not present a hazard and the grab rail shall be accessible from the foldable seat;
d) Rounded front corners (radius 10 mm to 15 mm); and
e) Rounded top edges (minimum radius of 2 mm to 3 mm).

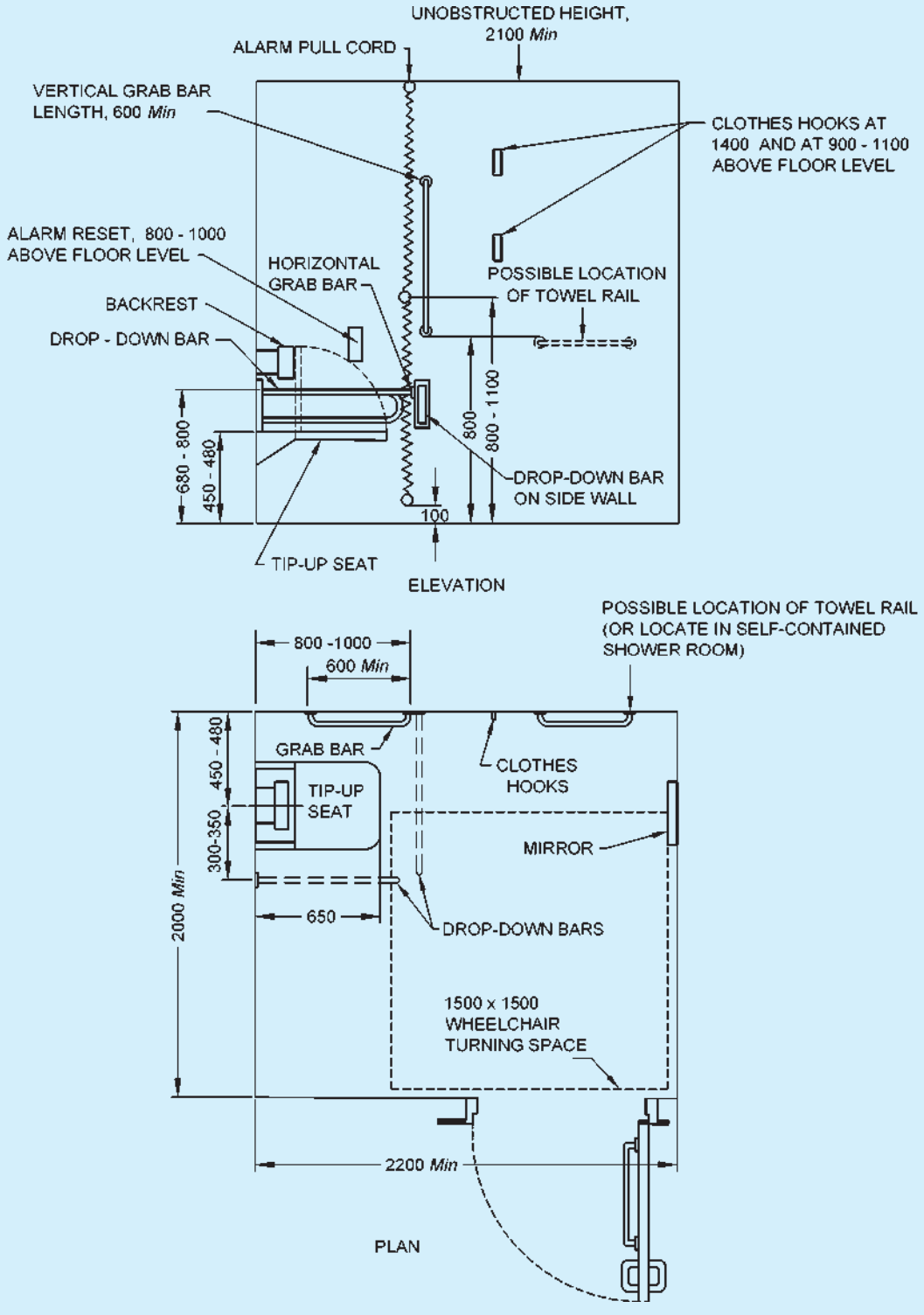
The foldable seat should preferably be height adjustable.



NOTE — Alarm pull cord, horizontal and vertical grab bars, shower curtain bar and towel rail not shown in elevation for clarity.

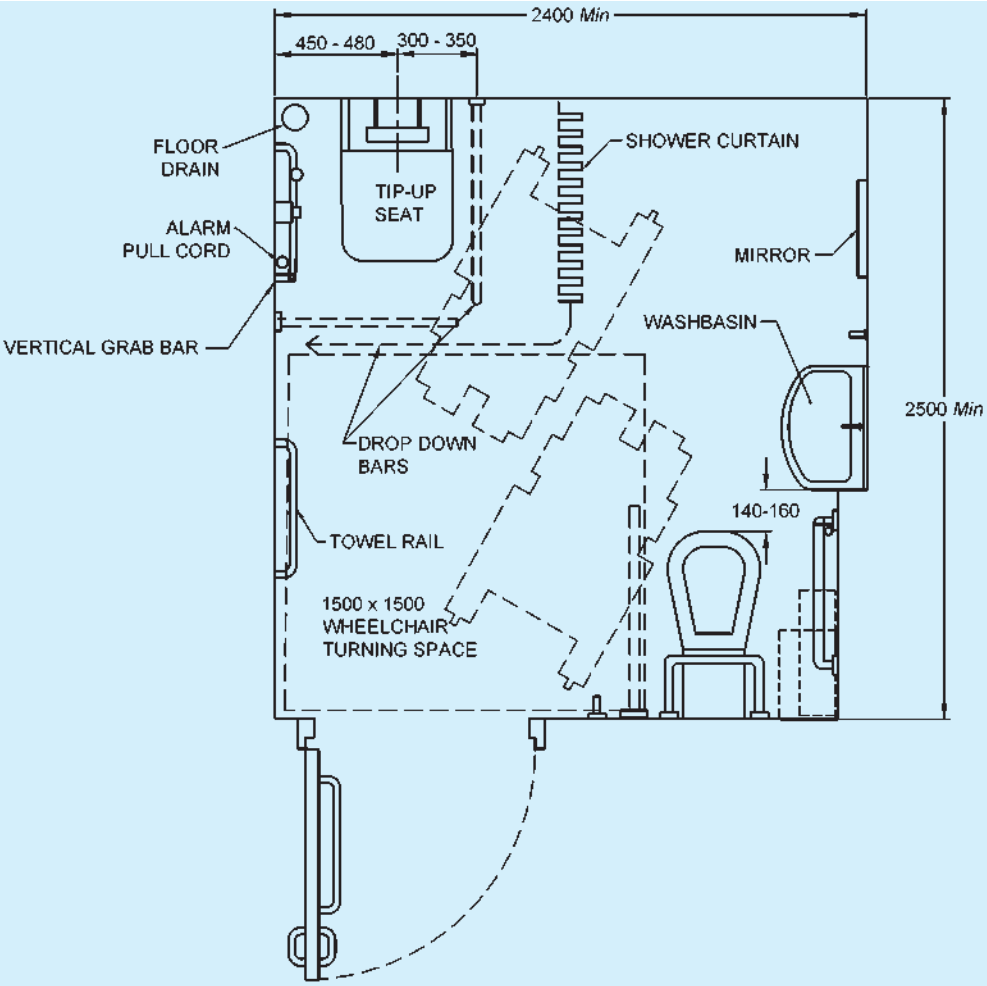
All dimensions in millimetres.

FIG. 85 SELF-CONTAINED SHOWER ROOM FOR INDIVIDUAL USE



All dimensions in millimetres.

FIG. 86 SELF-CONTAINED CHANGING ROOM FOR INDIVIDUAL USE



NOTES
1 Layout shown for right-hand transfer to shower seat and water closet.
2 The larger washbasin are set back 200 mm to maintain the correct relationship of its leading edge with the water closet.

All dimensions in millimetres

FIG. 87 SHOWER ROOM INCORPORATING AN ACCESSIBLE CORNER TOILET FOR INDIVIDUAL USE

B-9.14.4 *Grab Bars*

Grab bars in shower shall be set according to **B-9.6** and Fig. 87. The shower area shall be fitted with at least one vertical grab bar which may hold the flexible shower head.

B-9.14.5 *Stationary, Fittings and Accessories*

The length of the flexible (adjustable and detachable) shower hose (telephone shower/ handheld shower), shall be 1 500 mm minimum. The handheld shower head should be provided between 1 000 mm and 1 200 mm above the finished floor. The shower hose fitting should be a minimum 1 300 mm above floor level.

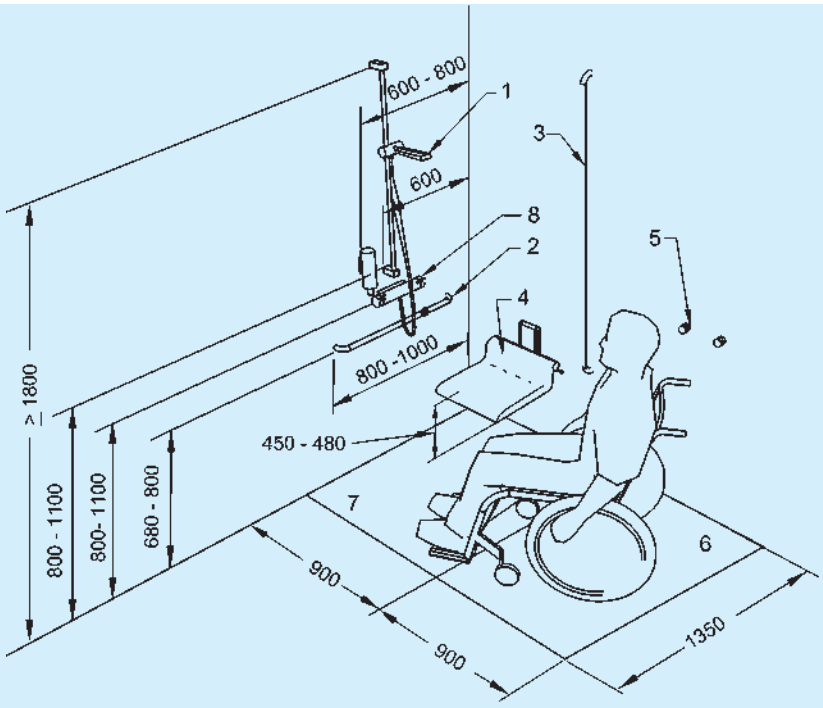
Shower controls and folding seat shall be set according to Fig. 88. Controls shall comply with **B-7**.

The shower room shall be equipped with a door complying with **B-9.4**. Assistance alarm(s) shall be provided in accordance with **B-9.12**.

B-9.14.6 *Individual Shower Room*

A clear floor space of at least 1 350 mm × 900 mm shall be provided on the clear side of the foldable seat, to allow access from a wheelchair, in addition to the manoeuvring space of 1 500 mm (*see* Fig. 85).

The screening of a shower recess shall be either a curtain or a door system that maintains the required circulation and manoeuvring space and does not interfere with the level entry.



Key
1 Hand-held shower head
2 Horizontal grab bar
3 Vertical grab bar
4 Foldable shower seat
5 Towel hooks
6 Transfer area
7 Wet showering area with gradient 1 : 50 to 1 : 60
8 Shower controls

All dimensions in millimtres.

FIG. 88 EXAMPLE OF A SHOWER PLACE WITH GRAB RAILS, ADJUSTABLE SHOWER HEAD AND FOLDING SEAT

A shower head support grab bar shall be fixed on the wall in the position shown in Fig. 88.

A hand held detachable shower head shall be provided with a flexible hose of minimum length 1 200 mm, and it shall be able to reach within 100 mm of the shower floor.

An adjustable shower head holder shall be provided to support the shower head, and shall,

a) be installed on the shower head holder support grab bar as shown in Fig. 88;
b) allow the graspable portion of the shower head to be positioned at various angles and heights; and
c) allow the graspable portion of the shower head to be located at heights between 1 000 mm and 1 800 mm above the finished floor.

The fastenings, materials and construction of the seat shall withstand a force of 1.1 kN applied at any position and in any direction.

Grab bars shall be fixed on the walls in the positions shown in Fig. 88. All other devices, for example taps, soap holder, shall be situated in an accessible range between 900 mm and 1 100 mm.

B-9.15 Public Toilets

Public toilets shall also comply with the overall requirements under **B-9** with respect to the facilities provided therein so as to ensure that the same are accessible. In all public toilets, the following shall be provided:

a) Male section shall have one urinal with support grab bars for ambulant disabled and at least one urinal for children at a lower height;
b) Both male and female section shall have one WC for ambulant disabled;
c) One Type A unisex accessible toilet room with independent entrance; and
d) Depending on footfall, one Type B accessible toilet in both male and female toilet groups.

B-9.16 Contrast and Lighting

Fixtures and fittings in sanitary facilities should visually

contrast with the items and surface on which they are positioned. Use of the same colour everywhere, for example white basins and white tiles, etc, shall be avoided and colour and tonal contrast should be used to differentiate elements in the environment.

Light switches should be fixed inside all accessible toilet cubicles or the light should automatically switch on when someone enters the room. Timed light switches should not be installed or used.

The minimum illumination measured at 800 mm above floor level shall be 200 lux in the area of the washbasin.

B-9.17 Floor Surface

The floor surface shall be slip resistant, anti-glare and firm.

B-9.18 Signage

Signage shall be clearly visible incorporating the international symbol of accessibility and shall comply with the requirements given in **B-24**. Signage for unisex accessible toilet, toilet for ambulant disabled, unisex change rooms or fitting rooms, unisex shower rooms shall be as shown in Fig. 89. Signage for Type B accessible toilet shall also indicate available transfer option, that is, right hand or left hand as shown in Fig. 90.

B-10 RECEPTION AREAS, COUNTERS, DESKS AND TICKET OFFICES

B-10.1 Hearing and Lip-Reading

Reception areas, counters, ticket offices, especially in

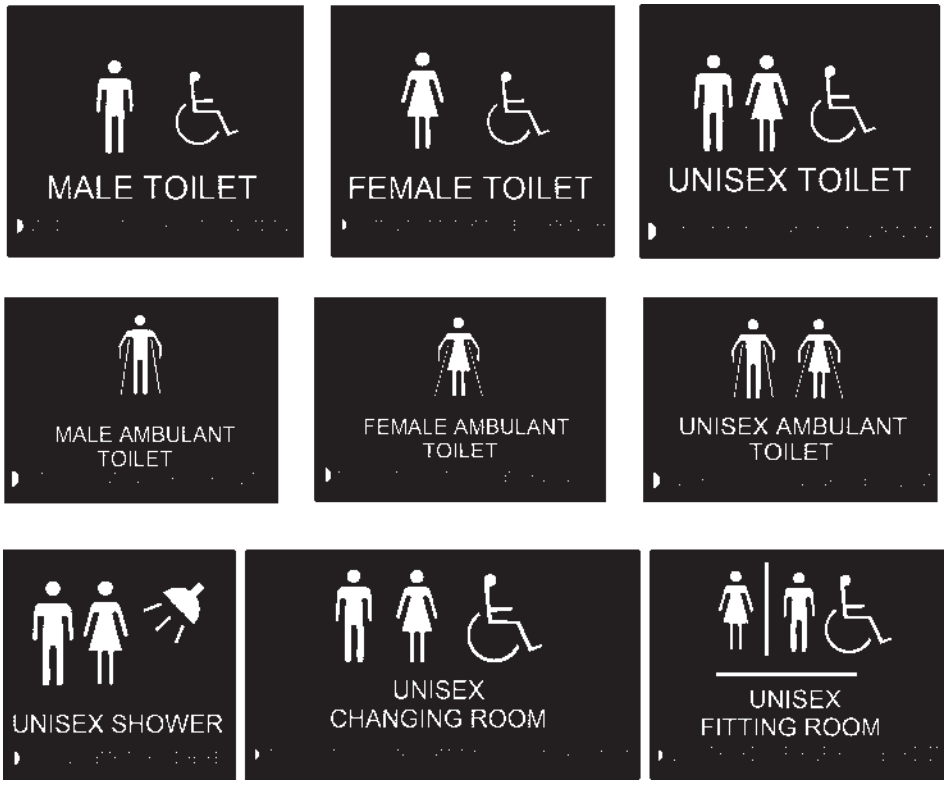


FIG. 89 SIGNAGE FOR DIFFERENT SANITARY FACILITIES

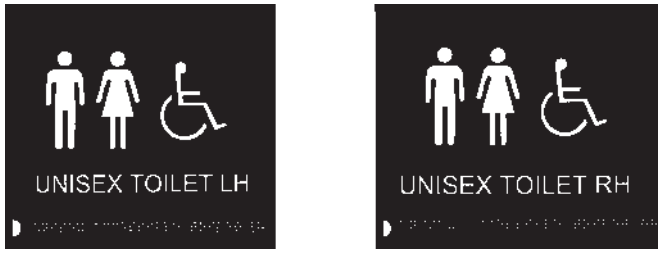


FIG. 90 SIGNAGE INDICATING TRANSFER OPTIONS (RIGHT HAND OR LEFT HAND) IN UNISEX ACCESSIBLE TOILET

noisy environments or those equipped with a separating security screen, should have at least one position fitted with a hearing enhancement system (for example induction loop system) to assist hearing-aid users, as described in **B-21**, and be clearly marked with the appropriate signage/symbol.

Positioning of service counters in front of windows where bright sunshine may come should be avoided as it causes the user's face to be in shadow and hence difficult to lip-read. Service counters equipped with a service screen are particularly difficult. Reflections and glare should be avoided.

B-10.2 Location

Counters and reception desks should be located and clearly identified so that they are easily recognizable from a building entrance. Information reception areas should be positioned near the main entrance. Entrance flooring systems or tactile ground surface indicators can help in locating reception counters for people who have vision impairment. Such products should be designed to minimize trip and slip hazards.

General design requirements for colour and visual contrast should be considered (*see* **B-24.3**).

B-10.3 Space to Manoeuvre

Counters, desks and ticket offices should be accessible to wheelchair users on both sides. A clear manoeuvring space at least 1 500 mm × 1 500 mm shall be provided in front of the counter on the receptionist's side and on the visitor's side; 1 800 mm × 1 800 mm is preferred.

B-10.4 Height

B-10.4.1 The counter level shall be between 750 mm and 800 mm from the floor. Clear knee space underneath shall be minimum 700 mm (*see also* Fig. 91).

B-10.4.2 Reception desks where writing is done by the visitor (for example at hotel receptions) should allow frontal approach by wheelchair users with space to provide clearance for wheelchair user's knees. The counter level and clear knee space underneath shall be as per **B-10.4.1**. At least a part of the desk should also be at a height suitable as a writing place for standing people, between 950 mm and 1 100 mm (*see* Fig. 91).

B-10.5 Lighting

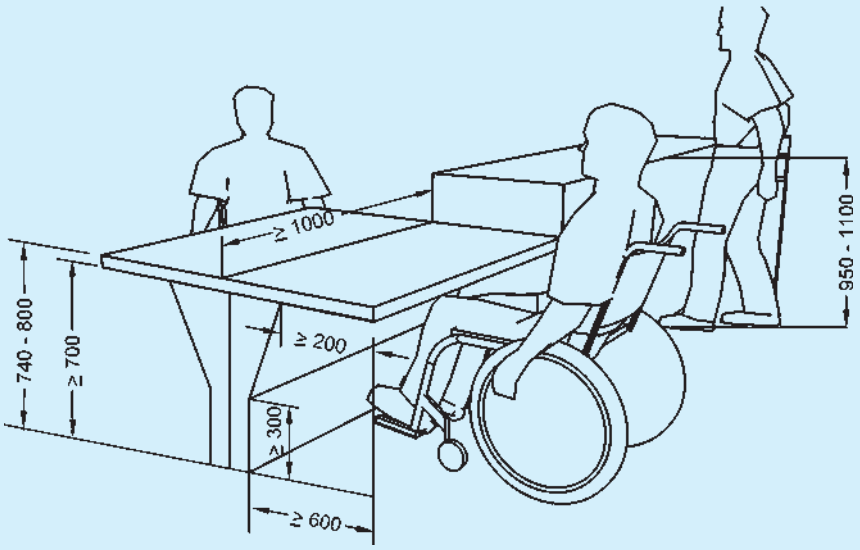
To facilitate lip reading, lighting should provide even illumination. The reading and writing surfaces at counters, desks and ticket offices shall be illuminated to a level of at least 200 lux in the room, and on the desk in a range of 350 lux to 450 lux.

B-10.6 Ticket Systems

If a queue number ticket system is used, it shall be suitably designed to be accessible. All control devices shall be located according to **B-7**. All necessary information shall be given in simple wording with sufficient visual contrast and based on the two-sense-principle (*see* **B-7**, **B-21**, **B-24.1.2**, and **B-24.3**). The ticket machine and the calling system shall provide visual and audible output.

B-11 CLOAKROOM

Attended cloakrooms are staffed rooms where bags/ luggage/other articles can be stored securely. Typically, a ticket or receipt is given to the customer, with a



All dimensions in millimetres.

FIG. 91 HEIGHTS OF COUNTERS SUITABLE FOR WHEELCHAIR USERS AND PEOPLE STANDING

corresponding ticket attached to the garment or item. A cloakroom shall comply with the requirements given for reception/counters (*see* **B-10**).

B-12 AUDITORIUMS, CONCERT HALLS, SPORTS ARENAS AND SIMILAR SEATING

B-12.1 Hearing Enhancement Systems

A hearing enhancement system should be provided. The system should also be provided on the stage/platform (*see* **B-21**).

B-12.2 Lighting for Sign Language Interpretation

Adequate provision should be made to facilitate sign language and lip reading. Lighting on the faces and hands of presenters and people signing should be provided at an angle of 45° to 50° from horizontal at ceiling level for people with a hearing impairment to be able to read the presenter's lips and the signer's lips and hands. A suitable contrasting backdrop should be provided, to assist in reading the presenter's lips and hands.

B-12.3 Designated Seating Areas for Wheelchair Users

At least 1 percent of seats shall be designated as seating areas (*see* **B-8** for requirements of seating spaces) for wheelchairs users, with a minimum of two.

For total seats exceeding 51, it is recommended to provide the designated seating areas in the following manner:

a) Total seats 51 to 100, minimum three designated seating areas for wheelchair users;
b) Total seats 101 to 200, minimum four designated seating areas for wheelchair users; and
c) One additional seating area should be provided for every two hundred additional seats or part thereof.

These spaces should be integrated among other seats and allow two wheelchair users to stay together. It is recommended that the armrest on the seats at the end of the row lift up to allow people to transfer from the wheelchair onto a seat. To accommodate groups of wheelchair users, in an auditorium with fixed seats, a minimum of 15 seats shall be foldable or removable to increase the number of designated areas for wheelchair users when necessary.

Some seats should be wider in order to allow larger size people to sit properly.

B-12.4 Access to Stage and Backstage

Access to the stage and to the backstage area shall be provided. Adequate provision should be made to direct the user to the designated spaces.

B-12.5 Row and Seat Numbers

The row and seat numbers should be legible to people who have impaired vision. They should be tactile, of adequate size and have enough visual contrast to the background on which they are mounted. The requirements given in **B-24** should also be considered.

B-12.6 Accessible Changing Rooms

The minimum number of accessible changing rooms should be provided depending on the type and use of the building.

In the event that changing rooms are provided alongside a toilet area, these should comply with the specifications given in **B-9.14**.

A fixed bench should be set at a height of 450 mm to 480 mm above floor level. The bench should be no less than 500 mm wide, 2 000 mm in length, and be provided with a grab bar at a height of 700 mm to 800 mm with a clearance of between 50 mm and 65 mm from the wall.

A clear space of 1 500 mm × 1 500 mm shall be beside the bench.

Coat hooks should be set at different heights, 900 mm to 1 100 mm, and additionally at least one hook at 1 400 mm.

Coat hooks, benches, locker handles and other furnishings should offer good colour and tonal contrast to their backgrounds. Non-slip floor surfaces should be used, and good lighting as well as matte finished surfaces and furnishings should be provided.

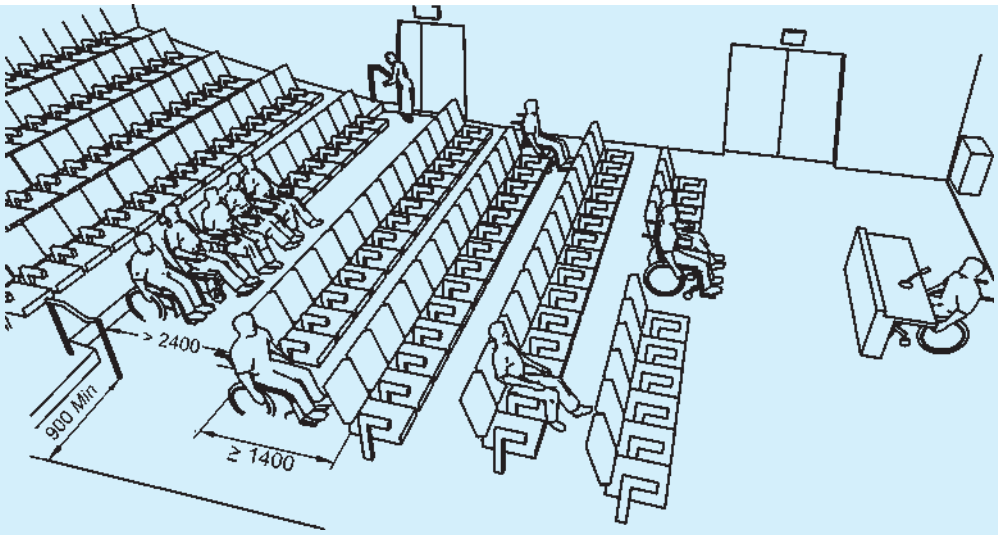
An alarm/call bell/switch may be provided (*see* **B-9.12**).

Changing rooms shall have a minimum area of 4 m^2.

B-13 CONFERENCE ROOMS AND MEETING ROOMS

The requirements for sufficient acoustic provision shall be provided in conference rooms and meeting rooms. Accessible toilet facilities, as per **B-9** should be as near as possible to such rooms. A sound augmentation system should be provided. Reverberation time for speech, music, etc, should be as per Part 8 'Building Services', Section 4 'Acoustics, Sound Insulation and Noise Control' of the Code.

All equipment in conference rooms shall be usable by people chairing or participating in the meeting and shall be at a height between 800 mm and 1 000 mm. *See also* **B-7** for requirements of controls and operating devices.



All dimensions in millimetres.

FIG. 92 EXAMPLES OF VIEWING SPACES FOR WHEELCHAIR USERS

B-14 VIEWING SPACES IN ASSEMBLY AREAS

B-14.1 Floor Area

The floor area for a wheelchair viewing space shall be connected to an accessible path of travel and shall meet the following requirements (*see* Fig. 92):

a) It shall be at least 900 mm × 1 400 mm;
b) The depth of the row shall be minimum 2 400 mm;
c) It shall have clear and level surface;
d) It shall have sufficient manoeuvring space;
e) Spaces for several wheelchair users shall be provided. They shall be located beside regular seating rows, for the wheelchair user to be able to stay by his/her accompanying person, if relevant; and
f) It is recommended that the armrest on the seats at the end of the row (aisle seats) lift up to allow wheelchair users to transfer from the wheelchair onto a seat.

Some seats should be provided with foldable armrests, considering transferences (*see* **B-12.3**); some other seats should be wider, considering larger size people.

B-14.2 Sight Lines

Wheelchair user viewing spaces shall provide viewing spaces that are,

a) comparable to those for all viewing positions with a minimum unobstructed eye level up to 1 200 mm; and
b) not reduced or obstructed by standing members of the audience.

Row and seat number identification signs shall be legible to persons who are visually impaired (*see* **B-24**).

B-15 BARS, PUBS, RESTAURANTS, ETC

In restaurants a minimum of 25 percent of the tables shall be usable by wheelchair users according to **B-8.3**. In bars, a minimum of 25 percent of bar counters shall not be more than 800 mm height, and shall have an unobstructed lateral access for wheelchair users.

Sufficient manoeuvring space between tables and the route to the accessible toilet facilities shall be provided.

The general design requirements for colour and visual contrast should also be considered, as described in **B-24.3**.

In self service restaurants, tray slides and counters shall be mounted at 800 mm from the floor for wheelchair users. Food shelves shall be mounted at a maximum height of 1 200 mm and aisle space of minimum 900 mm shall be provided. Where stools and high tables are provided, low tables suitable for wheelchair users shall be provided. Cantilevered table or tables with straight legs at each corner are preferable to central pedestals that might restrict wheelchair access.

B-16 TERRACES, *VERANDAHS* AND BALCONIES

Terraces, *Verandahs* and balconies shall be accessible to all people, including people with mobility impairments.

Parts of these facilities should be covered with a canopy, to give shelter against the weather (sun/rain/snow).

Walking surfaces shall be slip resistant.

B-17 ACCESSIBLE BEDROOMS IN NON-DOMESTIC BUILDINGS

The access to accessible bedrooms in non-domestic buildings (that is hotels, guesthouses, etc) shall comply with the requirements outlined in this annex and in particular with **B-4** and **B-5**. The minimum number of accessible bedrooms in non-domestic buildings shall be in accordance with Table 8.

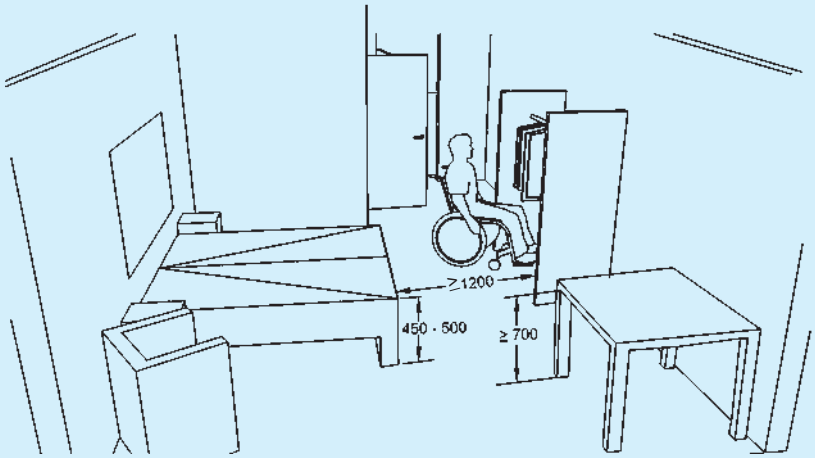
Rooms accessible for wheelchair users shall be designed for two beds. If a single bedroom accessible for wheelchair users is provided, a queen size bed is preferred, 1 500 mm width × 2 000 mm length.

Free space on at least one of the long sides of the bed shall be provided. This space should be 1 500 mm, and shall not be less than 1 200 mm. At the foot of the bed, at least 1 200 mm is required (*see* Fig. 93 and Fig. 94).

Sufficient clear manoeuvring space is needed to gain access to facilities, including the shower.

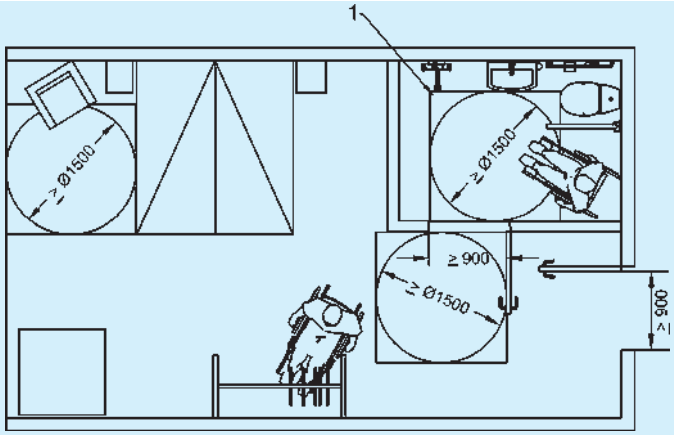
There should be a bench for luggage at a height between 450 mm and 650 mm.

The minimum height of a bed shall be between 450 mm and 500 mm, when it is compressed under a 90 kg weight.



All dimensions in millimetres.

FIG. 93 EXAMPLE OF SPACE ALLOWANCES FOR ACCESSIBLE BEDROOM



Key
1 Shower area

All dimensions in millimetres.

FIG. 94 EXAMPLE OF SPACE ALLOWANCES FOR ACCESSIBLE BEDROOM AND TOILET/SANITARY ROOM

For communication for people with hearing, vision and cognitive limitations, *see* **B-21**.

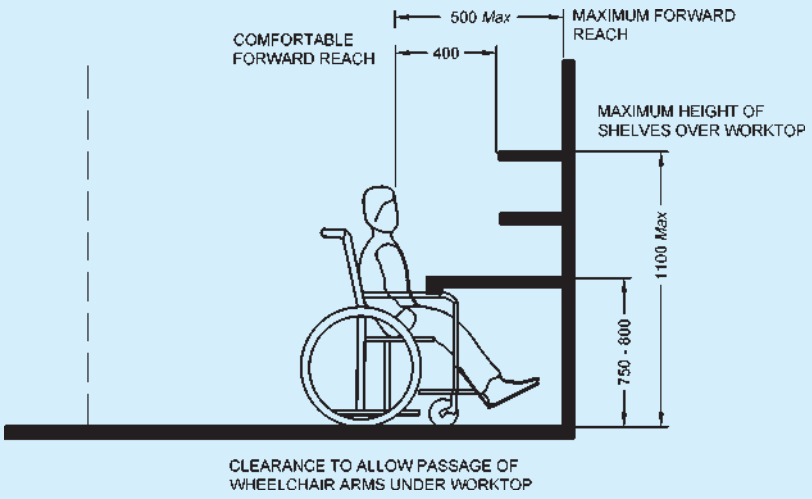
Visual and audible alarm systems shall be accessible to warn people with visual and hearing impairments.

Figures 87 and 88 shall be considered for accessible shower with an accessible toilet.

B-18 KITCHEN AREAS

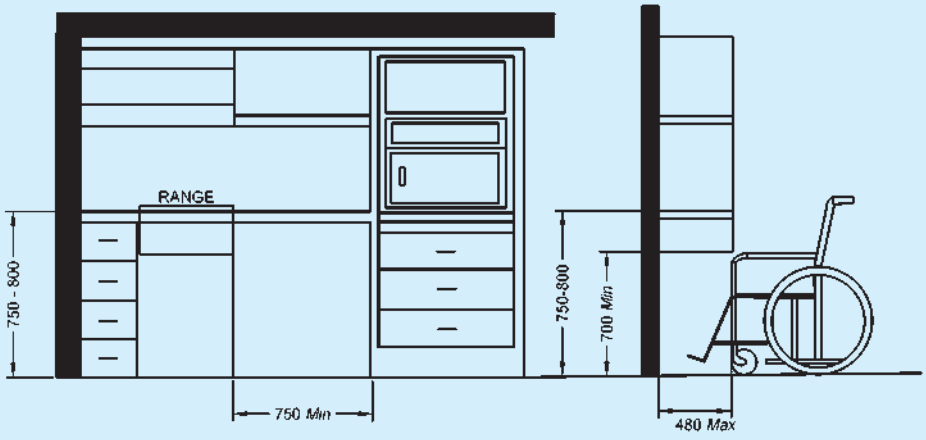
Kitchen areas shall take into account general design considerations in respect of manoeuvring space, slip resistant walking surface and accessible height of controls and devices. Wheelchair turning radius of at least 1 500 mm should be provided between the counter and the opposite walls. Floor surface should allow for easy wheelchair manoeuvrability. Essential kitchen appliances (oven, refrigerator, etc) should be usable by persons both standing and sitting in a wheelchair, and a worktop should be located beside all appliances.

The sink taps should be reachable and easy to operate with one hand. The sink should be reachable for a wheelchair user. If a knee recess is provided under a sink, its underside should be insulated. Counter tops should be between 750 mm and 800 mm in height and provide for clear knee space for a wheelchair user. The clear knee space for a wheelchair user is at least 900 mm wide, 480 mm deep and 680 to 700 mm high (*see* Fig. 95 and Fig. 96). Counter tops/slabs should have rounded edge. All surfaces should be smooth to facilitate sliding of heavy items from one area to another. Slide-out working spaces are useful in providing an over-the lap working surface. For people with ambulatory disabilities, stools (preferably with



All dimensions in millimetres.

FIG. 95 REQUIREMENTS FOR COUNTER TOP



All dimensions in millimetres.

FIG. 96 KITCHEN SHELVES AND CABINETS

back and foot rests) should be provided strategically at the main work area.

A section of the shelves should be within reaching distance for a wheelchair user, between 300 mm and 1 100 mm above floor surface.

All controls and operating mechanisms should comply with **B-7.**

B-19 STORAGE AREAS

The minimum manoeuvring space and reachability for wheelchair users should be taken into consideration when designing and constructing a storage area. Part of the shelves should be within reaching distance for a wheelchair user, between 300 mm and 1 100 mm above the floor. If a door is provided, it should open outwards.

B-20 ACCESSIBLE HOUSING

B-20.1 Exterior, Entrance and Access within the Building

The site planning and development, approach to the building and access at entrance and within the building shall be in accordance with **B-2**, **B-4** and **B-5**.

B-20.2 Interior

B-20.2.1 *Furniture Arrangement*

Sufficient manoeuvring space should be made available (at least 1 500 mm turning radius) for wheelchair user or person ambulating with an assistive device such as a walking frame or a white cane. Clear passage should be allowed from one room to the other. Unrestricted access should be provided to electrical outlets, telephones and wall switches. All controls and operating mechanisms shall comply with **B-7** and a clear floor space for the wheelchair, of at least 900 mm × 1 200 mm should be provided in front of all the utilities and furniture.

B-20.2.2 Floor Surface

Floor surface shall comply with **B-5.2.7**.

B-20.2.3 *Doors and Windows*

Doors and windows shall comply with **B-5.3** and **B-5.4**, respectively.

B-20.2.4 Vertical circulation within the house shall be in accordance with **B-6**.

B-20.3 Bedroom

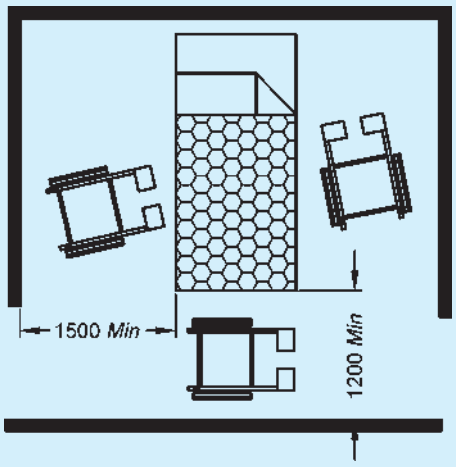
The bedroom should be planned to provide a 1 500 mm turning in space for wheelchair, at least near all the doors. There should be a clear floor space of at least 900 mm × 1 200 mm in front of all furniture.

The minimum height of a bed shall be between 450 mm and 500 mm, when it is compressed under a 90 kg weight. Stability may be improved by placing the bed against a wall or in corner of the room (except for when the wheelchair user plans to make the bed). The bed should be so positioned so as to provide free space on at least one of the long sides of the bed. This space should be 1 500 mm, and shall not be less than 1 200 mm. At the foot of the bed, at least 1 200 mm is required (*see* Fig. 97).

A bedside table or cabinet between 450 mm and 900 mm from the floor may be useful to hold a lamp, telephone, necessary medications and a call bell if assistance is needed.

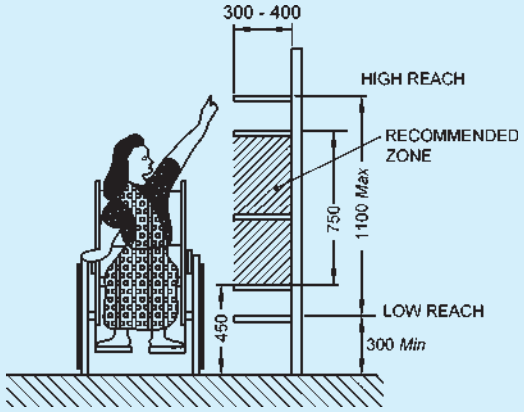
Wall hook installed at a height of 1 100 mm to 1 300 mm may be a useful addition to the closet area.

The closet should have a clear floor space of at



All dimensions in millimetres.

FIG. 97 SPACE AROUND BED



All dimensions in millimetres.

FIG. 98 STORAGE SPACE

least 900 mm × 1 200 mm. It should have the clothes bar at a height of 1 200 mm from the floor. The shelves should be installed at various levels between 300 mm and 1 100 mm from the floor surface (*see* Fig. 98). The door handle should be conforming to **B-7**.

B-20.4 Living Room

At least 1 500 mm turning in space for wheelchair should be provided near all entry points to the living room. A living-dining combination is preferable to a kitchen-dining combination (except when the wheelchair user does the cooking).

The seating space for a wheelchair user at the dining table should provide a clear knee space. The clear knee space for a wheelchair user is at least 900 mm wide, 480 mm deep and 680 to 700 mm high.

Floor surface should comply with **B-5.2.7**.

There should be a clear floor space for the wheelchair of at least 900 mm × 1 200 mm in front of all the fixtures. Chair seat heights should not be less than 500 mm.

Controls and operating mechanisms should comply with **B-7**.

B-20.5 Toilet or Sanitary Room

Toilet or sanitary room shall comply with **B-9**.

B-20.6 Kitchen

Kitchen shall comply with **B-18**.

B-21 ACOUSTIC ENVIRONMENT

B-21.1 General

The acoustic environment in a building should be suitable for its intended function for all building users. This includes all hearing people especially the hard of hearing. For deaf and hard of hearing people, good lighting is essential to understand the sign language interpreter and/or optical information devices. Many people with some degree of hearing loss have assistive devices to amplify sound, such as hearing aids or cochlear implants.

However, if the acoustic environment is not supportive of these devices, they do not work effectively. In addition, many people who have a mild or temporary hearing loss and do not have assistive devices may not be able to access information or communicate effectively. Most people with hearing loss and people without hearing loss rely on sight to lip read or interpret facial expressions; therefore where the acoustic environment is regarded as important, suitable lighting, colour and visual contrast should be considered to benefit all building users.

Information normally conveyed in visual form may not be accessible to people who are blind or partially sighted. This information should also be conveyed audibly; the clarity (speech transmission index) of this information is affected by the acoustic environment.

The following design considerations should be taken into account to maximize the functionality of the acoustic environment, and to support the use of assistive devices.

B-21.2 Acoustic Requirements

People with hearing impairments have particular difficulty in making out sounds and words in noisy environments. Adequate sound insulation should minimize noise from both outside and inside the building. Noise can often be mitigated, for example by introducing a buffer zone between a meeting area and extraneous noise, or partitioning a restaurant. The acoustics in a room are essentially connected with its location in the building and with the acoustic insulation of the building elements. The distribution of noise within the room itself and from exterior sources depends on the sound absorption of the surrounding surfaces and furnishing of the room. The calculation of acoustic absorption is significant in rooms where acoustic quality is important and also where noise reduction is required.

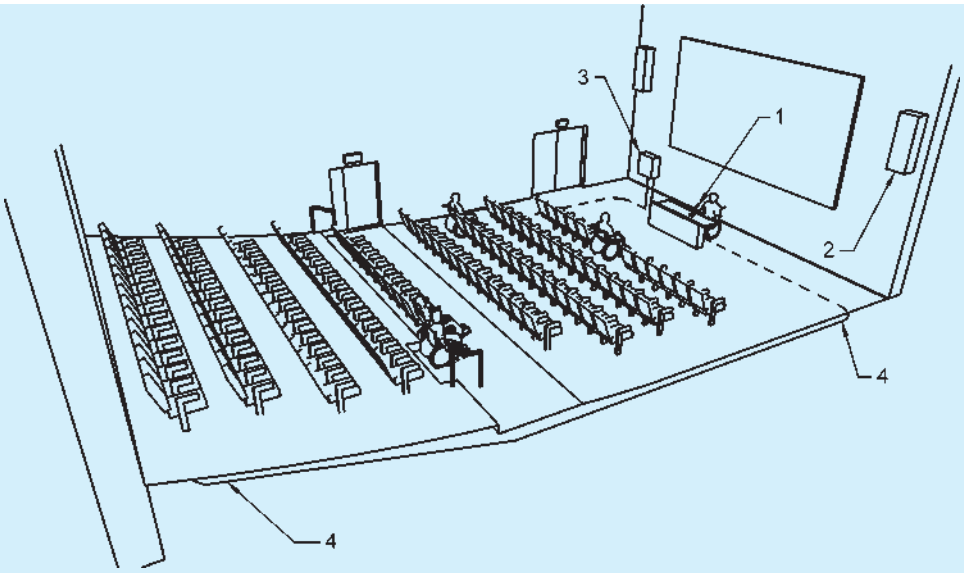
Good acoustics shall be achieved by optimizing the reverberation time, by considering the use/purpose of the room and by ensuring a low background noise level. The optimum reverberation time of a room should be determined having regard to the volume and the intended purpose of the room.

The geometry and shape of the room, as well as the distribution of sound absorbing and reflecting surfaces, are important. Surfaces that absorb sound should be carefully selected, as well as surfaces that reflect it. To develop an effective acoustic environment, sound absorbent surfaces can be used on floors and ceilings.

The optimum reverberation times for communication, speech only or music performance are different and depend on the size and shape of the room. Requirements for reverberation time shall be as per Part 8 'Building Services', Section 4 'Acoustics, Sound Insulation and Noise Control' of the Code.

B-21.3 Hearing Enhancement Systems

A hearing enhancement system fitted at an information point can significantly assist communication for a person with a hearing impairment who uses a personal hearing aid, or has a cochlear implant. Hearing aids or cochlear implants may have a Telecoil (T-switch) which



Key
1 Microphone
2 Loudspeakers
3 Induction loop amplifier
4 Induction loop

FIG. 99 EXAMPLE OF INDUCTION LOOP SYSTEM IN CONFERENCE ROOM

allows the listener to receive the sound signal directly.

NOTE — Hearing enhancement systems amplify audible communication and can be helpful to people who have a hearing impairment. They include a direct wire system, an inductive loop system, an infrared system, or a radio frequency system. All of these systems transmit a signal. Special purpose receivers are required for infrared and radio frequency systems, while hearing aids equipped with a T-switch are capable of receiving the signal from an induction loop system. Receivers can be equipped to be compatible with hearing aids.

Hearing enhancement systems, for example induction loops and infrared signal transmitting systems, shall be provided in conference and meeting areas. All seats, including the front scene, should be covered by hearing enhancement systems like induction loops (*see* Fig. 99). Portable hearing enhancement systems may be an alternative.

B-22 LIGHTING

B-22.1 General

The planning of artificial lighting should be co-ordinated with the planning of natural lighting, the choice of surfaces and colours. Lighting can be used to accentuate interior colour, tone and texture schemes, and to facilitate orientation. The lighting should not lead to glare or excessive contrast.

B-22.2 External Lighting

The routes to and around a building shall have sufficient artificial lighting to facilitate awareness of changes of level or gradient. The positioning of lights should not cause glare, reflection or shadows. Ramps, entrances, steps, signage, etc, to the building should be well lit artificially, with an illuminance of at least 100 lux.

B-22.3 Natural Lighting

It should be possible to shade windows from bright light.

B-22.4 Artificial Lighting

Lighting should provide visual conditions consistent with the visual task, orientation and safety. Key factors are,

a) level of illumination of horizontal and vertical surfaces;
b) limitation of glare from a light source or reflections;
c) uniformity and luminance distribution;
d) direction of lighting and shading; and
e) colour rendering.

NOTE — Good artificial lighting where needed is crucial for everyone, ensuring that vision impaired people are able to use buildings safely and conveniently, and that people with hearing impairments are able to lip read.

B-22.5 Lighting to Facilitate Wayfinding

Lighting should facilitate wayfinding. Building elements should be marked by increased illumination.

The lighting in critical locations such as entrances, corridors, stairs, changes of level and workstations should facilitate their identification.

Time dependent switch devices shall have a progressive switch off to reach the next switch. An automatic switch on detection system shall cover the complete surface of ramps and stairs. Lighting shall provide sufficient time necessary for users to travel safely along ramps.

Lighting which switches off when people are still on ramps or stairs should be avoided.

NOTE — Ramps and stairs are the most hazardous places for falls.

B-22.6 Controllable and Adjustable Lighting

All lighting, including natural light, should be controllable to avoid glare. Artificial lighting may be adjustable to suit individual needs.

B-22.7 Light Levels in Different Areas

Good light levels should be provided in hazardous areas such as stairs or changes in levels along a route, around doors and at communication or information systems. A minimum light level should be provided according to the visual task as given in different clauses of this annex.

B-22.8 Lighting in Auditoriums

Lighting conditions that support lip reading and sign language should be provided. The environment should be designed to avoid reflection and glare, and it should be possible to adjust both natural and artificial light.

B-22.9 Glare and Shadows

Lighting should not produce glare. Glare and shadows may be avoided by,

a) shielding or shading light sources;
b) use of indirect lighting;
c) appropriate location of light source in relation to the direction of vision and to the object that is to be observed;
d) up lighters, with light sources at floor or low level, should not be used;
e) avoidance of windows at the end of corridors;
f) avoidance of light sources against dark surfaces by choosing light colours for ceilings or walls; and
g) avoidance of abrupt transitions from light to dark spaces. Indoor and outdoor lighting around the doorway should be suitably adjusted to prevent dazzle when entering or leaving the building.

NOTE — Due to the increase of optical scatter in the eye, the effects of glare are exacerbated for elderly people and for individuals with some types of vision impairments (for example cataracts, corneal edema, and vitreous opacities). Glare can cause discomfort and interfere with task performance by decreasing the perceived contrast in visual displays (that is disability glare).

The provisions given in Part 8 'Building services, Section 1 Lighting and Natural Ventilation' of the Code in respect of glare shall also be complied with.

B-23 EMERGENCY EVACUATION IN BUILDINGS

Means of egress, alarm panel, alerting systems, evacuation plans, emergency evacuation routes, provision of area of rescue assistance/refuge areas and signages in such areas shall be in accordance with Part 4 'Fire and Life Safety' of the Code.

B-24 ORIENTATION AND INFORMATION, SIGNAGE, GRAPHICAL SYMBOLS AND VISUAL CONTRAST

B-24.1 Orientation and Information

B-24.1.1 *General*

The built environment should be designed, constructed and managed to facilitate orientation. Orientation means to find one's way, to avoid obstacles which could cause hazards, and to know when one has reached the destination.

Suitable provision shall be made at the entrance to the building and at decision points within the building to describe the location and nature of the building. In very complex buildings, visual, audible and tactile information should be provided.

Means to achieving satisfactory orientation conditions are,

a) planning layouts;
b) wayfinding and guided paths with TGSI (as given in this annex), other physical support of information (*see* **B-24.3**);
c) signage and symbols (*see* **B-24.2**);
d) visual contrast (*see* **B-24.3**);
e) choice of colours (*see* **B-24.3.2**);
f) avoiding surfaces which might make orientation more difficult;
g) lighting (*see* **B-22**); and
h) visual, audible and tactile information according to the two-sense principle (*see* **B-24.1.2**).

Orientation should be facilitated by differences in acoustics, material, light and colour. The design should indicate the use of the building elements.

To facilitate people with vision impairments who have

some residual vision, routes to be followed should have a difference in luminance to the surroundings (*see* **B-24.3**).

Additional illumination or visual contrast and tactile information, such as a change in material or tactile walking surface indicators, should be provided at decision points such as entrances, staircases, lifts, etc, to assist orientation and wayfinding.

Tactile ground surface indicators should be used to indicate directional orientation information where no other clues indicate the path of travel. Across large areas, halls and complex buildings, blind people need a tactile route or guiding pattern to follow (*see* **B-2.5**).

In complex buildings, an audible beacon should be installed in addition to visual and tactile information to provide information on decision points.

B-24.1.2 *Principle of Two Senses*

Supportive measures for information and wayfinding shall be provided in a format that is accessible to people with sensory impairments according to the principle of two senses, as given below (*see also* **B-6.4.7**):

a) audible/tactile information for people with vision impairments, and
b) visual information for people with hearing impairments.

B-24.1.3 *Audible Information*

Consideration should be given to provide suitable amplification and acoustic conditions; the message should be easily understandable and unambiguous. *See also* the principle of two senses in **B-24.1.2**.

Public address systems should be clearly audible and equipped with a hearing enhancement system as described as given in **B-21**.

Emergency information and warning systems are described in **B-6.4.8**, **B-9.12** and **B-9.13**.

B-24.1.4 *Levels of Information*

Information should be clear, concise, accurate and timely. Clarity of information can be defined as information that is legible and easily understood. Clarity of information therefore presupposes that people are able to distinguish between the different types of information that they receive.

Information can be divided into three levels,

a) *Level 1* — Safety information;
b) *Level 2* — General information; and
c) *Level 3* — Advertising information.

It is important that these three levels of information be clearly distinguished.

Information should be complete but concise. Too much information is difficult for people to retain.

All information provided should be accurate and consistent.

NOTE — Universally accepted pictograms should be used in preference to text.

B-24.2 Signage and Graphical Symbols

B-24.2.1 *General*

Signs should be readable and legible for people who have vision or mental impairments. Well-illuminated, clear and readable signs shall be placed at a consistent height (*see* **B-24.2.4**).

Information with text should be supplemented with graphical symbols to facilitate comprehension for everyone (*see* **B-24.2.16** for graphical symbols).

Signs should be provided in relief and Braille (*see* **B-24.2.10**).

The signs should be made of robust materials and be easy to change, clean and repair. Some suggested materials for signage are wood, acrylic and aluminium composite panel (ACP).

An excessive quantity of signs in close proximity should be avoided, as well as visual material placed too close to wall fixed signs (for example posters, timetables, etc).

Where Braille is used as a complementary or independent feature to tactile signs it should be easy to locate.

B-24.2.2 *Main Types of Signs*

The main types of signs are:

a) *Orientation signs* — Sketches, plans, models, etc.
b) *Directional signs* — Directional information from point A to B.
c) *Functional signs* — Explanatory information.
d) *Informative signs* — Purely informative, for example a name.
e) *Signs for emergency exits* (*see* Part 4 'Fire and Life safety' of the Code).

B-24.2.3 *Placement of Signs*

B-24.2.3.1 *Placement outside the building*

Informative signs shall be located adjacent to the entrance door and be illuminated and clearly visible. The sign shall be placed on the latch side. Design and size of letters shall be in accordance with **B-24.2.5**.

Communication systems shall also be placed on the latch side and preferably in a range of 1 000 mm to 1 200 mm above ground level.

B-24.2.3.2 *Placement in the building*

Orientation signs should be located in accessible places adjacent to, but not directly in, main access routes so that they can be examined without disturbance.

In public buildings there should be an orientation plan immediately inside the main entrance. This plan should follow all relevant design criteria stated in this Part and in **B-24.3**.

Directional signs should clearly direct people to the facilities. They should be located where directional decisions are made and constitute a logical orientation sequence from the starting point to different points of destination. They should be repeated, not too often, but every time there is a possibility of alteration in the traffic direction.

Directional signage to washrooms should be provided in all parts of a precinct or building.

Stairwells should have information signs identifying all points of entry and exit.

Floor numbers shall be located on each floor at top and bottom of stairs, on handrails and on each side of the outer frame of each lift-car entrance on each floor and prominently displayed elsewhere so they are visible from the lift car at each level.

B-24.2.4 *Height and Location of Signs*

Directional and functional signs should be located below 1 600 mm where they are easy to approach, to touch and read the raised signs with the fingers (*see* **B-24.2.10** to **B-24.2.12**).

Signs should be located where they are clearly visible to people who are seated, standing or walking.

Signs should be placed between 1 200 mm and 1 600 mm from the floor or ground surface. It should be possible to approach the sign to be read from a short distance (*see* Fig. 100).

Where it is likely that the sign may be obstructed, as in a crowded situation, the signs shall be placed at a height of at least 2 100 mm above the floor. The same requirement applies to signs fixed to the ceiling or projecting from walls. In that case, there should be two signs; one that can be seen from a distance above other people's heads, one as a complement at the height recommended above.

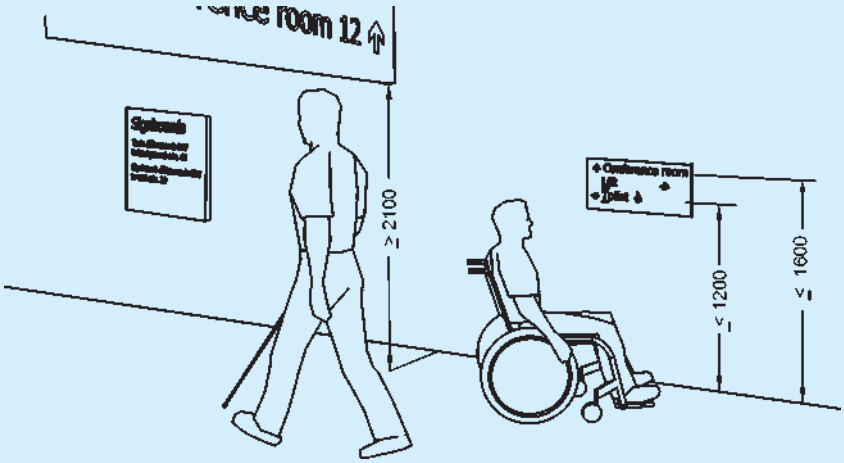
Where there is sufficient space, door signs shall be located on the latch side of the door within 50 mm to 100 mm of the architrave (*see* Fig. 101).

B-24.2.5 *Font and Size of Lettering*

The fonts should be easy to read. The font style should be a sans serif font similar to Helvetica or Arial medium.

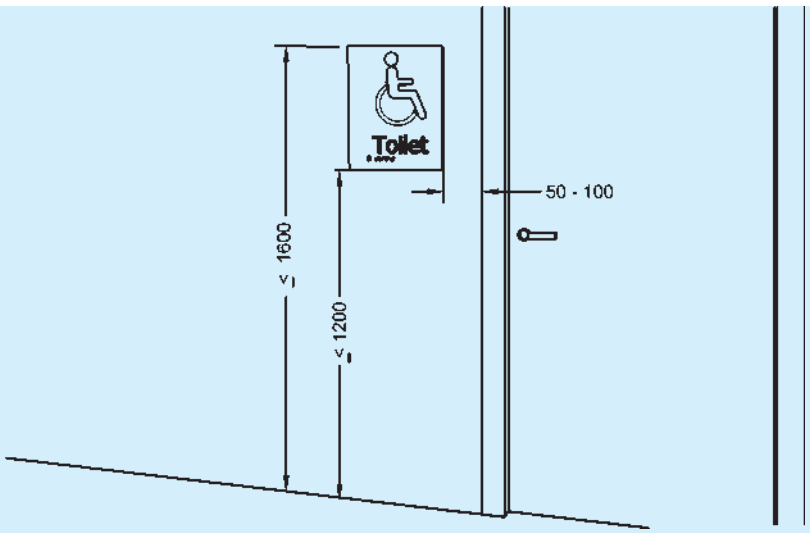
The letter height depends on the reading distance. A letter height between 20 mm and 30 mm for each metre of viewing distance is preferred. The letter height should not be less than 15 mm.

Usage of too many type sizes on any one sign should be avoided. Also italics, script texts, condensed texts, light stems should be avoided. Consistent font stem widths should be used.



All dimensions in millimetres.

FIG. 100 HEIGHT OF SIGNS



All dimensions in millimetres.

FIG. 101 LOCATION OF DOOR SIGNS ON THE LATCH SIDE OF THE DOOR

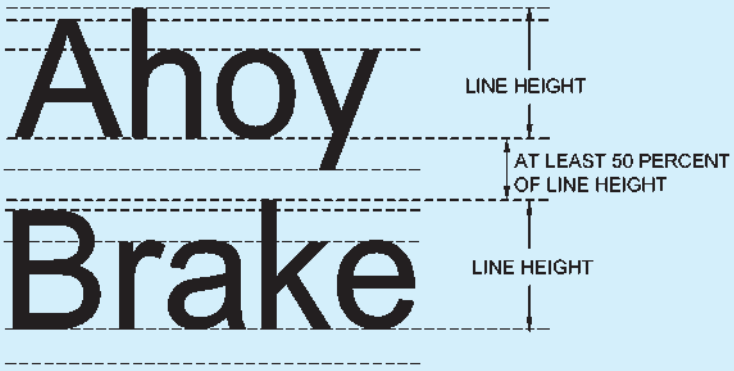


FIG. 102 LINE HEIGHT AND SPACING

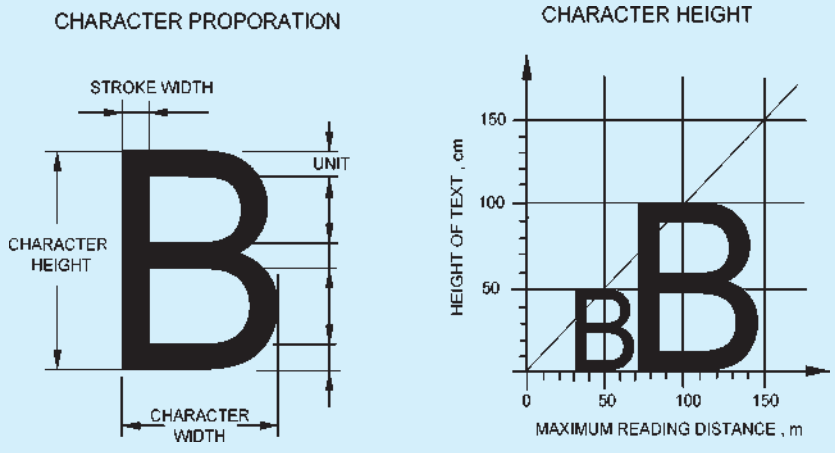


FIG. 103 DIMENSIONS OF CHARACTER IN A SIGNAGE SYSTEM

It is recommended that messages of single words or groups of words begin with an upper case letter and continue with lower case letters (sentence case).

The words should not be placed too close together. Adequate height spacing should separate the lines. Lines of text should be ranged from a vertical line (unjustified).

Signs with a single word may be centre justified, else the text should be left justified.

The spacing between two lines shall be 50 percent of the line height (*see* Fig. 102).

A style shall be chosen based on a character width-to-height ratio within 3:5 and 1:1 and the stroke width-to-height ratio between 1:5 and 1:10. It shall be consistent for each sign (*see* Fig. 103).

B-24.2.6 *Differences in LRV*

Minimum difference in LRV for small targets, such as signs and inscriptions, to signboards, should be 70 points.

Signboards should have a minimum difference in LRV from the background of 30 points.

Red-green combination should be avoided. Difficulties in perception can also appear when using the colours green, olive green, yellow, orange, pink and red (*see also* **B-24.3** for contrast).

B-24.2.7 *Glare Free*

Signs should be glare free when mounted. This depends on how the sign is placed, the material and the illumination. The background, graphical symbols, logos and other features shall be of a matte or low sheen finish.

B-24.2.8 *Illumination*

Signs should be well illuminated with no glare with uniform lighting over the surface of the sign of between 100 and 300 lux. Minimum acceptable level of lighting for directional signage, maps and text panel is 200 lux. Signs can be luminescent or artificially lit.

B-24.2.9 *Understandable*

Signs should be readily understandable. They should be designed so as to be simple and easy to interpret. The message should be unambiguous.

Short sentences and simple words should be used. Abbreviations and very long words are hard to understand and should be avoided.

B-24.2.10 *Provision of Raised Tactile and Braille signs*

Signs on panels in lifts, room numbers of rooms in hotels, doors to public toilets and so on shall be raised tactile and include Braille (*see also* **B-24.2.4**).

The preferred height of raised tactile information is between 1 200 mm and 1 600 mm. Signs with tactile information placed at a lower height should be mounted at an angle from the horizontal (preferably 20° to 30°, maximum 45°).

Key

1 Raised tactile letters and graphical symbols, height 15 mm to 55 mm, minimum relief 0.8 mm (1 mm to 1.5 mm relief is preferred)

2 Braille text

3 Braille Locator

FIG. 104 EXAMPLE OF RAISED TACTILE SIGNS AND BRAILLE

B-24.2.11 *Tactile Letters, Figures, Signs and Graphical Symbols*

The height of letters, figures, signs and graphical symbols shall be between 15 mm and 55 mm (*see* Fig. 104).

The minimum height of its relief shall be 0.8 mm; a height between 1 mm and 1.5 mm is preferred (*see* Fig. 104).

The profile of the relief should be shaped as a rounded upside-down turned letter V.

B-24.2.12 *Braille*

Where an arrow is used in the tactile sign, a small arrow shall be provided for Braille readers.

On signs with multiple lines of text and characters, a semi-circular Braille locator on the left margin shall be horizontally aligned with the first line of Braille text.

Braille should be raised, domed and comfortable to touch. It should be located 8 mm below the bottom line of the text and be left justified.

Common alternative formats may be used to assist people with visual impairments who are best able to interpret information through hearing or touch. Embossed letters, raised pictograms and raised arrows are tactile features that may be incorporated into signs, which may be particularly helpful to persons with visual impairments.

B-24.2.13 *Tactile Symbols*

Tactile symbols applied on handrails, doors, maps or floor plans shall have a raised relief contour similar to tactile letters.

B-24.2.14 *Tactile Maps and Floor Plans*

Only essential information should be included on a tactile map or floor plan.

Tactile maps shall be angled between 20° and 30° from the horizontal for ease of reading, and the bottom edge shall be at a minimum height of 900 mm. The map should have a level of illumination between 350 lux and 450 lux, without glare.

The key should be located at the bottom of the map and left justified. The use of a recessed Braille locator on the left hand side should assist in locating the legend.

The map shall be orientated with the building.

B-24.2.15 *Information Displays*

If video and media information displays are used, they should be placed at a height according to **B-24.2.4** and their lettering, etc, should be in conformity with the recommendations above.

Glare from artificial and natural lighting on the screen shall be avoided by,

a) positioning the display or the screen out of direct light; or
b) shading the display or the screen.

A complementary audible information system should be provided.

B-24.2.16 *Graphical Symbols*

The international symbol of accessibility (*see* Fig. 105) shall be replicated consistently in all wheelchair signage. The preferred colour is navy blue with white lettering.

Graphical symbols should be used in conjunction with building signage system, wherever possible.

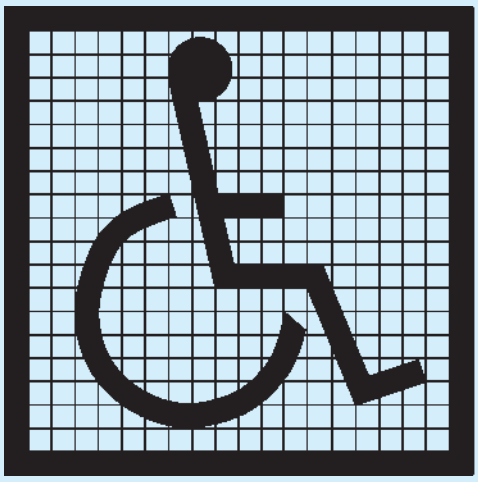
Graphical symbols shall be highly contrasted with a minimum difference in LRV of 70 points and properly illuminated. They shall be used on guides and directional signage (*see also* **B-24.3**).

Graphical symbols on directional and door signs should be tactile, and should be accompanied by raised lettering and Braille (*see* **B-24.2.13**). Signs above a height of 1 600 mm do not need to be tactile, nor to include raised lettering or Braille information.

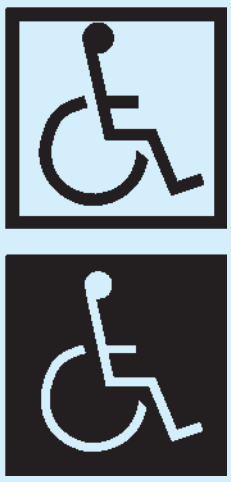
The size of graphical symbols is dependent on the viewing distance (*D*). The minimum size of the inner outline of the frame of graphical symbols (s) can be derived from formula $s = 0.09\ D$, applicable for a viewing distance of 1 000 mm to 10 000 mm.

The following accessible graphical symbols shall be used to denote particular components of a facility. The following facilities for disabled persons shall be marked as:

a) Those relating to people with mobility impairments,
   1) car parking places (parking places, garages);
   2) access and entrances without steps to buildings, especially where they are not identical with the main entrance;
   3) accessible lifts, in cases where not all lifts are accessible; lifting platforms and similar mounting devices;



105A PROPORTIONS



105B DISPLAY CONDITIONS

FIG. 105 INTERNATIONAL SYMBOL OF ACCESSIBILITY

NOTE — This graphical symbol also indicate full accessibility or accessible toilets.

FIG. 106 ACCESSIBLE FACILITY OR ENTRANCE

FIG. 107 SLOPED OR RAMPED ACCESS

FIG. 108 TOILETS ACCESSIBLE, FEMALE AND MALE

FIG. 109 TOILETS ACCESSIBLE, FEMALE

FIG. 110 TOILETS ACCESSIBLE, MALE

FIG. 111 ACCESSIBLE LIFT

FIG. 112 ACCESSIBILITY, BLIND OR LOW VISION

FIG. 113 ACCESSIBILITY, LIMITED WALKING CAPABILITY

FIG. 114 ACCESSIBILITY, ASSISTANCE DOG

FIG. 115 ACCESSIBILITY, HARD OF HEARING

FIG. 116 ACCESSIBILITY, PERSONAL ASSISTANT AVAILABLE

FIG. 117 ACCESSIBILITY, VISION IMPAIRED

4) accessible sanitary rooms;
5) wheelchair viewing spaces and accessible seating;
6) changing rooms; and
7) steps or hoists providing access to swimming pools.

b) Those relating to people with vision impairments: locations where audible and tactile information is provided.

c) Those relating to people with hearing impairments,
   1) telephones and emergency call facilities, equipped with sound amplification; and
   2) provision of an assistive listening system.

Some of the graphical symbols relevant to accessibility are shown in Figs. 106 to 118.

B-24.3 Visual Contrast

B-24.3.1 *General*

In order to facilitate orientation and to ensure safe use of an environment, adjacent surfaces, information and potential hazards shall provide a discernible visual contrast.

A minimum difference in LRV shall be provided in relation to the visual task in accordance with Table 11. Additionally, one of the two surfaces should have an LRV value of minimum 30 points for door furniture, 40 points for large area surfaces and 70 points for potential hazards and text information.

The minimum difference in the LRV shall be achieved and maintained throughout the life of the building elements. Deterioration and maintenance shall be considered at installation.

For lighting conditions lower than specified in this Code, the difference in LRVs should be higher.

NOTES

1 The LRV, sometimes also called the luminance reflectance value, or CIE Y value, is expressed on a scale of 0-100, with a value of 0 points for pure black and a value of 100 points for pure white.

2 The perception of visual contrast increases with better lighting conditions.

3 Reflections and glare from shiny surfaces can reduce visual contrast and can confuse people with vision impairments.

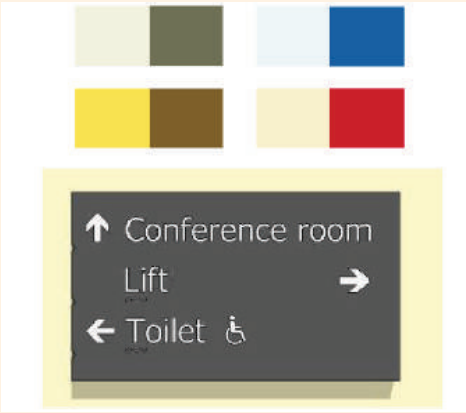
NOTE — Fig. 118 is a combination sign which combines a safety sign and one or more associated supplementary signs on the same rectangular carrier. The signs used in the figure are the following:

a) *Running man* (*centre of the combination sign*) — Emergency exit (right hand).
b) *Arrow* (*right*) — Supplementary arrow sign used with the emergency exit sign to indicate its location in the right direction.
c) *Supplementary sign* (*opposite to the arrow*) — Full accessibility or toilets accessible.

FIG. 118 ACCESSIBLE EMERGENCY EXIT ROUTE

Table 11 Minimum Difference in LRV According to the Visual Task

(*Clause* B-24.3.1)

Sl No.	Visual Task	Difference on the LRV Scale	Approximate Examples of Colour Contrasting
(1)	(2)	(3)	(4)
i)	Large surface areas (that is, walls, floors, doors, ceiling), elements and components to facilitate orientation (that is, handrails, switches and controls, tactile walking surface indicators, and visual indicators on glazed areas)	≥30 points	
ii)	Potential hazards and self contrasting markings (that is, visual indicator on steps) and text information (that is, signage)	≥70 points	

For door hardware (that is, the elements and components to facilitate opening and closing doors) a difference in LRV between the product and its background of at least 15 points and a minimum light reflectance value of 30 points for one of the two surfaces is acceptable.

NOTE — Door hardware is normally positioned at the same height on a door and is either on the left or right side. This makes the location of door hardware easier than other features. In addition, the three-dimensional features of door hardware create shadows and bright spots, which further enhance their location.

Floor patterns should have a visual contrast of less than 20 points difference on the LRV scale.

NOTE — Highly contrasted floor patterns can be perceived as differences in floor level, which may confuse people with vision impairments or cognition capacity. Highly contrasted floor patterns may trigger an attack of vertigo.

B-24.3.2 *Choice of Colours and Patterns*

Different colours should be used for identification of doors, different storeys or departments in a building to aid persons with impaired cognitive ability. The colours used to facilitate orientation shall also provide minimum difference in LRV according to **B-24.3.1**. Combinations of red tones and green tones should be avoided.

Different storeys should be marked with clearly defined large numbers relating to the floor (that is, '2' for the second floor, and so on) both in the stairwells to assist those evacuating and at the lift and stair lobbies on each level.

NOTE — Colour coding floors may not be practical from a long term maintenance perspective.

In case of signage and graphical symbols, contrasting colours shall be used to differentiate the figures from the background on the signboard. The colours of signboard shall also contrast with the surrounding surface so as to be clearly distinguishable (*see* **B-24.2.6**). Information from signs may be conveyed by the colour and brightness differentials between the letter and the background. For graphical symbols, it is preferable to use blue and white colours. Colours same as safety signs shall be avoided in other signs. Primarily red, yellow or green colour is used for safety signs. The colour combinations red/green and yellow/blue should not be used in order to avoid confusing persons who are colour blind. Use of the shades of the same colour in the sign and also use of more than 5 colours in a signage should be avoided.

A preferred schedule of colour contrast for signs from their background is given below:

Sl No.	*Background*	*Sign Board*	*Legend*
(1)	(2)	(3)	(4)
i)	Red brick or dark stone	White	Black, dark green or dark blue
ii)	Light brick or light stone	Black/dark	White or yellow
iii)	Whitewashed walls	Black/dark	White/Yellow
iv)	Green vegetation	White	Black, dark green or dark blue
v)	Back-lit sign	Black	White or yellow

B-25 MANAGEMENT AND MAINTENANCE ISSUES

B-25.1 Effective management of the built environment is essential to ensure that a building can be used by everyone. Management policies and procedures will be required to ensure that accessibility is maintained on an ongoing basis. The following management and maintenance issues, are important factors in ensuring that a building is easily accessed and used by disabled people.

B-25.2 External Issues

a) Keeping external routes, including steps and ramps, clean, unobstructed and free of surface water, dead leaves, lichen, debris, etc;
b) In car parking areas: ensuring that designated spaces are not being used by non-disabled motorists;
c) Where possible, allocating specific designated parking spaces to individual employees, marked by name or number;
d) Checking side-hung doors accompanying revolving doors to ensure they are not kept locked; and
e) Making available auxiliary aids such as portable ramps, and removing them when not in use.

B-25.3 Internal Issues

a) Ensuring that wheelchair spaces are available in seating areas;
b) Ensuring that staff understand the management issues relating to disabled people, including emergency procedures;
c) Ensuring that storage, planters, bins, etc, do not obstruct circulation space, WCs or lift call buttons;
d) Ensuring that cleaning and polishing does not produce a slippery surface;
e) Ensuring that trip hazards, such as at junctions between floor surfaces, are removed;
f) Ensuring access between moveable tables in refreshment areas;
g) Ensuring that in sanitary facilities, written instructions on the use of equipment is displayed beside each item;
h) Ensuring in sanitary facilities, that information is available on the type of sling connector and the types of sling that are compatible with their installed hoist and track;
j) Ensuring that a procedure is set up to respond to alarm calls from sanitary accommodation;
k) Ensuring that waterproof mattress covers can be made available for use in accessible bedrooms in non-domestic buildings;
m) Ensuring that, where floor sockets are provided (for example in meeting rooms), access to sockets is also available at desk level;
n) Ensuring that any temporary barriers that are used to channel customers to reception or serving points, and whose configuration needs to be changed frequently, have a semi-rigid top barrier (for example a spring-loaded band) which contrasts visually with the background against which it is seen; and
p) Ensuring that assistance is made available to carry trays where needed in refreshment areas.

B-25.4 Maintenance Issues

a) Maintaining doors, door closers and building hardware, including checking that the opening forces of self-closing doors are within acceptable limits;
b) Maintaining access control systems;
c) Checking floor surfaces, matting, surface-mounted carpets, etc, re-fixing to the floor where necessary, and replacing where damaged or worn (particularly at entrances to buildings);
d) Maintaining hearing enhancement systems;
e) Maintaining sanitary fittings, including checking that toilet seats are securely fixed, cleaning tap nozzles to ensure correct water flow, emptying and cleaning bins, and keeping equipment clean;
f) Ensuring that adjustable shower heads are lowered to be ready for the next user;
g) Ensuring that emergency assistance pull cords are kept fully extended and in working order at all times;
h) Checking the mountings of all grab bars, and the mechanism of drop-down bars, re-fixing or replacing, where necessary;
j) Servicing of all types of lifts and hoists;

k) Ensuring that facilities, such as lifts, hoists, etc, are in working order between servicing schedules, and providing alternative arrangements in case of facilities being out of order;
m) Maintaining ventilation and heating equipment;
n) Replacing defunct light bulbs and flickering fluorescent tubes quickly; and
p) Keeping windows, lamps and blinds clean to maximize lighting.

B-25.5 Communication Issues

a) Providing information on strobe lighting prior to entry;
b) Removing and/or changing signage as necessary, for example when departments relocate;
c) Providing accurate information on facilities prior to arrival;
d) Providing audio description services;
e) Providing all relevant literature, and reviewing/revising it when necessary;
f) Ensuring that a permanently manned position is available for the emergency lift telephone communications;
g) Updating maps of buildings following changes; and
h) Replacing signs correctly after decoration.

B-25.6 Policy Issues

a) Allocating and reviewing parking spaces;
b) Changing signs when departments move;
c) Reviewing the number of disabled people attending and needing facilities;
d) Establishing and running user groups;
e) Reviewing the number of instruments supporting infra-red systems;
f) Adopting a signage policy;
g) Having the loop position always manned in branches;
h) Providing portable ramps;
j) Arranging audits of journeys made by visitors;
k) Instructing accessibility audits;
m) Ensuring that services are provided when facilities such as lifts break down;
n) Ensuring that responsibilities are defined within the organization;
p) Ensuring that accessibility improvements are picked up whenever possible during maintenance and refurbishment work;
q) Reviewing and improving evacuation procedures;
r) Training of staff;
s) Reviewing all policies, procedures and practices;
t) Reviewing the provision of auxiliary aids; and
u) Considering the impact of background noise (for example music, equipment, ventilation) on people with a range of sensory conditions (hearing, vision, autism). This is especially important in areas where voice communication is necessary, such as reception, meeting and learning spaces.

ANNEX C

(*Clause* 14)

SPECIAL REQUIREMENTS FOR LOW INCOME HOUSING IN URBAN AREAS

C-1 GENERAL

These guidelines cover the planning and general building requirements of low income housing in urban areas, for houses having a maximum plinth area of 40 m^2 including future expansion. The requirement regarding layout planning of low income housing colonies are applicable to public and private agencies/ government bodies. The requirements on design and construction of buildings for low income housing in approved layouts are applicable to all private and public agencies.

C-2 PLANNING

C-2.1 Type of Development

The type of development for low income housing shall be plotted developments as row housing/flatted development as row housing or group housing on cluster pattern (*see* Annex D).

C-2.2 Layout Pattern

C-2.2.1 In the land to be developed, at least 75 percent of the plots may be of the size less than or up to 60 m^2

per dwelling unit in metropolitan towns and 100 m^2 in other towns and hill areas. Remaining 25 percent of the plots may be more than 60 m^2, however, no plot shall be more than 200 m^2. In case of group housing or flatted development at least 75 percent units should have a plinth area (excluding external circulation such as stairs, lifts, lobbies, etc) up to or not exceeding 40 m^2 including future expansion.

C-2.2.2 The mix of plot of different sizes should have a wide range to accommodate the need of lower income group. The project may include more than one site provided they are in the same neighbourhood.

C-2.2.3 The layout should generally conform to the following land use:

Sl No.	*Land Use*	*Percentage of Land Under Each Use*	
		General	Hill Area
(1)	(2)	(3)	(4)
i)	Saleable:		
	a) Residential	50, *Min*	35
	b) Work places, schools institutions, shops, community places, etc	20, *Max*	15
ii)	Non-saleable: Roads, pedestrian paths, drains, public and semi-public open spaces	30, *Max*	50

NOTES

1 Any neighbourhood development should have provision for basic civic and community facilities, however, where such facilities are available in proximity the same could be considered and, in that case, the area under residential use could be increased correspondingly.

2 If land required under statutory provisions of master plan/development plan is proportionately higher but serves larger city needs, readjustment of the recommended land use pattern may be considered. Such provisions should, however, be carefully reviewed by the planning authorities to keep them to the barest minimum levels.

C-2.3 Plot Area

C-2.3.1 *Plot Size*

The minimum plot size with ground coverage not exceeding 75 percent, shall not be less than 40 m^2 in small and medium town and not less than 30 m^2 in metropolitan cities. Plot sizes below 30 m^2 but not less than 15 m^2 may be permitted in case of cluster planning, however, in such cases the ground coverage and FAR shall be 100 percent and 2, respectively (*see also* Annex D for special requirements for cluster planning for housing).

NOTES

1 In exceptional cases in metropolitan cities with population more than 1 million the size of plots may be brought down to 25 m^2 in cases of low income housing colonies located in congested areas as decided by the Authority. In mega cities it may be further reduced to 15 m^2. In such cases where plot size is below 25 m^2, only cluster planning or group housing may be adopted.

2 A minimum of 25 percent of the plot size shall be left open without adversely affecting light and ventilation for habitable spaces and toilet. It shall not be made mandatory to leave set back on any side.

C-2.3.2 *Minimum Frontage*

The minimum frontage of the plot shall be 3.6 m in width.

C-2.4 Density

C-2.4.1 The density norms for plotted development and mixed development shall be as follows:

Sl No.	*Type of Development*	*Range of Densities (Gross)*
(1)	(2)	(3)
i)	Plotted development	65-120 plots per hectare
ii)	Mixed development :	
	a) Small towns	75-100 dwelling units per hectare
	b) Cities	100-125 dwelling units per hectare
	c) Metropolitan cities	125-150 dwelling units per hectare

C-2.4.2 In case of developments with per dwelling unit covered area of 15 m^2, four storeyed walk ups without future incremental growth with maximum densities of 500 dwelling units per hectare shall be permissible. In case of four storeyed walk ups, having two roomed dwelling unit where one room is for future expansion, maximum density of 400 dwelling units per hectare shall be permissible.

C-2.5 Height of Building

The height of building shall not exceed 15 m.

NOTES

1 For buildings up to the height of 15 m, there is no need to provide lifts.

2 Housing for the low-income group shall preferably be up to a maximum of two storeys.

3 Buildings for housing beyond 15 m in height should be resorted to in exceptional circumstances and it should be governed by provisions laid down in this Code.

C-2.6 Cluster Planning

For size of open cluster and open space, set backs, vehicular access and pedestrian paths in cluster

planning, the provisions given in Annex D shall apply.

C-3 GENERAL BUILDING REQUIREMENTS

C-3.1 General

The requirements of parts of buildings shall be as given in **C-3.2** to **C-3.9**.

C-3.2 Plinth

The minimum height of plinth shall be regulated on the basis of environmental and topographical condition and higher plinth height may be required in areas prone to flooding.

C-3.3 Size of Room

C-3.3.1 *Habitable Room*

Every dwelling unit to be provided should have at least two habitable rooms. Even if one room house is provided initially it should be capable of adding a new second room in future. However, in case single room tenements are required to be provided where future additions are not possible, the carpet area of multipurpose single room should be at least 12.5 m^2. Such one room dwelling units with 12.5 m^2 carpet area of habitable space is permitted only in case of on-site rehabilitation of slum dwellers. In a house of two rooms, first room shall not be less than 9.0 m^2 with minimum width of 2.5 m and second room shall not be less than 6.5 m^2 with a minimum width of 2.1 m provided the total area of both the rooms is not less than 15.5 m^2. In incremental housing the bigger room shall always be the first room.

C-3.3.1.1 To facilitate incremental housing in case of flatted development or otherwise, habitable space at mezzanine level may be permitted. The minimum size of such a mezzanine floor should not be lesser than 6.5 m^2 and such a floor should occupy not more than 50 percent of the room area of which it is a part. Such a mezzanine floor should have appropriate openings to facilitate light and ventilation as per **C-3.6**. Minimum clear height below and above the mezzanine floor should be 2.4 m and 2.1 m, respectively.

As far as possible mezzanine floor should have direct ventilation from the external face of the building. Where this is not possible ventilation through main room may be allowed provided total area of openings in the main room is provided taking into consideration area of mezzanine floor.

Such mezzanine floor may be accessible through the main room by a ladder, whose minimum angle with vertical plane should be 22.5°. Height of the riser should be less than 250 mm.

C-3.3.2 *Water-Closet/Bath Room*

a) The size of independent water-closet shall be 0.90 m^2 with minimum width of 0.9 m;
b) The size of independent bath room shall be 1.20 m^2 with a minimum width of 1.0 m; and
c) The size of combined bath room and water-closet shall be 1.80 m^2 with minimum width of 1.0 m.

C-3.3.3 *Kitchen*

The size of a cooking alcove serving as cooking space shall not be less than 2.4 m^2 with a minimum width of 1.2 m. The size of individual kitchen provided in a two-roomed house shall not be less than 3.3 m^2 with a minimum width of 1.5 m.

C-3.3.4 *Balcony*

The minimum width of individual balcony, where provided, shall be 0.9 m and shall not be more than 1.2 m and it shall not project beyond the plot line and on roads or pathway.

C-3.4 Basement

No basement floor shall be allowed.

C-3.5 Minimum Height

The minimum height of rooms/spaces shall be as follows:

a) Habitable room : 2.6 m
b) Kitchen : 2.6 m
c) Bath/water-closet : 2.1 m
d) Corridor : 2.1 m

C-3.5.1 In the case of sloping roofs, the average height of roof for habitable rooms shall be 2.6 m and the minimum height at eaves shall be 2.0 m.

C-3.6 Lighting and Ventilation

The openings through windows, ventilators and other openings for lighting and ventilation shall be in accordance with **20.1.2**.

NOTE — The windows and other openings shall abut onto open spaces either through areas left open within the plot or the front, side and rear spaces provided in the layouts which shall be deemed to be sufficient for light and ventilation purposes. Wherever, ventilation/lighting is provided by means of *Jali* or grill of any material, total area of openings shall be calculated excluding solid portion of the *Jali* or grill.

C-3.7 Stairs

The following criteria shall be adopted for internal individual staircase:

a) *Minimum clear width*:
   1) 2 storeyed — straight : 0.60 m
   2) 2 storeyed — winding : 0.75 m

3) 3 or more storeyed — straight : 0.75 m

4) 3 or more storeyed — winding : 0.90 m

b) *Riser* : 200 mm, *Max*

c) *Tread*

1) 2 storeyed : 225 mm, *Min* (*see* Note)

2) 3 storeyed or more : 250 mm, *Min*

NOTE — This could be reduced to 200 mm as the clear tread between perpends, with possibility of open riser as well as nosing and inclined riser to have an effective tread of 225 mm.

d) *Head room* — The minimum clear head room shall be 2.1 m.

C-3.8 Circulation Area

The circulation area on any floor including staircase, shall not exceed 8 m^2/dwelling unit.

C-3.9 Water Seal Latrine

No building plan shall be approved and no building shall be deemed to have been completed and fit for human occupation unless provision is made for water seal latrine. No dry latrine shall be allowed. Water seal latrines may also be provided on the basis of community toilets or shared toilets as per the recommendation given in good practice [3(9)].

Where leaching pits are used, it should be constructed within the premises of the households as it would be economical as well as facilitate their cleaning. However, where, due to space constraint, construction of pits within the premises may not be possible, pits may be constructed in places like lanes, streets and roads.

In case the pit is located under the road, street or foot path, the inverted level of the pipe connecting the latrine pan with the pit shall be at least 1.1 m below ground level or below the bottom of the water main existing within adistance of 3 m from the pits whichever is more. Construction of such pits may be in accordance with good practice [3(10)].

The water seal latrine should be properly maintained and kept in sanitary condition by the owner or the occupier. The contents of the septic tanks, soak pits, leach pits, etc, should be periodically emptied.

The leach pits should be cleaned only after 2 years of their being put out of service after they were full.

C-4 ROADS AND PATHWAYS

The area under roads and path-ways in such housing projects should normally not exceed 20 percent of the total land area of the project.

Access to the dwelling units, particularly where motorized vehicles are not normally expected should be by means of paved footpaths with a right of way of 6 m and a pathway of 2 m only. The right of way should be adequate to allow for the plying of emergency vehicles and also for road side drains and plantation.

Where pedestrian pathways are not meant for motorable access to the minimum, right of way of such pedestrian pathway shall be 3 m. Where houses are accessible from one side only pathway may be 2 m wide. The maximum length of such pathways should not be more than 60 m.

C-5 OTHER REQUIREMENTS

C-5.1 Requirements of fire safety, structural design, building services and plumbing services shall be as specified in the Code.

C-5.2 One water tap per dwelling unit may be provided, where adequate drinking water supply is available. If supply is inadequate, public hydrants shall be provided. In the absence of piped water supply, hand pumps may be used for provision of water supply.

C-5.3 Recognizing the need for informal use of space for shopping and informal occupation like road side repairs, *Pan* shops, etc, it is suggested that about ¼ of the total shopping area in a layout should be reserved for such informal uses tocater to the needs of low income families.

C-5.4 The infrastructural services shall be provided before the plots are handed over to individual owners.

C-6 SITE AND SERVICES SCHEMES

C-6.1 The developed plot sizes shall be as per **C-2.3.1**. Services should be laid by the agency concerned as per the provisions of the Code. In so far as roads and pathways are concerned, they should be in line with **C-4**.

C-6.2 Site and services schemes should provide for the following:

a) Complete infrastructural needs for a permanent housing, on the periphery of individual plot or a group/cluster plots;

b) A service sanitary core in the plot;

c) A skeletal structure of columns and roof or a developed plinth; and

d) Permission to allow temporary construction on the plot.

While provisions in (a) and (d) are essential for site and services projects, recommendations in (b) and (c) are additional provisions depending upon affordability.

ANNEX D

(*Clause* 15)

SPECIAL REQUIREMENTS OF CLUSTER PLANNING FOR HOUSING

D-1 GENERAL

These guidelines cover planning and building requirements of housing developed as clusters. These requirements are applicable to all housing projects taken up by public, private or cooperative agencies.

D-2 PLANNING

D-2.1 Plot Size

The minimum plot size permissible shall be 15 m^2 with 100 percent ground coverage and an FAR of 2. 100 percent ground coverage and FAR of 2 will be applicable up to plot size of 25 m^2. For plot sizes beyond 25 m^2, provision in accordance with good practice [3(3)] shall be applicable.

D-2.2 Plot/Plinth Area for Slum Resettlement on Same Site

In case of slum resettlement on the same site, minimum area may be reduced to 12.5 m^2 with potential for adding another 12.5 m^2 on first floor with an internal staircase.

D-2.3 Group Housing

Group housing may be permitted within cluster housing concept. However, dwelling units with plinth areas up to 20 m^2 should have scope for adding a habitable room. Group housing in a cluster should not be more than 15 m in height.

D-2.4 Size of Cluster

In ground and one storeyed structures not more than 20 houses should be grouped in a cluster. Clusters with more dwelling units may create problems relating to identity, encroachment and maintenance.

D-2.5 Size of Cluster Open Space

Minimum dimensions of open spaces shall be not less than 6 m or 3/4th of the height of buildings along the cluster open space, whichever is higher. The area of such cluster court shall not be less than 36 m^2. Group housing around a cluster open space should not be normally more than 15 m in height. Maximum cluster courtyard width and breadth shall be 13 m.

D-2.6 Setbacks

No setbacks are needed from the edges of cluster as pedestrian/vehicular access roads surrounding the cluster.

D-2.7 Right to Build in Sky

Pedestrian paths and vehicular access roads to clusters separating two adjacent clusters may be bridged to provide additional dwelling units. While bridging the pedestrian path way minimum clearance should be one storey height, length of such bridging should be not more than two dwelling units. While bridging the vehicular access roads minimum clearance should be 6 m.

D-2.8 Vehicular Access

A right of way of at least 6 m width should be provided up to the entrance to the cluster to facilitate emergency vehicle movement up to cluster.

D-2.9 Pedestrian Paths

Minimum width of pedestrian paths shall be 3 m.

D-2.10 Width of Access Between Two Clusters

Built area of dwelling unit within cluster shall have no setbacks from the path or road, space. Hence, the height of the building along the pathway or roads shall be not less than 60 percent of the height of the adjacent building subject to minimum of 3 m in case of pathway and 6 m in case of vehicular access.

D-2.11 Density

Cluster planning methodologies result in higher densities with low rise structures. With per dwelling unit covered area of 15 m^2 densities of 500 dwelling units per hectare (net) shall be permissible. Densities higher than this should not be allowed.

D-2.12 Group Toilet

Cluster housing for economically weaker section families may have group toilets at the rate of one water-closet, one bath and a washing place for three families. These shall not be community toilets, as keys to these toilets shall be only with these three families, making them solely responsible for the maintenance and upkeep of these toilets.

D-3 OTHER REQUIREMENTS

D-3.1 Requirements of Building Design

With the exception of clauses mentioned above, requirements of building will be governed by the provision of this Code and good practice [3(3)].

D-3.2 Requirements of fire safety, structural design, building services and plumbing services shall be as specified in this Code.

ANNEX E

(*Clause* 16)

SPECIAL REQUIREMENTS FOR LOW INCOME HABITAT PLANNING IN RURAL AREAS

E-1 GENERAL

These guidelines cover planning and general building requirements for low-income houses having a maximum built-up area of 40 m^2 including future expansion, built on notified (as notified by the State Governments) rural areas. The provisions on layout planning of low-income housing colonies in rural areas are applicable to public and private agencies/government bodies. The provisions of this Guide on design and construction of buildings for low income housing in approved layouts are applicable to all private and public agencies.

E-2 SETTLEMENT AND ENVIRONMENT PLANNING

While planning for rural settlements the following factors shall be taken into consideration:

a) Eco-system and biodiversity.

b) Topography with its direct effect on climate, likelihood of natural disasters, natural drainage, etc.

c) Identity of the place rooted in its culture and heritage.

d) Nearness and connectivity with nearby urban centres.

e) Occupation related requirements.

f) Water management.

g) Waste management.

h) Land tenure.

j) Site selected shall be conveniently approachable and suitably developed and shall not be subjected to water logging/flooding.

k) Plot size : 80 m^2, *Min*

m) Density (Gross) : 60 plots per hectare, *Max*

n) Minimum frontage : 6 m

p) Ground coverage : 33 percent (subject to a maximum of 50 percent)

q) Floor area ratio (FAR) : 2, *Max*

r) Open spaces : 1.21 hectare open space for a village with 200 houses

s) Facilities like branch of cooperative bank, a fertilizer depot, a veterinary hospital, market place and a branch of the cooperative consumer store besides facilities for educational and health care should be available within a maximum distance of 5 km from any settlement.

t) Proposed road hierarchy:

Sl No.	*Road Type*	*Road Description*	*Road Width* m	*Function/ Remarks*
(1)	(2)	(3)	(4)	(5)
i)	R1	Road which connects village to nearby areas	9	Widest road
ii)	R2	Road which take major traffic to the village	6	Main village roads with drain on both sides to facilitate drainage system of the village
iii)	R3	Internal village road	4.5	Other village roads
iv)	R4	Internal village road	3	Village lanes

E-3 GENERAL BUILDING REQUIREMENTS (HOMESTEAD)

E-3.1 General

The requirements of parts of buildings shall be as given in **E-3.2** to **E-3.7**.

E-3.2 Plinth

The minimum height of plinth shall be regulated on the basis of environmental and topographical condition and higher plinth height may be required in areas prone to flooding.

E-3.3 Size of Room

E-3.3.1 *Habitable Room*

Every dwelling unit to be provided should have at least two habitable rooms. Even if one room house is provided initially it should be capable of adding a new second room in future. In a house of two rooms, first room shall not be less than 9.0 m^2. with minimum width of 2.5 m and second room shall not be less than 6.5 m^2 with a minimum width of 2.1 m provided the total area of both the rooms is not less than 15.5 m^2. In incremental housing the bigger room shall always be the first room.

E-3.3.1.1 To facilitate incremental housing in case of flatted development or otherwise, habitable space at mezzanine level may be permitted. The minimum size of such a mezzanine floor should not be lesser than 6.5 m^2 and such a floor should occupy not more than 50 percent of the room area of which it is a part. Such a mezzanine floor should have appropriate openings to facilitate light and ventilation as per **E-3.5**. Minimum clear height below and above the mezzanine floor should be 2.4 m and 2.1 m, respectively.

As far as possible mezzanine floor should have direct ventilation from the external face of the building. Where this is not possible ventilation through main room may be allowed provided total area of openings in the main room is provided taking into consideration area of mezzanine floor.

Such mezzanine floor may be accessible through the main room by a ladder, whose minimum angle with vertical plane should be 22.5°. Height of the riser should be less than 250 mm.

E-3.3.2 *Water-Closet/Bath Room*

a) The size of independent water-closet shall be 0.9 m^2; with minimum width of 900 mm.

b) The size of independent bath room shall be 1.2 m^2 with minimum width of 1 m, and

c) The size of combined bath and water-closet shall be 1.8 m^2 with minimum width of 1 m.

E-3.3.3 *Kitchen*

The size of a cooking alcove serving as cooking space shall not be less than 2.4 m^2 with a minimum width of 1.2 m. The size of individual kitchen shall not be less than 3.3 m^2 with a minimum width of 1.5 m. Semi-open spaces with low walls and roof may also be provided for cooking in areas where such provision is suitable with respect to climatic comfort. Provision for smokeless *Chullha* shall be made in all kitchens considering fuel efficiency and health hazard due to smoke inhalation.

E-3.3.4 *Balcony*

The minimum width of individual balcony, where provided, shall be 0.9 m. and shall not be more than 1.2 m and it shall not project beyond the plot line and on roads or pathway.

E-3.4 Minimum Height

The minimum height of rooms/spaces shall be as follows:

a) Habitable room : 2.75 m
b) Kitchen : 2.6 m
c) Bath/Water-closet : 2.2 m
d) Corridor : 2.1 m

E-3.4.1 In the case of sloping roofs, the average height of roof for habitable rooms shall be 2.75 m and the minimum height at eaves shall be 2.10 m.

E-3.5 Lighting and Ventilation

The openings through windows, ventilators and other openings for lighting and ventilation shall be as per in accordance with **20.1.2**.

NOTE — The windows and other openings shall abut onto open spaces either through areas left open within the plot or the front, side and rear spaces provided in the layouts which shall be deemed to be sufficient for light and ventilation purposes. Wherever ventilation/lighting is provided by means of *Jali* or grill of any material, total area of openings shall be calculated excluding solid portion of the *Jali* or grill.

E-3.6 Stairs

The following criteria shall be adopted for internal individual staircase:

a) *Minimum width*:
   1) 2 storeyed-straight : 0.60 m
   2) 2 storeyed-winding : 0.75 m
   3) 3 or more storeyed straight : 0.75 m
   4) 3 or more storeyed winding : 0.90 m
b) *Riser* : 200 mm, *Max*
c) *Tread*:
   1) 2 storeyed : 225 mm, *Min* (*See* Note)
   2) 3 storeyed or more : 250 mm, *Min*

NOTE — This can be reduced to 200 mm as the clear tread between perpends, with possibility of open riser as well as nosing and inclined riser to have an effective tread of 225 mm.

E-3.7 Water Seal Latrine

No building plan shall be approved and no building shall be deemed to have been completed and fit for human occupation unless provision is made for water seal latrine. No dry latrine shall be allowed. Water seal latrines may also be provide on the basis of community toilets or shared toilets as per the recommendation given in good practice [3(9)].

Where leaching pits are used, it should be constructed within the premises of the households as it would be economical as well as facilitate their cleaning. However, where, due to space constraint, construction of pits within the premises may not be possible, pits may be constructed in places like lanes, streets and roads.

In case the pit is located under the road, street or foot path, the inverted level of the pipe connecting the latrine pan with the pit shall be at least 1.1 m below ground level or below the bottom of the water main existing within a distance of 3 m from the pits whichever is

more. Construction of such pits, may be in accordance with good practice [3(10)].

The water seal latrine should be properly maintained and kept in sanitary condition by the owner or the occupier. The contents of the septic tanks, soak pits, leach pits, etc, should be periodically emptied.

The leach pits should be cleaned only after 2 years of their being put out of service after they were full.

Location of sanitary facility either as part of the house or separately shall be decided on the basis of felt perceptions.

E-3.8 The house site shall provide space for storage of food grains and keeping cattle. A manure pit having a minimum area of 1.0 m^2 shall also be catered for. This will take care of composting of biodegradable waste.

E-4 OTHER REQUIREMENTS

E-4.1 Requirements of fire safety, structural design, building services and plumbing services shall be as specified in relevant parts of the Code.

E-4.2 One water tap per dwelling unit may be provided, where adequate drinking water supply is available. If supply is inadequate, public hydrants shall be provided. In the absence of piped water supply, hand pumps may be used for provision of water supply.

E-4.3 Drainage System

E-4.3.1 Water from drains shall be connected to village ponds and appropriate eco-friendly methods like growing of duck weed plants shall be adopted to treat waste water.

E-4.3.2 This treated water may be used for irrigation and agriculture.

E-4.4 Appropriate methods (namely conservation, ground water recharging, rain water harvesting, etc) should be employed to ensure effective water management.

E-4.5 Community Facilities

E-4.5.1 A community hall/*Baraat Ghar* shall be established.

E-4.5.2 Rural development centre shall include *Panchayat Ghar*, a *Mahila Kendra* that may also serve as a vocational training centre.

E-4.5.3 School, health centre, post office, police post, shopping, work sheds for the artisans, telephone facilities, etc, should also be established.

E-4.6 The use (to the extent possible) of locally available building materials and cost effective substitutes for scarce building materials should be deployed. Appropriate technology inputs shall be introduced for improving the local materials or conventional or traditional practices for improved efficiency.

E-4.7 The concept of 'aided self-help' shall be ensured for active participation of the prospective users and association in the construction and development of dwelling units and other community building.

E-4.8 The special needs of women headed households/ single and working women/woman in difficult circumstances should be addressed. The specific requirement of women in terms of providing necessary facilities in homes to lessen their drudgery would be given sufficient attention.

E-4.9 Protecting and promoting our cultural heritage, architecture and traditional skills should be given due importance.

ANNEX F

(*Clause* 17)

SPECIAL REQUIREMENTS FOR DEVELOPMENT PLANNING IN HILLY AREAS

F-1 GENERAL

F-1.1 These guidelines provides requirements relating to development planning and design of buildings in hilly areas. Any area above 600 m in height from mean sea level may be classified as hilly, or any area with average slope of 30° may also be classified as hilly, considering the sensitive and fragile ecosystem of hills and mountains. However, the State Governments may identify and notify areas to be covered under 'Hilly Area', which need to be dealt with special consideration, when developmental activities are taken up.

F-1.2 Strategies for Development in Hilly Areas

Hilly areas have one of the most fragile ecosystems, which need to be conserved. Therefore planning and development strategies for hilly areas shall have to be designed with added sensitivity and stress on integrated development. The development approach shall comprise sound land use planning and settlement planning. Following strategies may be adopted for an integrated planning approach for conservation, preservation and planned development in hilly areas.

a) *Strategy 1*: *Land Conservation and Optimization*

1) *Environment inventory/impact assessment* — For planning of the new settlements or working out the strategies for the growth of the existing settlements, it is necessary to conduct detailed environmental inventory/impact assessment. The inventory would involve geological investigations, slope analysis, soil, flora and fauna analysis, climatic inventories, vulnerability to natural disasters (such as earthquakes, landslides, floods etc), etc. In addition to this the aesthetic factors, cultural, architectural and historical heritage, scenic/landscape value shall also be taken into consideration.

2) *Identification of developable area* — Identification and quantification of developable area is done by deducting the natural ecological area from the entire township jurisdiction area. Jurisdiction may be large to control the surrounding areas. The classification of land uses should be given only for developable area, while the rest of the ecological area shall be for conservation or restoration.

Hill Town Developable Area = (Hill town jurisdiction area – Natural Ecological Area)

3) *Land use optimization* — Keeping in view the scarcity of good buildable land and also the high cost of the construction, it is necessary to optimize the use of land by calculation of carrying capacity and land suitability analysis. Sustainable building approach should be adopted, such as use of cost effective and appropriate building materials and technologies.

b) *Strategy 2*: *Sustainable Development based on Watershed Management*

A watershed, also called a drainage basin or catchment area, is defined as an area in which all water flowing into, goes to a common outlet. People and livestock are the integral part of watershed and their activities affect the productive status of watersheds and *vice-versa*. From the hydrological point of view, the different phases of hydrological cycle in a watershed are dependent on the various natural features and human activities. In hilly areas or where intensive agriculture development is planned, the size of watershed preferred is relatively small. Watershed managements, that is, river basin management also is important in the context of regional planning both in terms of, as a source of water and sources of disaster risk like flood, etc. Efforts shall be made to achieve a balance between beneficiary oriented and infrastructural development programmes, keeping in view the vital importance of ecological restoration and conservation. This may be achieved through,

1) better water and land use and control of soil erosion through watershed management;
2) afforestation, silvi pasture development and replacement of annual crops with perennial shrubs and trees and plantation crops in steep slopes and development of other high value low volume crops linked with processing and marketing; and
3) rural and small industries and electronic

and precision instruments industries may also be promoted taking advantage of favourable weather conditions.

To understand watershed system, data from latest and authentic sources should be collected, simulation models may be used to analyze (drainage pattern modification) scenarios before Development Plan Preparation and formulating building regulations.

F-1.3 In hill areas, the space standards are affected by the following and therefore these factors should be considered while setting norms in such areas:

a) Exposure to sunlight, degree of slopes and accessibility in the form of distance travelled;
b) Minimum needs of the people and the conservation principle;
c) Flexibility in norms and standards to accommodate conditions guided by difficult hill terrain and its geology;
d) Work place and residence relationship;
e) Energy needs;
f) Alternative mode of transportation communication network;
g) Communication network; and
h) Mobile and emergency facilities.

F-2 LAND USE PLANNING

The following land use structure shall be adopted in Development Planning in Hilly areas:

Sl No.	*Land Use*	*Percentage of Developed Area*		
		Small Towns	Medium Towns	Large Cities
(1)	(2)	(3)	(4)	(5)
i)	Residential	50-55	48-52	45-48
ii)	Commercial	2-3	2-3	4-5
iii)	Industrial	3-4	4-5	4-6
iv)	Public and semi-public	8-10	8-10	12-14
v)	Recreational	15-18	15-18	16-18
vi)	Transport and commerce	5-6	5-6	6-8
vii)	Ecological	Balance	Balance	Balance

NOTE — The ecological area (non-developable area) given in the table above for hill towns is applicable for the hill town jurisdiction developable area only. Hill town developable area shall be considered as area under hill town jurisdiction minus natural ecological area. Where non-developable area is defined as earthquake/landslide prone, cliffs and environmentally hazardous area, areas adjacent to faul t lines, areas with slope higher than 45°, flood plain and areas adjacent to major drainage lines for general guidance and all environmentally sensitive areas. Land suitability analysis should be an important tool in first principal approach for deciding o n land use proportions.

F-3 OPEN SPACES

The following norms shall be adopted in development planning in hilly areas:

Sl No.	*Type*	*Area Range*	*Area per 1 000 Population*	*Remarks*
		ha	ha	
(1)	(2)	(3)	(4)	(5)
i)	Tot lot	0.03-0.05	—	Minimum width 15 m
ii)	Playground	0.50-1.00	0.12 to 0.20	One for every 5 000 may be combined with schools
iii)	Parks	1.20-2.00	0.12 to 0.20	One for every 10 000 population
iv)	City parks/playgrounds/ *Maidan*/exhibition grounds/ cultural gathering grounds	—	0.12 to 0.20	For the entire town at one or more sites, depending upon design and space availability
v)	Botanical garden	10-20	—	One for every town
vi)	Recreational complex including zoo	10-12	—	One for every settlement with tourist potential

F-4 ROADS AND PATHS

F-4.1 Street orientation shall preferably be east-west to allow for maximum south sun to enter the buildings. The street shall be wide enough to ensure that the buildings on one side do not shade those on the other side.

F-4.2 The following road widths shall be adopted for urban roads in hilly areas:

Sl No.	*Road Type*	*Width* m		
		Open Areas	Built-up Areas	Plains
(1)	(2)	(3)	(4)	(5)
i)	Arterial road	18-24	15-18	50-60
ii)	Sub-arterial road	15-18	12-15	30-40
iii)	Collector road	9-12	7.5-9	20-30
iv)	Local street	4.5-6	3-6	10-20
v)	Loop street (maximum length = 500 m)	4.5	4.5	9
vi)	*Cul-de-sac* (maximum length = 500 m)	4.5	4.5	7.5
vii)	Pedestrian path	1.5-2.5	1-1.5	1.5-4.5

F-4.3 Hill Road Manual (IRC:SP:48-1998), a publication of the Indian Roads Congress shall be referred to for detailed guidelines for planning roads in hilly areas.

F-5 COMMUNITY FACILITIES AND SERVICES

The following minimum norms shall be adopted for community facilities and services in hilly areas:

Sl No.	*Type*	*Population*	*Distance between Two Facilities* km	*Area Range* *ha*
(1)	(2)	(3)	(4)	(5)
i)	*Educational facilities*:			
a)	Primary school	4 000	1-2	0.20 to 0.30
b)	Secondary school (10 + 2)	15 000	5-7	0.30 to 0.50
c)	Industrial training centre	—	8-12	0.30 to 0.60
d)	College	30 000	8-12	2.00 to 3.00
e)	Professional college	30 000	8-12	1.00 to 1.50
f)	University	50 000	8-12	2.00 to 3.00
ii)	*Health*:			
a)	Dispensary	2 500	2-4	0.015 to 0.020
b)	Health sub-centre	3 000	2-4	0.025 to 0.067
c)	Primary health centre (25-50 beds)	20 000	16-20	0.105 to 0.210
d)	Hospital (200-250 beds)	80 000	16-20	0.840 to 2.100
e)	Veterinary centre	1 000	16-20	0.050 to 0.100
f)	Family welfare centre	5 000	5-10	0.025 to 0.050
g)	Maternity home	15 000	5-10	0.025 to 0.050
h)	Nursing home	15 000	5-10	0.050 to 0.075
iii)	*Other facilities*:			
a)	Community welfare centre	16 000	5-7	0.10 to 0.15
b)	Local convenience shopping	10 000	2-4	0.50 to 0.10
c)	Milk booth	10 000	2-4	0.04
d)	Banquet hall	10 000	5-10	0.10
e)	Religious buildings	10 000	5-10	0.10
f)	Cremation ground	10 000	5-10	0.20
g)	Informal bazaar	15 000	5-10	0.10 to 0.20

(1)	(2)	(3)	(4)	(5)
iv)	*Services*:			
a)	Fire station	50 000	—	0.30 to 0.80
b)	General post office	50 000	10-15	0.20 to 0.40
c)	Post office	10 000	5-7	0.10 to 0.15
d)	Rural post office	2 000	2-4	—
e)	Rural post office	1 000	1-2	0.025 to 0.050
f)	Bank (tribal areas)	10 000	16-20	0.100 to 0.150
g)	Telephone exchange	50 000	10-15	0.20 to 0.40
h)	Electric sub-station (66 kV)		—	1.00
j)	Electric sub-station (11 kV)	—	—	0.05
k)	Police chowki	5 000	2-4	0.10
m)	Police station	15 000	5-10	0.50
n)	Disaster management centre	20 000	5-10	1.00
p)	LPG godown	As per requirement	—	0.15

F-6 OTHER ASPECTS FOR PLANNING FOR THE HILLY AREAS

F-6.1 Following aspects should also be considered while planning for land/building development in hilly areas:

a) The hillside with less than 30° slope are in general stable. Therefore, building sites (temporary or permanent) should in general be located on hillside with not more than 30°–45° slope. In areas where most of the land is above 30° slope, spatial regulations should control construction activity on slopes above 30°, provided that appropriate technology is used.

b) The maximum height of the building shall be fixed.

c) Flat land is normally not available in hilly regions. The houses are required to be constructed on partially sloping land made available by cut and fill. It shall be therefore necessary to protect the houses by building retaining walls/breast walls to avoid landslides occurring at time of earthquakes or heavy rains (*see* **F-7.4**).

d) Cut slopes with height less than 5 m or two to three storey heights of residential buildings are in general stable. For higher cut slopes, special investigation should be carried out and details of protection works should be worked out and implemented.

e) Site development in hilly regions consumes about 30 to 40 per cent of total cost of building complex, therefore the following investigations shall be done to obtain the following geotechnical parametres depending upon the size and complexity of the building project:

   1) Type of soil rock, weathered or intact, dip of bedding planes, drainage conditions, shear planes, material between the joints, tension cracks, type of plantation, verticality of trunks of the trees, etc.

   2) Cliff sides and spur faces need to be protected with appropriate technology including wire netting and/or blowing of RCC along the walls.

   3) Thickness of overburden, nature of soil strata, details of soil matrix, etc.

   4) Estimation of shear parametres of the in situ soil mass, which will govern the failure.

   5) Drainage pattern of the area and permeability tests to observe the drainage conditions.

   6) Specific slip zones in the area, if any.

f) Provisions for landslide hazard mitigation, seismic micro zonation and mitigation of liquefaction hazard should be integrated.

F-6.2 Additional Aspects for New Hill Towns

In addition to considerations given in **F-6.1**, following aspects should also be considered while planning for new hill towns:

a) The basic principles of hill architecture should be followed including use of local building materials, slanting roofs, seismic bands in structures, etc, so that they merge in cultural landscape of their regions.

b) Travelling time from nearest town to the new township should be at least 1 h or distance between the new township and the nearest town should be less than 20 km.

c) The new town should be self sufficient in infrastructure and its area should ideally not be less than 40 ha.

d) Provision of facilities for additional (and/or floating) population should be made.

F-7 GENERAL BUILDING REQUIREMENTS

F-7.1 General

The provisions contained in this Part shall apply excepting for the specific provisions given hereunder.

F-7.2 Siting

F-7.2.1 No house shall preferably be located closer than 1 m to another house.

F-7.2.2 No house shall be located closer than 10 m to a steep slope.

F-7.2.3 No house shall be built on a landfill or on the edge of a slope known to have been levelled.

F-7.2.4 Buildings in hills shall be clustered together to minimize the exposure to cold winds. Open spaces provided shall allow for maximum south sun.

F-7.2.5 Buildings shall be located on the south slope of a hill or mountain for better exposure to solar radiation. At the same time, exposure to cold winds may be minimized by locating the building on the leeward side.

F-7.2.6 A minimum clearance of 1.5 m should be provided between toe of boundary wall and building wall.

F-7.3 Passive Systems for Climatic Control

F-7.3.1 Appropriate solar passive methods, such as orientation, double-glazing, trombe walls and solar collectors, shall be adopted to achieve climatic comfort with little use of conventional energy.

F-7.3.2 Care shall be taken in siting and design of buildings to provide passive controls to modify the effect of cold/strong winds.

F-7.4 The houses constructed on sloping land shall be protected by building retaining walls/breast walls [*see* good practices 3(11)] to avoid landslides occurring at time of earthquakes or heavy rains.

F-7.5 Maximum height of plinth level shall be 2.00 m.

F-7.6 On the uphill side of the building on a sloping site, the natural flow of the water shall be diverted away from the foundations.

The slope of ground all around building should be not less than 1:50, built in such a way that rain water does not find way to percolate in ground excessively and moves away quickly to surface drains or away on adjoining hill surface towards natural streams.

A minimum of 0.75 m wide apron should be provided all around the building to prevent entry of water into foundation.

F-7.7 Stepped terrace development and stepped storeyed building construction may be adopted for offices, schools and other building complexes because of following advantages:

a) It results in least hill cutting, disturbance to hill stability and also in least deforestation.
b) Cost of site development works, slope protection and other protection works is reduced considerably.
c) Least load comes on valley side, so danger of foundation failures is avoided.

F-7.8 Disaster Resistance

All necessary steps shall be taken in designing and building in hilly regions to achieve disaster resistance as per the relevant codes and Part 6 'Structural Design' of the Code. All natural disasters likely to affect the locality shall be taken into consideration namely earthquakes, cyclones, avalanches, flash floods, landslides, etc. For guidelines for selection of various landslide control methods for effective correction measures to avoid landslides in hill areas, reference shall be made to good practice [3(12)].

F-7.9 Drainage Facilities

Buildings to be provided with good drainage facilities to prevent excessive saturation of sub-surface formations. Construction should not obstruct existing surface drainage courses.

For guidelines relating to rainwater harvesting in hilly areas, reference shall be made to Part 9 'Plumbing Services (including Solid Waste Management), Section 2 Drainage and Sanitation' of the Code.

F-7.10 The shear walls shall be constructed on all the three sides of parking floor so that it is not a soft storey.

F-7.11 Reference shall also be made to good practice [3(13)] for guidelines relating to siting, design and selection of materials for construction of residential buildings in hilly areas.

F-8 SOLID WASTE MANAGEMENT FOR HILLY AREAS

Cities and towns located on hills shall have location specific methods evolved for final disposal of solid wastes by the concerned Authority. The municipal authority shall set up processing facilities for utilization of biodegradable organic wastes. The inert and non biodegradable waste shall be used for building roads or filling up of appropriate areas on hills. Because of constraints in finding adequate land in hilly areas, wastes not suitable for road laying or filling up shall be disposed of in specially designed landfills.

LIST OF STANDARDS

The following list records those standards which are acceptable as 'good practice' and 'accepted standards' in the fulfillment of the requirements of the Code. The latest version of a standard shall be adopted at the time of enforcement of the Code. The standards listed may be used by the Authority as a guide in conformance with the requirements of the referred clauses in the Code.

In the following list, the number appearing in the first column within parentheses indicates the number of the reference in this Part of the Code.

	IS No.	*Title*
(1)	3861 : 2002	Method of measurement of plinth, carpet and rentable areas of buildings (*second revision*)
(2)	4878 : 1986	Byelaws for construction of cinema buildings (*first revision*)
(3)	8888 (Part 1) : 1993	Guide for requirements of low income housing: Part 1 Urban area (*first revision*)
(4)	12933	Solar flat plate collector — Specification
	(Part 1) : 2003	Requirements (*second revision*)
	(Part 2) : 2003	Components (*second revision*)
	(Part 3) : 2003	Measuring instruments (*first revision*)
	(Part 5) : 2003	Test methods (*second revision*)
	12976 : 1990	Solar water heating systems — Code of practice
(5)	3792 : 1978	Guide for heat insulation of non-industrial buildings (*first revision*)
	11907 : 1986	Recommendations for calculation of solar radiation on buildings
(6)	10976 : 1993 ISO 6440 : 1985	Wheelchairs nomenclature, terms and definitions (*first revision*)
(7)	6571 : 1991	Rehabilitation equipment — Wheelchairs, non-folding, adult size, institutional model — Specification (*first revision*)
	7454 : 1991	Rehabilitation equipment — Wheelchairs, folding, adult size — Specification (*first revision*)
	8086 : 1991	Rehabilitation equipment — Wheelchairs, folding, junior size — Specification (*first revision*)
(8)	15330 : 2003	Installation and maintenance of lifts for handicapped persons — Code of practice
(9)	13727 : 1993	Guide for requirements of cluster planning for housing
(10)	12314 : 1987	Code of practice for sanitation for leaching pits for rural community
(11)	14458	Guidelines for retaining walls for hill area
	(Part 1) : 1998	Selection of type of wall
	(Part 2) : 1997	Design of retaining/breast walls
	(Part 3) : 1998	Construction of dry stone walls
(12)	14680 : 1999	Guidelines for landslide control
(13)	14804 : 2000	Guidelines for siting, design and selection of materials for residential buildings in hilly areas

NATIONAL BUILDING CODE OF INDIA

PART 4 FIRE AND LIFE SAFETY

BUREAU OF INDIAN STANDARDS

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FOREWORD

This Code (Part 4) deals with safety from fire. It specifies the demarcation of fire zones, restrictions on construction of buildings in each fire zone, classification of buildings based on occupancy, types of building construction according to fire resistance of the structural and non-structural components and other restrictions and requirements necessary to minimise danger to life from fire, smoke, fumes or panic before the buildings can be evacuated. The Code recognizes that safety of life is more than a matter of means of egress and accordingly deals with various matters which are considered essential to the safety of life. The Code therefore covers provisions relating to means of egress covering various components thereof namely exit access, exit and exit discharge. It also covers provisions relating to fire protection of buildings through portable and fixed firefighting installations.

Fire protection techniques have to be based on the fire behaviour characteristics of different materials and structural elements of buildings. The activities pursued by the occupants of buildings must also be taken into consideration for assessing the extent of hazards, and method should then be devised by which the hazards could be minimised. An indefinite combination of variables is involved in the phenomenon of fire, all of which cannot be quantified. The requirements of this Code should, therefore, be taken as a guide and an engineering design approach should be adopted for ensuring a fire safe design for buildings. Depending upon the type and complexities in a building, qualified and trained fire protection engineers should be associated with the planning of buildings, so that adequate fire and life safety measures could be incorporated in the building design right from the beginning.

Absolute safety from fire is not attainable in practice. The objective of this Part is to specify measures that will provide that degree of safety from fire which can be reasonably achieved. The Code endeavours to avoid requirements that might involve unreasonable hardships or unnecessary inconvenience or interference with normal use and occupancy of buildings, but insists upon compliance with minimum standards of fire safety necessary for building occupants and users. For ensuring compliance of fire protection equipment/installations to the laid down quality requirements, it is desirable to use such equipment/installation duly certified under the BIS Certification Marks Scheme.

While providing guidelines for minimizing chances of occurrence of fire through passive fire protection measures, this Part does not intend to cover all aspects of general fire prevention including sources of ignition. Nor does it cover the prevention of accidental personal injuries during the course of normal occupancy of buildings.

This Part while recognizing that panic in a building on fire may be uncontrollable, deals with the potential panic hazard through measures designed to prevent the development of panic. Experience indicates that panic seldom develops even in the presence of potential danger, so long as occupants of buildings are moving towards exits which they can see within a reasonable distance and with no obstruction or undue congestion in the path of travel. However, any uncertainty as to the location or adequacy of means of egress, the presence of smoke or fumes and the stoppage of travel towards the exit, such as may occur when one person stumbles and falls on stairs, may be conducive to panic. Danger from panic is greater when a large number of people are trapped in a confined area particularly when people are not adequately guided towards egress and safety notifications are not implemented or practiced. Consideration towards announcements and annunciations needs to be given to guide the occupants to safe egress routes and to control panic during situation of distress.

Experience has shown that concealed spaces within a building, such as, space between ceiling and false ceiling, horizontal and vertical ducts and shafts, etc, tend to act as flues/tunnels during a fire. Provision should, therefore, be made to provide fire stopping within such spaces.

Nothing in this Part of the Code shall be construed to prohibit better types of building construction, more exits or otherwise safer conditions than the minimum requirements specified in this Part.

Compliance with this Part shall not be construed as eliminating or reducing the necessity for other provisions for safety of persons using a building or structure under normal occupancy conditions. Nor shall any provision of this

Part be construed as requiring or permitting any addition that maybe hazardous under normal occupancy conditions.

One of the major points brought out in this Part is the limitation of heights and areas of buildings based on fire safety of the occupants. Individual municipal corporations are free to alter Table 2 based on local conditions, but the ratios of areas as maintained in the table for different occupancies and types of construction shall be adhered to.

Advantage has been taken of the developments, particularly in fire resistance rating of materials, designating types of construction in a rational manner and relating the area limitations of different occupancies to different types of construction.

Halons (halogenated hydrocarbons) which exhibit exceptional firefighting and explosion prevention/suppression characteristics have been found to possess high ozone depleting potential. They come under Group II of Annex A of the Montreal Protocol on Substances that Deplete the Ozone Layer, the international environmental agreement for phasing out ozone depleting substances. Due to increasing evidence that the ozone layer is getting depleted at a faster rate than thought earlier, the Code takes into cognizance the need to promote use of halon alternatives as fire extinguishing media.

The first version of this Part was formulated in 1970 and was revised in 1983. Subsequently the first revision of this Part was modified in 1997 through Amendment No. 3 to 1983 version of the Code. This modified version of this Part included few tables for the fire resistance ratings of various building components, such as walls, columns, beams and floors. The requirements for wet riser, down-comer, automatic sprinkler installation, high velocity (10-15 m/s) water spray or foam generating system, etc, for buildings were modified. Annex giving guidelines for selection of fire detectors had been deleted and relevant Indian Standards on fire alarm system and smoke detectors had been referred. Also, an annex for determination of fire loads and flue load density for arriving at the classification of occupancy hazard and calorific values of some common materials were included. Annex for broad classification of industrial and non-industrial occupancies into low, moderate and high hazard had also been included.

The Code was then revised in 2005. In this revision, the significant modifications incorporated were: The text was divided into the following broad clauses: (a) *Fire prevention* — Covering aspects of fire prevention pertaining to design and construction of buildings on passive fire protection measures, also describing the various types of building materials and their fire rating; (b) *Life safety* — Covering life safety provisions in the event of fire and similar emergencies, also addressing construction and occupancy features that are necessary to minimise danger to life from fire, smoke, fumes or panic; (c) *Fire protection* — Covering the significant appurtenances and their related components and guidelines for selecting the correct type of equipment and installation meant for fire protection of the building, depending upon the classification and type of the building. Also, the classification of building based on occupancy was elaborated, wherein, starred hotels were covered as a new Subdivision A-6 under occupancy Group A Residential; heritage structures and archaeological monuments were covered under Subdivision D-3 occupancy Group D Assembly buildings; mixed assembly occupancies were covered as a new Subdivision D-6; underground elevated railways were covered as a new Subdivision D-7 under occupancy Group D Assembly buildings; and TV stations were covered under Subdivision E-5 of occupancy Group E Business buildings. Further, for the external stairs for exit requirements, the width and treads were increased to 1 250 mm and 250 mm, respectively; under the requirements for institutional buildings the clear width of all required exits which serve as egress from hospital or infirmary section was increased from 1.5 m to 2 m. Also, provision of patient-lift was included; and due cognizance of halon phase out programme was taken, while specifying provisions in this Part with respect to fire protection using fire extinguishers/systems.

Based on various comments received from time-to-time, an Amendment No. 2 relating to Part 4 of the 2005 version of the Code, was issued.

In this current revision, the following significant changes have been made:

General:

1) The scope of application of provisions of this Part of the Code for different occupancies has been clarified.

2) Definitions of various new terms have been included and definitions of some of the existing terms have been updated based on latest developments and use.

Fire Prevention:

3) Based on the experience in the use of the provisions of the Code in relation to various occupancies and

subdivision classification under various building occupancy types, the same has been reviewed and updated. Also, mixed occupancy and minor occupancy have been further clarified.

4) Table 1 on fire resistance ratings of structural and non-structural elements has been updated.

5) The provisions relating to fire separating walls, fire separating floors and fire partitions have been detailed.

6) Provisions of fire safety requirements of services shafts have been rationalized and updated.

7) A separate comprehensive clause on electrical power supply distribution for fire and life safety systems has been included.

8) Detailed clauses on air conditioning systems towards safety and smoke control integration have been provided.

9) Glass facade requirements have been detailed towards fire protection and smoke exhaust aspects.

10) A separate comprehensive clause on Fire Command Centre (FCC) has been introduced covering various requirements.

Life Safety:

11) The components of means of egress have been comprehensively brought out covering specific aspects relating to exit access, exit and exit discharge. The relationship of occupant load, exit width requirements and travel distances have also been duly detailed enabling efficient planning for enhanced life safety provisions. The table on capacity factors has been modified based on aspect of width per person approach used globally.

12) Requirement for displaying the occupancy load for assembly buildings and call centres, has been included.

13) The concept of firefighting shaft for safe and efficient use by the fire fighters to access the floor on fire and also allow egress/evacuation of the occupants with simultaneous use of refuge area used as staging of the occupants, have been well integrated, including in the annex for high rise buildings.

14) Aspects of compartmentation with fire barrier and its passive fire safety requirements have been detailed for respective occupancies.

15) Pressurization of exits and smoke extraction requirements for respective areas including car parking have been updated with an approach towards selecting alternative means therefor.

16) The clause on gas supply has been comprehensively updated.

17) The clause on fire detection and alarm system has been completely reviewed and updated as per the latest practices.

Fire Protection:

18) The table on minimum requirements for firefighting installations (erstwhile Table 23 and now Table 7) has been comprehensively updated.

19) Detailed provisions have been included on fire water storage, fire pump room, sprinkler system and various alternative fire suppression systems.

Additional Occupancy-wise Requirements

20) Concept of progressive evacuation in case of hospital buildings has been included in detail to ensure life safety of the inmates.

21) Provisions relating to requirement of refuge area have been updated including for D-6 occupancy and introduced for apartment buildings of height 60 m and above.

22) Separate provisions on atrium have been included in Annex F.

23) Detailed separate provisions have been included on commercial kitchens in Annex G.

24) Detailed separate provisions have been included on car parking facilities in Annex H.

25) Separate provisions on fire and life safety requirements for metro stations and metro trainways have been included in Annex J and Annex K, respectively.

For provisions relating to universal accessibility and barrier-free environment Part 3 'Development Control Rules and General Building Requirements' of the Code may be referred.

All standards cross-referred to in the main text of this Part, are subject to revision. The parties to agreement based on this Part are encouraged to investigate the possibility of applying the most recent editions of the standards.

For the purpose of deciding whether a particular requirement of this Part of the Code is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this Part.

NATIONAL BUILDING CODE OF INDIA

PART 4 FIRE AND LIFE SAFETY

1 SCOPE

1.1 This Code (Part 4) covers the requirements for fire prevention, life safety in relation to fire and fire protection of buildings. This Code (Part 4) specifies occupancy-wise classification, constructional aspects, egress requirements and protection features that are necessary to minimise danger to life and property from fire.

1.2 The provisions of this Part are applicable to,

a) all high rise buildings; and

b) special buildings, those are,

1) hotel, educational, institutional, business, mercantile, industrial, storage, hazardous and mixed occupancies, where any of these buildings have floor area more than 500 m^2 on any one or more floors;

2) educational buildings having height 9 m and above;

3) institutional buildings having height 9 m and above;

4) all assembly buildings;

5) buildings, having area more than 300 m^2 of incidental assembly occupancy on any floor; and

6) buildings with two basements or more, or with one basement of area more than 500 m^2.

unless otherwise mentioned specifically in the provisions.

NOTE — The owner of the building and parties to agreement, may however, decide to apply the provisions of this Part to buildings other than those given above.

2 TERMINOLOGY

For the purpose of this Part, the following definitions shall apply.

2.1 Assisted Evacuation — Strategy that exists during which a designated person or persons provide assistance, during an emergency, to another person(s) to leave a building or a specific part of the built environment and to reach a final place of safety.

2.2 Atrium — A large-volume space created by a floor opening or series of floor openings connecting two or more stories that is covered at the top of the series of openings and is used for purposes other than an enclosed stairway; lifts hoist-way; an escalator opening; or as a utility shaft used for plumbing, electrical, air conditioning, or communications facilities.

2.3 Authorities Concerned — An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving or accepting equipment, materials, an installation, or a procedure.

2.4 Automatic Fire Detection and Alarm System — A system comprising components and sub-systems required for automatically detecting smoke, heat or fire initiating an alarm and other actions as appropriate. This system also includes manually operated electronic fire alarm (MOEFA) system.

NOTE — MOEFA system (with or without automatic fire detection and alarm system) includes all or some of the components such as manual call stations (initiating an alarm for fire and other actions as required), talk-back system and public address system.

2.5 Building — Any structure for whatsoever purpose and of whatsoever materials constructed and every part thereof whether used as human habitation or not and includes foundation, plinth, walls, floors, roofs, chimneys, plumbing and building services, fixed platforms, *Veranda*, balcony, cornice or projection, part of a building or anything affixed thereto or any wall enclosing or intended to enclose any land or space and signs and outdoor display structures. Tents, *Shamianahs*, tarpaulin shelters, etc, erected for temporary and ceremonial occasions with the permission of the Authority shall not be considered as building.

2.6 Building, Height of — The vertical distance measured in the case of flat roofs, from the average level of the ground around and contiguous to the building or as decided by the Authority to the terrace of the last livable floor of the building adjacent to the external wall; and 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 the case of gables facing the road, the mid-point between the eaves level and the ridge. Where the building is located in a sloped terrain, height shall be determined from the lowest level (that is approachable by the fire service vehicles) to the terrace level. Architectural features serving no other function except that of decoration shall be excluded for the purpose of measuring heights.

2.7 Combustible Material — A material which either burns itself or adds heat to a fire, when tested for non-combustibility in accordance with accepted standard [4(1)].

2.8 Common Path of Travel — That portion of the exit access which the occupants are required to traverse before two (or more) separate and distinct routes or two (or more) exits become available. Common paths of travel are part of travel distance.

2.9 Covered Area — Ground area covered by the building immediately above the plinth level. The area covered by the following in the open spaces is excluded from covered area (*see* Table 9):

a) Garden, rockery, well and well structures, plant nursery, water pool, swimming pool (if uncovered), platform round a tree, tank, fountain, bench, *Chabutara* with open top and unenclosed on sides by walls and the like;

b) Drainage culvert, conduit, catch-pit, gully pit, chamber, gutter and the like;

c) Compound wall, gate, unstoreyed porch and portico, slide, swing, uncovered staircases, ramp areas covered by *Chhajja* and the like; and

d) Watchman's booth, pump house, garbage shaft, electric cabin or substations, and such other utility structures meant for the services of the building under consideration.

NOTE — For the purpose of this Part, covered area equals the plot area minus the area due for open spaces in the plot.

2.10 Down-comer — An arrangement of firefighting within the building by means of down-comer pipe connected to terrace tank through terrace pump, gate valve and non-return valve and having mains not less than 100 mm internal diameter with landing valves on each floor/landing. It is also fitted with inlet connections at ground level for charging with water by pumping from fire service appliances and air release valve at roof level to release trapped air inside.

2.11 Dry Riser — An arrangement of firefighting within the building by means of vertical rising mains not less than 100 mm internal diameter with landing valves on each floor/landing which is normally dry but is capable of being charged with water usually by pumping from fire service appliances.

2.12 Emergency Lighting — Lighting provided for use when the supply to the normal lighting fails.

2.13 Emergency Lighting System — A complete but discrete emergency lighting installation also fed from the standby power source to the emergency lighting lamp(s), for example, self-contained emergency luminaire or a circuit from central battery (with or without monitoring system) connected through wiring to several escape lighting luminaries.

2.14 Escape Lighting — That part of the emergency lighting which is provided to ensure that the escape route is illuminated at all material times, for example, at all times when persons are on the premises, or at times the main lighting is not available, either for the whole building or for the means of egress.

2.15 Evacuation Lift — Lift that can be used, during an emergency, for self-evacuation.

2.16 Exit — That unobstructed component of means of egress which is between the exit access and the exit discharge or public way. Exit components include exterior exit doors at the level of exit discharge, interior exit stairways, exit passageways, exterior exit stairways and exterior exit ramps (*see* Fig. 1).

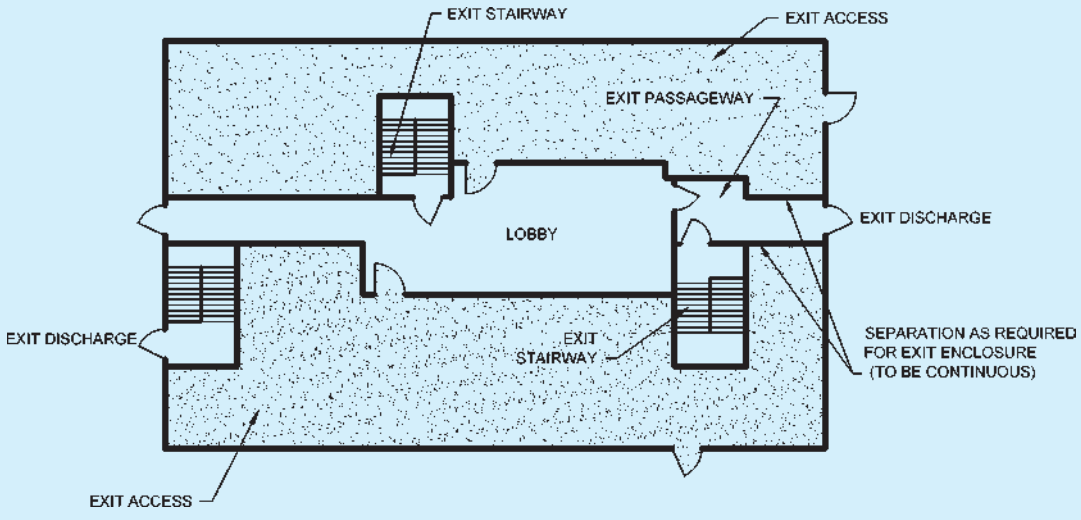


FIG. 1 COMPONENTS OF MEANS OF EGRESS

2.17 Exit Access — That portion of a means of egress that leads to an exit (for example, doorways, staircase lobby, ramps, *Veranda*, corridor or passageway leading to an exit) (*see* Fig. 1).

2.18 Exit Access Corridor — A corridor in exit access which may not necessarily have the requirement of exits being met.

2.19 Exit Discharge — The component of a means of egress between the termination of an exit and a public way (*see* Fig. 1).

2.20 Fire Barrier (or Fire Resisting Barrier) — A fire barrier is a vertically or horizontally aligned member such as a wall or a fire curtain, or a floor. These may be with discontinuities created by openings with a specified fire resistance rating, where such members are designed and constructed with a specified fire resistance rating to limit the spread of fire that also restricts the movement of smoke.

2.21 Fire Compartment — A space within a building that is enclosed by fire barrier or fire resistant walls on all sides, including the top and bottom.

2.22 Fire Door and Fire Door Assembly — Any combination of fire door, frame, hardware and other accessories that together provide a specific fire resistant rating to the opening in terms of its stability, integrity and insulation properties, when installed in the openings in fire separation walls. Fire door is a component of fire door assembly.

NOTES

1 Wherever reference has been made to fire door or fire check door in this Part, the same shall be construed as fire door assembly.

2 Fire doors in exits shall have fire rating as required in this Part to meet the requirement of integrity and stability; and the insulation criteria shall be 20 min.

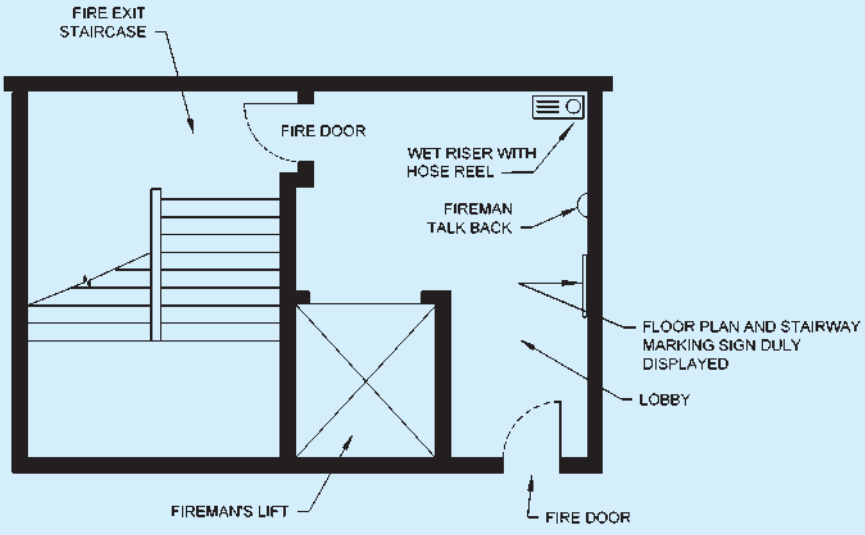
3 Fire doors in exits shall be provided with intumescent seal.

4 Fire doors in exits shall not be allowed to be on hold open position and kept closed and to close by 'door closure — spring mechanism'.

5 Fire curtains shall not be allowed as fire exits. If so provided for compartmentation, independent fire door shall be provided meeting the requirement for fire door in exits as above (of the width as required) within the prescribed travel distance requirement.

2.23 Fire Exit — A way out leading from exit access with or without panic bar provided on the door.

2.24 Firefighting Shaft (Fire Tower) — An enclosed shaft having protected area of 120 min fire resistance rating comprising protected lobby, staircase and fireman's lift, connected directly to exit discharge or through exit passageway with 120 min fire resistant wall at the level of exit discharge to exit discharge. These shall also serve the purpose of exit requirement/ strategy for the occupants. The respective floors shall be approachable from fire-fighting shaft enabling the fire fighters to access the floor and also enabling the fire fighters to assist in evacuation through fireman's lift. The firefighting shaft shall be equipped with 120 min fire doors. The firefighting shaft shall be equipped with firemen talk back, wet riser and landing valve in its lobby, to fight fire by fire fighters (*see* Fig. 2 for a typical firefighting shaft).



(LAYOUT TO BE PLANNED AS PER PROJECT BASIS MEETING ALL THE REQUIRED DETAILS)

NOTES

1 Where such lobbies and staircase in the firefighting shaft are naturally ventilated/cross-ventilated, the shaft may not be enclosed and fire door need not be provided.

2 For all enclosed firefighting shaft, the shaft's lobby should have floor plan duly displayed for the information of fire fighters.

FIG. 2 TYPICAL FIRE FIGHTING SHAFT

2.25 Fire Load — Calorific energy, of the whole contents contained in a space, including the facings of the walls, partitions, floors and ceilings.

2.26 Fire Load Density — Fire load divided by floor area.

2.27 Fireman's Lift — A lift or a group of lifts invariably associated with all the features and requirements of a fire-fighting shaft. Such lift(s) are installed to enable fire services personnel to reach different floors with minimum delay, and shall meet the additional features as required in accordance with this Part. This lift also serves the purpose of meeting the requirement of evacuation lift for assisted evacuation.

2.28 Fire Resistance — Fire resistance is a property of an element of building construction and is the measure of its ability to satisfy for a stated period, some or all of the following criteria:

a) *Load bearing capacity* (*Stability*) (*R*) — The ability of a load bearing element to withstand fire exposure without any loss of structural stability.

b) *Integrity* (*E*) — Resistance to penetration of flame and hot gases.

c) *Insulation* (*I*) — Resistance to temperature rise on the unexposed face up to a maximum of 180°C at any single point and average temperature of 140°C.

2.29 Fire Resistance Rating — The time that a material or construction will withstand the standard fire exposure as determined by fire test done in accordance with the standard methods of fire tests of materials/ structures as per the accepted standard [4(2)].

NOTES

1 The requirement of rating of various building elements as given in this Part shall be applicable in accordance with the provisions given in the accepted standard [4(2)].

2 The fire resistance rating shall be specified in terms of minutes.

3 Fire resistance rating for non-structural material/assembly shall bear a label of compliance to such rating as per the approval of competent authority based on testing and evaluation. The label shall be permanently affixed to the material/assembly and may carry other relevant details such as name and type of the product, and manufacturer's details.

2.30 Fire Resistant Wall — Fire resistance rated wall, having opening(s) with specified fire resistant rating, which restricts the spread of fire from one part of a building to another part of the same building.

2.31 Fire Separation — The distance in metre, measured from the external wall of the building concerned to the external wall of any other building on the site, or from other site, or from the opposite side of street or other public space for the purpose of preventing the spread of fire.

2.32 Fire Stop — A fire resistant material, or construction, having a fire resistance rating of not less than the fire separating elements, installed in concealed spaces or between structural elements of a building to prevent the spread/propagation of fire and smoke through walls, ceilings and the like as per the laid down criteria.

NOTES

1 Fire stop assembly for through penetrations is a combination of firestop compatible for use with the penetrant, penetration items such as cables, cable tray, conduits, ducts, pipes, etc, and their means of support through the wall or opening that together restores the fire resistance rating of the fire separating elements in terms of its integrity and/or insulation properties.

2 Fire stop assembly for joints is the one where fire stop with movement capability is used to seal the linear joints between adjacent fire separating elements, to maintain the fire resistance of the separating elements, which should be installed within its tested design limits with regard to size of the joint, type of assembly, and anticipated compression and extension of the joint.

2.33 Fire Suppression Systems

a) *Gas based systems* — Systems that use gaseous agents as fire suppression media, such as, all agents alternate to Halon gases, listed and approved for use by relevant Indian Standards; other methods/types of gas based systems where their protection is equal to or better than what is suggested above for the type of application subject to the acceptance of Authorities concerned may also fall under such systems.

b) *Water based systems* — Systems that use mainly water as firefighting media such as hydrant system, sprinkler system, water spray system, foam system and water mist system.

2.34 Fire Wall or Fire Separating Wall — A fire resistance rated wall having fire protected openings, which restricts the spread of fire and extends continuously from the foundation to the roof (and through the roof at least 1m above the roof in case of combustible roof), with sufficient structural stability under fire conditions to allow collapse of construction on one side or either side without collapse of the wall.

2.35 Floor Area (Gross) — The area of the floor within the inside perimeter of the outside walls of the floor of the building under consideration with no deductions for corridors and passage-ways, stairs, closets, thickness of interior walls, columns, lifts and building shafts or other features.

2.36 Floor Area Ratio (FAR) — The quotient obtained by dividing the total covered area (plinth area) on all

floors by the area of the plot:

$$\text{FAR} = \frac{\text{Total covered area of all floors}}{\text{Plot area}}$$

2.37 Fire Exit Hardware — A door-latching assembly incorporating an actuating member or panic bar that releases the latch bolt upon the application of a force in the direction of egress travel, provided on exits.

2.38 High Rise Building — A building 15 m or above in height (irrespective of its occupancy).

2.39 Horizontal Exit — A defend in place or a staging arrangement, providing safety from fire and smoke originating from the area of incidence, by allowing alternative egress from a compartment to an area of refuge or another compartment at or near the same level. This also includes such egress from a compartment to an adjoining building. A horizontal exit shall be through a fire door of 120 min rating in a fire resistant wall. Horizontal exit require separation with the refuge area or adjoining compartment through 120 min fire barrier. The adjoining compartment of the horizontal exit should allow unlocked and ease of egress and exits for the occupants using defend in place strategy.

2.40 Lift Lobby — A space from which people directly enter a lift car(s) and into which people directly enter upon exiting a lift car(s).

2.41 Means of Egress — A continuous way of travel from any point in a building or structure to a public way, consisting of three separate and distinct parts, that is, exit access, exit and exit discharge.

2.42 Means of Escape — A way out of a building or structure that does not conform to the strict definition of 'means of egress' but does provide an alternate way out.

2.43 Metro Station

2.43.1 *Concourse* — Intermediate level(s) or area(s) connecting a station platform(s) to a public way through stairs, escalators or corridors.

2.43.2 *Crush Train Load* **—** The number of passengers inside a train when it is filled to maximum capacity permissible by rolling stock design.

2.43.3 *Entraining Load* –The number of passengers boarding a train at a platform.

2.43.4 *Headway* — The interval of time between the arrivals of consecutive trains at a platform in a station.

2.43.5 *Mass Rapid Transit* — Any station building or part thereof, permanent or temporary, through which people transit for the duration of time required to enter the building and board the train to depart the station platform or to alight from the train and depart from the station building.

2.43.6 *Non-transit Occupancy* **—** Occupancy not under the control of the system operating authority.

2.43.7 *Point of Safety* — One of the following: (a) An enclosed exit that leads to a public way or safe location outside the station, trainway, or vehicle, (b) An at-grade point beyond the vehicle, enclosing stations, or trainway, (c) A point on open track beyond the open or enclosed station or enclosed train-way, and (d) Any other location approved by the Authorities concerned.

2.43.8 *Station* — A place designated for the purpose of loading and unloading passengers, including service area and ancillary spaces associated with the same structure.

2.43.8.1 *Composite station* — A transit station that is constructed contiguous with non-transit occupancy.

2.43.8.2 *Enclosed station* — A station or portion thereof that does not meet the definition of an open station.

2.43.8.3 *Open station* — A station that is constructed such that it is directly open to the atmosphere, and smoke and heat are allowed to disperse directly into surrounding open atmosphere.

2.43.9 *Station Platform* — The area of a station immediately adjacent to a guideway, used primarily for loading and unloading passengers.

2.44 Mixed Occupancy — A multiple occupancy where the occupancies are intermingled.

2.45 Multiple Occupancy — A building or structure in which two or more classes of occupancy exist.

2.46 Occupancy or Use Group — The principal occupancy for which a building or a part of a building is used or intended to be used; for the purpose of classification of a building according to the occupancy, an occupancy shall be deemed to include subsidiary occupancies which are contingent upon it.

2.47 Occupant Load — Maximum number of persons that might occupy a building or portion thereof at any one time.

2.48 Place of Comparative Safety — Places within a building where people can stay little longer until evacuation, for example, refuge areas, terrace, fire/ smoke separated compartments, etc.

2.49 Pressurization — The establishment of a pressure difference across a barrier to protect exit, stairway, lobby, exit passageway or room of a building from smoke penetration.

2.50 Pressurization Level — The pressure difference between the pressurized space and the adjoining area served by the pressurized space expressed in Pascal (Pa).

2.51 Public Way — A street, alley, or other similar parcel of land essentially open to the outside air, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width and height of not less than 3 m.

2.52 Ramp — The construction, in the form of an inclined plane that is steeper than or equal to 1 : 20 (5 percent) from the horizontal, together with any intermediate landing, that makes it possible to pass from one level to another.

2.53 Refuge Area — An area within the building for a temporary use during egress. It generally serves as a staging area which is protected from the effect of fire and smoke.

2.54 Roof Exits — A means of escape on to the roof of a building, where the roof has access to it from the ground through alternative stair case or adjacent building.

2.55 Site (Plot) — A parcel (piece) of land enclosed by definite boundaries.

2.56 Smoke Barrier — A continuous membrane, or a membrane, where such membrane is designed and constructed to restrict the movement of smoke.

2.57 Smoke Compartment — A space within a building enclosed by smoke barriers on all sides.

2.58 Stack Pressure — Pressure difference caused by a temperature difference creating an air movement within a duct, chimney or enclosure.

2.59 Travel Distance — The distance to be travelled from any point in a building to a protected exit or external escape route or final exit measured along the line of travel.

2.60 Ventilation — Supply of outside air into, or the removal of inside air from an enclosed space.

2.61 Venting Fire — The process of facilitating heat and smoke to leave a building as quickly as possible by such paths so that lateral spread of fire and heat is checked, firefighting operations are facilitated and minimum fire damage is caused.

2.62 Visual Strobes/Flashing — It is an audio-visual fire alarm for alerting persons with hearing impairment with flashing light. The strobe frequency should be from 0.5 Hz to 4.0 Hz.

NOTE — Care should be taken to ensure that overlapping strobes do not combine to result in a higher frequency of flashing.

2.63 Volume to Plot Area Ratio (VPR) — The ratio of volume of building measured in cubic metre to the area of the plot measured in square metre and expressed in metre.

2.64 Water Based Systems

2.64.1 *Hydrant System* — A distribution system having a network of piping installed underground/above-ground around and/or through inside of a building with internal and/or external hydrants fitted with landing valves at regular intervals according to the occupancy. The distribution system is connected to water supply system for firefighting.

2.64.2 *Automatic Sprinkler System* — A system of water pipes fitted with sprinkler heads at suitable intervals and heights and designed to actuate automatically, control and extinguish a fire by the discharge of water.

2.64.3 *Automatic Water Spray Systems* — A special fixed pipe system connected to a reliable source of fire protection water supply and equipped with water spray nozzles for specific water discharge and distribution over the surface or area to be protected. The piping system is connected to the water supply through an automatically actuated deluge valve which initiates flow of water. Automatic actuation is achieved by operation of automatic detecting equipment installed along with water spray nozzles. There are two types of systems namely high velocity and medium velocity systems.

2.64.4 *Water Mist Systems* — A distribution system connected to a pumping and water supply system that is equipped with nozzles capable of delivering water mist to the part/entire enclosure or area, intended to control, suppress, or extinguish fire and is capable of meeting the specified performance requirements.

2.64.5 *Foam Protection System* — Firefighting systems where foam is made by mechanically mixing air with a solution consisting of fresh water to which a foaming agent (liquid concentrate) has been added. Firefighting foam is a stable aggregation of small bubbles of density lower than oil or water, and shows tenacious qualities for covering horizontal surfaces. There are three types of foam applications that is, low, medium and high expansion foams depending upon the application.

2.65 Wet Riser — An arrangement for firefighting within the building by means of vertical rising mains not less than 100 mm nominal diameter with landing valves on each floor/landing for firefighting purposes and permanently charged with water from a pressurized supply.

NOTE — For definition of other terms, reference shall be made to accepted standards [4(3)].

3 FIRE PREVENTION

3.1 Classification of Buildings Based on Occupancy

3.1.1 *General Classification*

All buildings, whether existing or hereafter erected shall be classified according to use or the character of

occupancy in one of the following groups:

Group A	Residential
Group B	Educational
Group C	Institutional
Group D	Assembly
Group E	Business
Group F	Mercantile
Group G	Industrial
Group H	Storage
Group J	Hazardous

The details of each occupancy and example of buildings in each group are given in **3.1.2** to **3.1.10.**

3.1.1.1 *Minor occupancy*

This is purely incidental to operations in a main occupancy, which shall be considered as part of the main occupancy and shall be classified under the relevant group for the main occupancy.

3.1.1.2 *Mixed occupancy*

Where two or more types of occupancies intermingle in the same building, the entire building shall be treated as mixed occupancy and the same shall comply with **3.1.12**.

3.1.2 *Group A Residential Buildings*

These shall include any building in which sleeping accommodation is provided for normal residential purposes with or without cooking or dining or both facilities, except any building classified under Group C.

Buildings and structures under Group A shall be further subdivided as follows:

Subdivision A-1	Lodging and rooming houses
Subdivision A-2	One or two family private dwellings
Subdivision A-3	Dormitories
Subdivision A-4	Apartment houses
Subdivision A-5	Hotels
Subdivision A-6	Starred hotels

a) *Subdivision A-1 Lodging and rooming houses* — These shall include any building or group of buildings under the same management, in which separate sleeping accommodation on transient or permanent basis, with or without dining facilities but without cooking facilities for individuals is provided. This includes inns, clubs, motels and guest houses.

NOTE — A lodging or rooming house shall be classified as a dwelling in Subdivision A-2, if no room in any of its private dwelling units is rented to more than three persons.

b) *Subdivision A-2 One or two family private dwellings* — These shall include any private dwelling, which is occupied by members of one or two families and has a total sleeping accommodation for not more than 20 persons.

If rooms in a private dwelling are rented to outsiders, these shall be for accommodating not more than three persons per room.

If sleeping accommodation for more than 20 persons is provided in any one residential building, it shall be classified as a building in Subdivision A-1 or Subdivision A-4 as the case may be.

c) *Subdivision A-3 Dormitories* — These shall include any building in which group sleeping accommodation is provided, with or without dining facilities for persons who are not members of the same family, in one room or a series of closely associated rooms under joint occupancy and single management, for example, school and college dormitories, students, and other hostels and military barracks.

d) *Subdivision A-4 Apartment houses* — These shall include any building or structure in which living quarters are provided for three or more families, living independently of each other and with independent cooking facilities, for example, apartment houses, mansions and *Chawls*.

e) *Subdivision A-5 Hotels* — These shall include any building or group of buildings under single management, in which sleeping accommodation is provided, with or without dining facilities for hotels classified up to Four Star Category.

f) *Subdivision A-6 Starred hotels* — These shall include the hotels duly approved by the concerned authorities as Five Star and above hotels.

3.1.3 *Group B Educational Buildings*

These shall include any building used for school, college, other training institutions involving assembly for instruction, education or recreation for not less than 20 students.

Buildings and structures under Group B shall be further subdivided as follows:

Subdivision B-1	Schools up to senior secondary level
Subdivision B-2	All others/training institutions

a) *Subdivision B-1 Schools up to senior secondary level* — This subdivision shall

include any building or a group of buildings under single management which is used for students not less than 20 in number.

b) *Subdivision B-2 All others/training institutions* — This subdivision shall include any building or a group of buildings under single management which is used for students not less than 100 in number.

In the case of temporary buildings/structures which are utilized for educational purposes, the provisions of **3.2.5.3** shall apply.

If residential accommodation is provided in the schools/ institutions that portion of occupancy shall be classified as a building in Subdivision A-3.

3.1.4 *Group C Institutional Buildings*

These shall include any building or part thereof, which is used for purposes, such as medical or other treatment or care of persons suffering from physical or mental illness, disease or infirmity; care of infants, convalescents or aged persons and for penal or correctional detention in which the liberty of the inmates is restricted. Institutional buildings ordinarily provide sleeping accommodation for the occupants.

Buildings and structures under Group C shall be further subdivided as follows:

Subdivision C-1	Hospitals and sanatoria
Subdivision C-2	Custodial institutions
Subdivision C-3	Penal and mental institutions

a) *Subdivision C-1 Hospitals and sanatoria* — This subdivision shall include any building or a group of buildings under single management, which is used for housing persons suffering from physical limitations because of health or age and those incapable of self-preservation, for example, hospitals, infirmaries, sanatoria and nursing homes.

b) *Subdivision C-2 Custodial institutions* — This subdivision shall include any building or a group of buildings under single management, which is used for the custody and care of persons, such as children, convalescents and the aged who are incapable of self-preservation, for example, homes for the aged and infirm, convalescent homes and orphanages.

c) *Subdivision C-3 Penal and mental institutions* — This subdivision shall include any building or a group of buildings under single management, which is used for housing persons under restraint, or who are detained for penal or corrective purposes, in which the liberty of the inmates is restricted, for example, jails, prisons, mental hospitals, mental sanatoria and reformatories.

3.1.5 *Group D Assembly Buildings*

These shall include any building or part of a building, where not less than 50 persons congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes, for example, theatres; motion picture houses; assembly halls; auditoria; exhibition halls; museums; skating rinks; gymnasiums; restaurants; places of worship; dance halls; club rooms; passenger stations and terminals of air, surface and marine public transportation services; and stadia.

Buildings under Group D shall be further subdivided as follows:

Subdivision D-1	Buildings having a theatrical or motion picture or any other stage and fixed seats for over 1 000 persons
Subdivision D-2	Buildings having a theatrical or motion picture or any other stage and fixed seats up to 1 000 persons
Subdivision D-3	Buildings without a permanent stage having accommodation for 300 or more persons but no permanent seating arrangement
Subdivision D-4	Buildings without a permanent stage having accommodation for less than 300 persons with no permanent seating arrangement
Subdivision D-5	All other structures including temporary structures designed for assembly of people not covered by Subdivisions D-1 to D-4, at ground level
Subdivision D-6	Buildings having mixed occupancies of assembly and mercantile (for example, shopping malls providing facilities such as shopping, cinema theatres, multiplexes and restaurants/food courts)
Subdivision D-7	Underground and elevated mass rapid transit system

a) *Subdivision D-1* — This subdivision shall include any building primarily meant for theatrical or operatic performances and which has a stage, proscenium curtain, fixed or portable scenery or scenery loft, lights, mechanical appliances or other theatrical

accessories and equipment for example, theatres, motion picture houses, auditoria, concert halls, television and radio studios admitting an audience and which are provided with fixed seats for over 1 000 persons.

b) *Subdivision D-2* — This subdivision shall include any building primarily meant for use as described for Subdivision D-1, but with fixed seats up to 1 000 persons.

c) *Subdivision D-3* — This subdivision shall include any building, its lobbies, rooms and other spaces connected thereto, primarily intended for assembly of people, but which has no theatrical stage or permanent theatrical and/or cinematographic accessories and has accommodation for 300 persons or more, for example, dance halls, night clubs, halls for incidental picture shows, dramatic, theatrical or educational presentation, lectures or other similar purposes having no theatrical stage except a raised platform and used without permanent seating arrangement; art galleries, community halls, marriage halls, places of worship, museums, lecture halls, passenger terminals and heritage and archaeological monuments, pool and billiard parlours, bowling alleys, community halls, courtrooms, gymnasiums (without spectator seating), indoor swimming pools (without spectator seating), indoor tennis courts (without spectator seating).

d) *Subdivision D-4* — This subdivision shall include any building primarily intended for use as described in Subdivision D-3, but with accommodation for less than 300 persons with no permanent seating arrangements.

e) *Subdivision D-5* — This subdivision shall include any building or structure, permanent or temporary meant for assembly of people not covered by Subdivisions D-1 to D-4, for example, grandstands, stadia, amusement park structures, reviewing stands and circus tents, arenas, external swimming pools, tennis and similar type of courts.

f) *Subdivision D-6* — This subdivision shall include any building for assembly of people provided with multiple services/facilities like shopping, cinema theatres, multiplexes, restaurants/food court.

g) *Subdivision D-7* — This subdivision shall include any building or structure like example, underground or elevated railways.

3.1.6 *Group E Business Buildings*

These shall include any building or part thereof which is used for transaction of business for keeping of accounts and records and similar purposes, professional establishments, service facilities, etc. City halls, town halls, courthouses and libraries shall be classified in this group so far as the principal function of these is transaction of public business and keeping of books and records.

Buildings under Group E shall be further subdivided as follows:

Subdivision E-1	Offices, banks, professional establishments, like offices of architects, engineers, doctors, lawyers, post offices and police stations
Subdivision E-2	Laboratories, outpatient clinics, research establishments, libraries and test houses
Subdivision E-3	Electronic data processing centres, computer installations, information technology parks and call centres
Subdivision E-4	Telephone exchanges
Subdivision E-5	Broadcasting stations, T.V. stations and air traffic control towers

3.1.7 *Group F Mercantile Buildings*

These shall include any building or part thereof, which is used as shops, stores, market, for display and sale of merchandise, either wholesale or retail.

Mercantile buildings shall be further subdivided as follows:

Subdivision F-1	Shops, stores, departmental stores, markets (any with covered area up to 500 m^2)
Subdivision F-2	Shops, stores, departmental stores, markets (any with covered area more than 500 m^2)
Subdivision F-3	Underground shopping centres

Storage and service facilities incidental to the sale of merchandise and located in the same building shall also be included under this group.

3.1.8 *Group G Industrial Buildings*

These shall include any building or part of a building or structure, in which products or materials of all kinds and properties are fabricated, assembled, manufactured or processed, for example, assembly plants, industrial laboratories, dry cleaning plants, power plants,

generating units, pumping stations, fumigation chambers, laundries, buildings or structures in gas plants, refineries, dairies and saw-mills, etc.

Buildings under Group G shall be further subdivided as follows:

Subdivision G-1	Buildings used for low hazard industries
Subdivision G-2	Buildings used for moderate hazard industries
Subdivision G-3	Buildings used for high hazard industries

The hazard of occupancy, for the purpose of the Code, shall be the relative danger of the start and spread of fire, the danger of smoke or gases generated, the danger of explosion or other occurrences potentially endangering the lives and safety of the occupants of the buildings.

Hazard of occupancy shall be determined by the Authority on the basis of the fire loads of the contents, and the processes or operations conducted in the building, provided, however, that where the combustibility of the material, the flame spread rating of the interior finish or other features of the building or structure are such as to involve a hazard greater than the occupancy hazard, the greater degree of hazard shall govern the classification.

For determination of fire loads and fire load density for arriving at the classification of occupancy hazard, guidance on calorific values of some common materials is given at Annex A.

A broad classification of industrial occupancies into low, moderate and high hazard classes is given at Annex B, for guidance. Any occupancy not covered in Annex B, shall be classified in the most appropriate class depending on the degree of hazard.

Where different degrees of hazard of occupancy exist in different parts of a building, the most hazardous of those shall govern the classification for the purpose of this Code, except in cases where hazardous areas are segregated or protected as specified in the Code.

a) *Subdivision G-1* — This subdivision shall include any building in which the contents are of such comparative low combustibility and the industrial processes or operations conducted therein are of such a nature that there is hardly any possibility for any self-propagating fire to occur and the only consequent danger to life and property may arise from panic, fumes or smoke, or fire from some external source.

b) *Subdivision G-2* — This subdivision shall include any building in which the contents or industrial processes or operations conducted therein are liable to give rise to a fire which will burn with moderate rapidity or result in other hazardous situation and may give off a considerable volume of smoke, but from which neither toxic fumes nor explosions are to be feared in the event of fire.

c) *Subdivision G-3* — This subdivision shall include any building in which the contents or industrial processes or operations conducted therein are liable to give rise to a fire which will burn with extreme rapidity or result in other hazardous situation or from which poisonous fumes or explosions are to be feared in the event of a fire.

3.1.9 *Group H Storage Buildings*

These shall include any building or part of a building used primarily for the storage or sheltering (including servicing, processing or repairs incidental to storage) of goods, ware or merchandise (except those that involve highly combustible or explosive products or materials), vehicles or animals, for example, warehouses, cold storages, freight depots, transit sheds, storehouses, truck and marine terminals, garages, hangars, grain elevators, barns and stables. Storage properties are characterized by the presence of relatively small number of persons in proportion to the area. Any new use which increases the number of occupants to a figure comparable with other classes of occupancy shall change the classification of the building to that of the new use, for example, hangars used for assembly purposes, warehouses used for office purposes, garage buildings used for manufacturing.

3.1.10 *Group J Hazardous Buildings*

These shall include any building or part thereof which is used for the storage, handling, manufacture or processing of highly combustible or explosive materials or products which are liable to burn with extreme rapidity and/or which may produce poisonous fumes or explosions for storage, handling, manufacturing or processing which involve highly corrosive, toxic or noxious alkalis, acids or other liquids or chemicals producing flame, fumes and explosive, poisonous, irritant or corrosive gases; and for the storage, handling or processing of any material producing explosive mixtures of dust which result in the division of matter into fine particles subject to spontaneous ignition. Examples of buildings in this class are those buildings which are used for,

a) storage, under pressure of more than 0.1 N/mm^2 and in quantities exceeding 70 m^3,

of acetylene, hydrogen, illuminating and natural gases, ammonia, chlorine, phosgene, sulphur dioxide, carbon dioxide, methyloxide and all gases subject to explosion, fume or toxic hazard, cryogenic gases, etc;

b) storage and handling of hazardous and highly flammable liquids, liquefiable gases like LPG, rocket propellants, etc;

c) storage and handling of hazardous and highly flammable or explosive materials (other than liquids); and

d) manufacture of artificial flowers, synthetic leather, ammunition, explosives and fireworks.

NOTE — A list of hazardous substances giving quantities, for which or exceeding which owners handling such substances are required to be covered under *The Public Liability Insurance Act*, 1991, has been notified under the '*Rules on Emergency Planning, Preparedness and Response for Chemical Accidents'* by the Govt. of India, Ministry of Environment and Forests Notification No. G.S.R. 347(E) dated 01 August 1996.

3.1.11 *Mixed Occupancy*

In case of mixed occupancy, in so far as fire protection is concerned, all the occupancies/the entire building shall be governed by the most restrictive provisions of the Code among those applicable for individual occupancies. The provisions for life safety given in the Code for individual occupancy shall, however, apply to the respective occupancies. Exits in such mixed occupancy shall be arranged so as to ensure that means of egress is not decreased in the direction of egress travel.

Further, in such mixed occupancies, the occupancies are also required to be separated (horizontally and/or vertically as the case may be) by a 240 min fire resistance rating.

3.1.12 Where change in the occupancy of any building places it in a different group or in a different subdivision of the same group, such building shall be made to comply with the requirements of the Code for the new group or its subdivision.

3.1.13 Where the new occupancy of a building is less hazardous, based on life and fire risk, than its existing occupancy, it shall not be necessary to conform to the requirements of the Code for the new group or its subdivision.

3.1.14 A certificate of occupancy shall be necessary, as required under Part 2 'Administration' of the Code, before any change is effected in the character of occupancy of any building.

3.2 Fire Zones

3.2.1 *Demarcation*

The city or area under the jurisdiction of the Authority shall, for the purpose of the Code, be demarcated into distinct zones, based on fire hazard inherent in the buildings and structures according to occupancy (*see* **3.1**), which shall be called as 'Fire Zones'.

3.2.2 *Number and Designation of Fire Zones*

3.2.2.1 The number of fire zones in a city or area under the jurisdiction of the Authority depends upon the existing layout, types of building construction (*see* **3.3**), classification of existing buildings based on occupancy (*see* **3.1**) and expected future development of the city or area. In large cities or areas, three fire zones may be necessary, while in smaller ones, one or two may be adequate.

3.2.2.2 The fire zones shall be made use of in land use development plan and shall be designated as follows:

a) *Fire Zone No. 1* — This shall comprise areas having residential (Group A), educational (Group B), institutional (Group C), assembly (Group D), small business (Subdivision E-1) and mercantile (Group F) buildings, or areas which are under development for such occupancies.

b) *Fire Zone No. 2* — This shall comprise business (Subdivisions E-2 to E-5) and industrial buildings (Subdivisions G-1 and G-2), except high hazard industrial buildings (Subdivision G-3) or areas which are under development for such occupancies.

c) *Fire Zone No. 3* — This shall comprise areas having high hazard industrial buildings (Subdivision G-3), storage buildings (Group H) and buildings for hazardous uses (Group J) or areas which are under development for such occupancies.

3.2.3 *Change in the Fire Zone Boundaries*

When the boundaries of any fire zone are changed, or when it is intended to include other areas or types of occupancies in any fire zone, it shall be done by following the same procedure as for promulgating new rules or ordinances or both.

3.2.4 *Overlapping Fire Zone*

3.2.4.1 When any building is so situated that it extends to more than one fire zone, it shall be deemed to be in the fire zone in which the major portion of the building or structure is situated.

3.2.4.2 When any building is so situated that it extends equally to more than one fire zone, it shall be deemed

to be in the fire zone having more hazardous occupancy buildings.

3.2.5 *Temporary Buildings or Structures*

3.2.5.1 Temporary buildings and structures shall be permitted only in Fire Zones No. 1 and 2 as the case may be, according to the purpose for which these are to be used, by special permit from the Authority for a limited period and subject to such conditions as may be imposed in the permit.

3.2.5.2 Such buildings and temporary structures shall be completely removed on the expiry of the period specified in the permit.

3.2.5.3 Adequate fire precautionary measures in the construction of temporary structures and *Pandals* shall be taken in accordance with good practice [4(4)].

3.2.6 *Restrictions on the Type of Construction for New Buildings*

These shall be as follows:

a) Buildings erected in Fire Zone No. 1 shall conform to construction of Type 1, 2, 3 or 4.
b) Buildings erected in Fire Zone No. 2 shall conform to construction of Type 1, 2 or 3.
c) Buildings erected in Fire Zone No. 3 shall conform to construction of Type 1 or 2.

3.2.7 *Restrictions on Existing Buildings*

The existing buildings in any fire zone shall not be required to comply with the requirements of the Code unless these are altered, or in the opinion of the Authority, such building constitutes a hazard to the safety of the adjacent property or to the occupants of the building itself or is an unsafe building. In the event of alteration, it shall be necessary to obtain permission of the Authority for such alteration consistent with fire hazard (*see* Part 2 'Administration' of the Code).

Alterations/modifications/renovations shall be accomplished so as to ensure conformity with all the safety requirements of the new buildings. Such alterations shall not in any way bring down level of fire and life safety below that which existed earlier. Any addition or alterations or construction of cubicles or partitioning, for floor area exceeding 500 m^2 for all high rise buildings shall be with the approval of local fire authority.

3.3 Types of Construction

3.3.1 The design of any building and the type of materials used in its construction are important factors in making the building resistant to a complete burn-out and in preventing the rapid spread of fire, smoke or fumes, which may otherwise contribute to the loss of lives and property.

The fire resistance of a building or its structural and non-structural elements is expressed in minutes against a specified fire load which is expressed in kcal/m^2, and against a certain intensity of fire. The fire-resistance test for structural element shall be done in accordance with accepted standards [4(2)]. For the purpose of the Code, the types of construction according to fire resistance shall be classified into four categories, namely, Type 1 Construction, Type 2 Construction, Type 3 Construction and Type 4 Construction. The minimum fire resistance ratings of structural and non-structural members for various types of construction shall be as given in Table 1.

Non-combustible materials should be used for construction of buildings, and the internal walls of staircase enclosures should be of brick work or reinforced concrete or any other material of construction with minimum of 120 min rating. The walls for the chimney shall be of Type 1 or Type 2 Construction depending on whether the flue gas temperature is above 200°C or less, respectively.

3.3.2 It is required that a structural and/or non-structural element/component shall have the requisite fire resistance rating as per Table 1. The fire resistance rating for the structural and non-structural elements shall be based on guidelines as per approved and accepted standards. The fire rating shall be validated and certified with a view to meeting the requirements of Table 1. In the absence of any validated/certified rating, guidance may be obtained from the information available in Annex C.

3.3.3 Load bearing steel beams and columns of buildings having total covered area of 500 m^2 and above shall be protected against failure/collapse of structure in case of fire. This could be achieved by use of appropriate methodology using suitable fire resistance rated materials along with suppression system (*see* Annex C, Table 25 and Table 26).

3.3.4 The false ceiling, including all fixtures used for its suspension, shall be of non-combustible material and shall provide adequate fire resistance to the ceiling in order to prevent spread of fire across ceiling.

3.4 General Requirements of All Individual Occupancies

3.4.1 *General*

All buildings shall satisfy certain requirements, which contribute, individually and collectively, to the safety of life from fire, smoke, fumes and panic arising from these or similar causes. There are, however, certain general principles and common requirements, which are applicable to all or most of the occupancies.

Table 1 Fire Resistance Ratings of Structural and Non-Structural Elements (minutes)
(*Clauses* 3.3.1 *and* 3.3.2)

Sl No.	Structural Element	Fire Resistance Ratings (min) for Type of Construction			
		Type 1	Type 2	Type 3	Type 4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Exterior walls:				
	a) Fire separation less than 3.7 m:				
	1) Bearing	240	120	120	60
	2) Non-bearing	120	90	60	60
	b) Fire separation of 3.7 m or more but less than 9 m:				
	1) Bearing	240	120	120	60
	2) Non-bearing	90	60	60	60
	c) Fire separation of 9 m or more:				
	1) Bearing	240	120	120	60
	2) Non-bearing	60	60	60	60
ii)	Fire separation assemblies (like fire check doors)	120	120	120	120
iii)	Fire enclosures of exits	120	120	120	120
iv)	Shafts for services, lift hoistway and refuse chutes	120	120	120	120
v)	Vertical separation between adjacent tenant spaces	60	60	60	60
vi)	Dwelling unit separation:				
	a) Load bearing	120	120	60	60
	b) Non-load bearing	60	60	30	30
vii)	Interior bearing walls, bearing partitions, columns, beams, girders, trusses (other than roof trusses) and framing:				
	a) Supporting more than one floor	240	120	120	120
	b) Supporting one floor only	180	90	60	60
	c) Supporting a roof only	180	90	60	60
viii)	Walls supporting structural members	180	90	60	60
ix)	Floor construction	120	90	60	60
x)	Roof construction:				
	a) 5 m or less in height to lowest member	120	90	60	60
	b) More than 5 m but less than 6.7 m in height to lowest member	60	60	60	60
	c) 6.7 m or more in height to lowest member	0	0	0	0

NOTES

1 The above fire resistance rating shall be required to achieve the respective type of construction unless otherwise specified in the respective clauses for different applications/use.

2 In case of lift bank, the partition wall, if any, need not be of fire rating specified in this table.

3.4.2 *Exceptions and Deviations*

Exceptions and deviations to the general provisions of requirements of individual occupancies are given as applicable to each type of occupancy in **6.1** to **6.9**. In case of practical difficulty or to avoid unnecessary hardship, without sacrificing reasonable safety, local head, fire services may consider exemptions from the Code.

3.4.3 *Occupation of Buildings under Construction*

3.4.3.1 A building or portion of the building may be occupied during construction, repairs, alterations or additions only if all means of exit and fire protection measures are in place and continuously maintained for the occupied part of the building.

3.4.3.2 A high rise building during construction shall be provided with the following fire protection measures, which shall be maintained in good working condition at all the times:

a) Dry riser of minimum 100 mm diameter pipe with hydrant outlets on the floors constructed with a fire service inlet to boost the water in the dry riser and maintenance should be in accordance with good practice [4(5)].

b) Drums of 2 000 litre capacity filled with water with two fire buckets on each floor;

c) A water storage tank of minimum 20 000 litre capacity, which may be used for other construction purposes also.

3.4.4 *Maximum Height, Floor Area Ratio and Open Spaces*

3.4.4.1 Every building shall be restricted in its height above the ground level and the number of storeys, depending upon its occupancy and the type of construction. The height shall be measured as specified in Part 3 'Development Control Rules and General Building Requirements' of the Code. The maximum permissible height for any combination of occupancy and types of construction should necessarily be related to the width of street fronting the building, or floor area ratios and the local firefighting facilities available.

NOTE — Set-back distances (according to the permissible height for each type of building as per the occupancy), width of streets providing approach to the building, permitted floor area ratio (FAR), permitted open space around or inside buildings, provision of adequate passageway and clearances required for firefighting vehicles, etc shall be strictly governed by the provisions of Part 3 'Development Control Rules and General Building Requirements' of the Code.

3.4.4.2 *Floor area ratio*

The comparative floor area ratios for different occupancies and types of construction are given in Table 2 (*see also* Part 3 'Development Control Rules and General Building Requirements' of the Code).

3.4.4.3 The requirements of open space around the building(s) shall be in accordance with Part 3 'Development Control Rules and General Building Requirements' of the Code.

3.4.5 *Openings in Fire Resistant Walls and Floors*

3.4.5.1 At the time of designing openings in fire resistant walls and floors, particular attention shall be paid to all such factors which limit fire spread through these openings and maintain fire rating of the structural members.

3.4.5.2 For Types 1 to 3 constructions, a doorway or opening in a fire resistant wall on any floor shall be limited to 5.6 m^2 in area with a maximum height/width of 2.75 m. Every wall opening shall be protected with fire-resisting doors, having the fire rating of not less than 120 min. The openings in the floors shall be protected by vertical enclosures extending above and below such openings, such enclosures having a fire resistance of not less than 120 min and all openings therein being protected with a fire-resisting assembly as specified in **3.4.5.6**.

For escalator openings, the smoke spill shall be avoided by provision of smoke barrier (of 450-600 mm) thereby creating smoke compartment. Further, the protection shall be ensured through installation of sprinklers on all sides of the cut out opening on each floor (*see* Fig. 3 for details).

3.4.5.3 For Type 4 construction, openings in the fire separating walls or floors shall be fitted with 120 min fire-resistance rated assemblies.

Table 2 Comparative Floor Area Ratios for Occupancies Facing One Public Street at least 9 m Wide
(*Clause* 3.4.4.2)

Sl No.	Occupancy Classification	Type of Construction			
		Type 1	Type 2	Type 3	Type 4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Residential	UL	2.0	1.4	1.0
ii)	Educational	UL	2.0	1.4	1.0
iii)	Institutional	UL	1.5	1.0	0.8
iv)	Assembly	UL	1.0	0.7	0.5
v)	Business	UL	2.9	2.3	1.6
vi)	Mercantile	8.0	1.8	1.4	1.0
vii)	Industrial	7.5	1.9	1.6	1.3
viii)	Storage (*see* Note 5)	6.0	1.5	1.3	1.0
ix)	Hazardous (*see* Note 5)	2.8	1.1	0.9	NP

UL — Unlimited.

NP — Not permitted.

NOTES

1 The FAR values given in this table are subject to overall restrictions on the heights of buildings in the case of educational, institutional, assembly, storage and hazardous occupancies as specified in col 2 of Table 7.

2 This table has been prepared, taking into account the combustible content in the different occupancies as well as the fire resistance offered by the type of construction.

3 This table should be modified by the Authority, taking into account the other aspects as given below:

a) Density in terms of dwelling units per hectare;
b) Traffic considerations;
c) Parking spaces;
d) Local fire-fighting facilities; and
e) Water supply, drainage and sanitation requirements.

4 The FAR values specified in this table may be increased by 20 percent for the following services:

a) A basement or cellar space under a building constructed on stilts and used as a parking space and air conditioning plant room used as accessory to the principal use;
b) Watchman's booth, pump house, garbage shaft, electric cabin or substation and other utility structures meant for the services of the building under considerations;
c) Projections and accessory buildings as specifically exempted under the Code; and
d) Staircase room and lift rooms above the topmost storey; architectural feature; and chimneys and elevated tanks of dimensions as permissible under the Code; the area of the lift shaft shall be taken only on one floor.

5 In so far as single storey storage and hazardous occupancies are concerned, they would be further governed by volume to plot area ratio (VPR) to be decided by the Authority.

3.4.5.4 *Service ducts and shafts*

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 a fire resistance not less than 120 min. The inspection door for electrical shafts/ducts

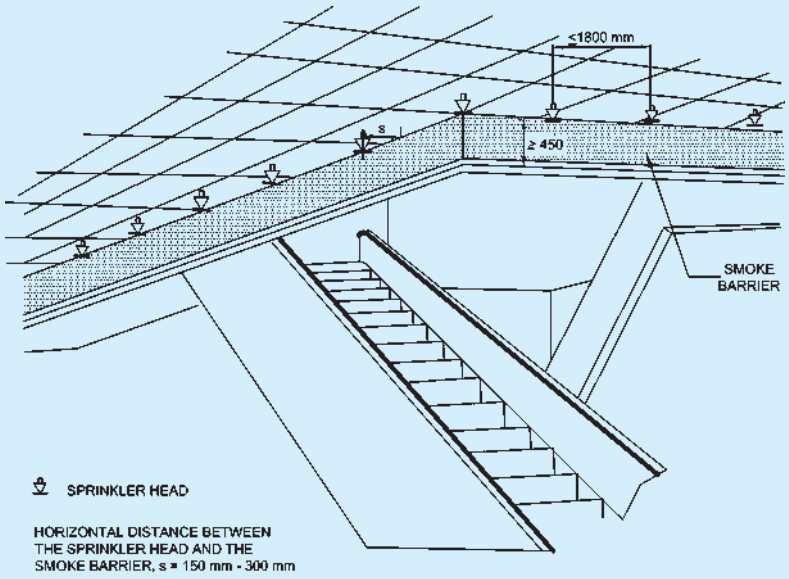


FIG. 3 SPRINKLERS AROUND ESCALATOR OPENING

shall be not less than 120 min. Further, medium and low voltage wiring running in shafts/ducts, shall either be armoured type or run through metal conduits.

The space between the electrical cables/conduits and the walls/slabs shall be filled in by a fire stop material having fire resistance rating of not less than 120 min. This shall exclude requirement of fire stop sealing for low voltage services shaft.

For plumbing shafts in the core of the building, with shaft door opening inside the building, the shafts shall have inspection doors having fire resistance rating not less than 30 min.

For plumbing shafts doors which open in wet areas or in naturally ventilated areas or on external wall of the building, the shafts may not require doors having any specified fire rating.

NOTE — In the case of buildings where it is necessary to lower or lift heavy machinery or goods from one floor to the other, it may be necessary to provide larger openings in the floor. Such openings shall be provided with removable covers which shall have the same strength and fire resistance as the floor.

3.4.5.5 *Refuse chutes*

Refuse chutes, if any provided in a building, shall have opening at least 1 m 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 6 m away from exits.

3.4.5.6 *Vertical opening*

Every vertical opening between the floors of a building shall be suitably enclosed or protected, as necessary, to provide the following:

a) Reasonable safety to the occupants while using the means of egress by preventing spread of fire, smoke, or fumes through vertical openings from floor to floor to allow occupants to complete their use of the means of egress. Further it shall be ensured to provide a clear height of 2 100 mm in the exit access.
b) Limitation of damage to the building and its contents.

3.4.6 *Electrical Installation*

3.4.6.1 For requirements regarding electrical installations from the point of view of fire safety, reference may be made to good practice [4(6)] and Part 8 'Building Services, Section 2 Electrical and Allied Installations' of the Code.

In general, it is desirable that the wiring and cabling are with flame retardant property. Medium and low voltage wiring running in shafts, and within false ceiling shall run in metal conduit. Any 230 V wiring for lighting or other services, above false ceiling, shall have 660 V grade insulation.

The electric distribution cables/wiring shall be laid in a separate shaft. The shaft shall be sealed at every floor with fire stop materials having the same fire resistance as that of the floor. High, medium and low voltage wiring running in shaft and in false ceiling shall run in separate shaft/conduits.

Water mains, gas pipes, telephone lines, intercom lines or any other service line shall not be laid in the duct for electrical cables; use of bus ducts/solid rising mains instead of cables is preferred.

All metallic items like steel structural members, etc, shall be bonded properly to the earthing system.

3.4.6.2 *Emergency power for fire and life safety systems*

Emergency power supplying distribution system for critical requirement for functioning of fire and life safety system and equipment shall be planned for efficient and reliable power and control supply to the following systems and equipment where provided:

a) Fire pumps.
b) Pressurization and smoke venting; including its ancillary systems such as dampers and actuators.
c) Fireman's lifts (including all lifts).
d) Exit signage lighting.
e) Emergency lighting.
f) Fire alarm system.
g) Public address (PA) system (relating to emergency voice evacuation and annunciation).
h) Magnetic door hold open devices.
j) Lighting in fire command centre and security room.

Power supply to these systems and equipment shall be from normal and emergency (standby generator) power sources with changeover facility. If power supply, is from HV source and HV generation, the transformer should be planned in standby capacity to ensure continuity of power to such systems. Wherever transformers are installed at higher levels in buildings and backup DG sets are of higher voltage rating, then dual redundant cables shall be taken to all transformers. The generator shall be capable of taking starting current of all the fire and life safety systems and equipment as above. Where parallel HV/LV supply from a separate substation fed from different grid is provided with appropriate transformer for emergency, the provision of generator may be waived in consultation with the Authority.

The power supply to the panel/distribution board of these fire and life safety systems shall be through fire proof enclosures or circuit integrity cables or through alternate route in the adjoining fire compartment to ensure supply of power is reliable to these systems and equipment. It shall be ensured that the cabling from the adjoining fire compartment is protected within the compartment of vulnerability. The location of the panel/ distribution board feeding the fire and life safety system shall be in fire safe zone ensuring supply of power to these systems.

Circuits of such emergency system shall be protected at origin by an automatic circuit breaker with its no-volt coil removed. Master switches controlling essential service circuits shall be clearly labelled.

Cables for fire alarm and PA system shall be laid in metal conduits or armoured to provide physical segregation from the power cables.

3.4.6.3 *Substation/Transformers*

Areas in substation shall not be used as storage/dump areas or for other utility purposes other than those required for the functioning of the substation.

The substation area should be adequately ventilated.

An independent, ventilated or air conditioned MV panel room shall be provided on the ground level or first basement. This room shall be provided with access from outside (or through exit passageway accessible from outside). The MV panel room shall be provided with fire resistant walls and doors of fire resistance of not less than 120 min.

If the licensees agree to provide meters on upper floors, the licensees' cables shall be segregated from consumers' cables by providing a partition in the shaft. Meter rooms on upper floors shall not open into staircase enclosures and should be ventilated directly to open air outside or in electrical room of 120 min fire resistant walls.

Electrical MV main distribution panel and lift panels shall be provided with CO_2/inert gas flooding system for all panel compartments with a cylinder located beside the panel.

3.4.6.3.1 *Oil filled substation*

A substation or a switch-station with oil filled equipment shall be limited to be installed in utility building or in outdoor location. Such substation/utility building shall be at least 7 m away from the adjoining building(s).

Substation equipment (exceeding oil capacity of 2 000 litre) in utility building shall have fire rated baffle walls of 240 min rating constructed between such equipment, raised to at least 600 mm above the height of the equipment (including height of oil conservators) and exceeding 300 mm on each side of the equipment.

All transformers where capacity exceeds 10 MVA shall be protected by high velocity water spray systems or nitrogen injection system.

3.4.6.3.2 *Dry type substation*

Transformers located inside a building shall be of dry type and all substation/switch room walls, ceiling, floor, opening including doors shall have a fire resistance

rating of 120 min. Access to the substation shall be provided from the nearest fire exit/exit staircase for the purpose of electrical isolation.

3.4.6.4 *Standby supply*

Diesel generator set(s) shall not be installed at any floor other than ground/first basement. If the same are installed indoors, proper ventilation and exhaust shall be planned. The DG set room shall be separated by 120 min fire resistance rated walls and doors.

The oil tank for the DG sets (if not in the base of the DG) shall be provided with a dyked enclosure having a volumetric capacity of at least 10 percent more than the volume of the oil tank. The enclosure shall be filled with sand for a height of 300 mm.

For detailed information regarding fire safety requirements for hazardous petroleum products, reference may be made to *The Petroleum Act*, 1934 and the Rules framed thereunder.

3.4.6.5 *Lightning protection of buildings*

Routing of down conductors (insulated or uninsulated) of lightning protection through electrical or other service shafts are not allowed as it can create fire and explosion during lightning. For details, *see* Part 8 'Building Services, Section 2 Electrical and Allied Installations' of the Code.

3.4.7 *Escape Lighting and Exit Signage*

Exit access, exits and exit discharge shall be properly identified, with adequate lighting maintained in the elements of the egress systems so that all occupants shall be able to leave the facility safely.

3.4.7.1 *Lighting*

a) The exit, exit access and exit discharge systems shall be illuminated continuously. The floors of the means of egress shall be illuminated at all points, including angles and intersections, in corridors and passageways, stairwells, landings of stairwells and exit.

b) Emergency lighting shall be powered from a source independent of that supplying the normal lighting.

c) Escape lighting shall be capable of,
   1) indicating clearly and unambiguously the escape routes;
   2) providing adequate illumination along such routes to allow safe movement of persons towards and through the exits; and
   3) ensuring that fire alarm call points and firefighting equipment provided along the escape routes can be readily located.

d) The horizontal luminance at floor level on the centreline of an escape route shall not be less than 10 lumen/m^2. In addition, for escape routes up to 2 m wide, 50 percent of the route width shall be lit to a minimum of 5 lumen/m^2. In auditoriums, theatres, concert halls and such other places of assembly, the illumination of floor exit/access may be reduced during period of performances to values not less than 2 lux.

e) Required illumination shall be arranged such that the failure of any single lighting unit, such as the burning out of one luminaire, will not leave any area in darkness and does not impede the functioning of the system further.

f) The emergency lighting shall be provided to be put on within 5 s of the failure of the normal lighting supply. Also, emergency lighting shall be able to maintain the required illumination level for a period of not less than 90 min in the event of failure of the normal lighting even for smaller premises.

g) Battery pack emergency lighting, because of its limited duration and reliability, shall not be allowed to be used in lieu of a diesel engine driven emergency power supply.

h) Escape lighting luminaires should be sited to cover the following locations:
   1) Near each intersection of corridors,
   2) At exits and at each exit door,
   3) Near each change of direction in the escape route,
   4) Near each staircase so that each flight of stairs receives direct light,
   5) Near any other change of floor level,
   6) Outside each final exit and close to it,
   7) Near each fire alarm call point,
   8) Near firefighting equipment, and
   9) To illuminate exit and safety signs as required by the enforcing authority.

   NOTE — For the purpose of this clause 'near' is normally considered to be within 2 m measured horizontally.

j) The luminaires shall be mounted as low as possible, but at least 2 m above the floor level.

k) Signs are required at all exits, emergency exits and escape routes, which should comply with the graphic requirements of the relevant Indian Standards.

3.4.7.2 Exit passageway (at ground) and staircase lighting shall also be connected to alternative supply. The alternative source of supply may be provided by battery continuously trickle charged from the electric mains.

3.4.7.3 Suitable arrangements shall be made by installing double throw switches to ensure that the lighting installed in the staircase and the corridor does not get connected to two sources of supply simultaneously. Double throw switch shall be installed in the service room for terminating the stand-by supply.

The emergency lighting system shall be well maintained by periodical inspections and tests so as to ensure their perfect serviceability at all times.

3.4.7.4 *Exit signage*

Where exit access is provided through corridors/paths, the occupants shall be able to easily identify the way to exits. Exit signs shall be provided such that no point in an exit access is more than 30 m from a visible exit directional sign. An exit sign indicating the direction to an exit shall be provided at all changes in direction.

Exits shall be clearly visible and the route to reach the exits shall be clearly marked and signs posted to guide the occupants of the floor concerned. Signs shall be illuminated and wired to an independent electrical circuit on an alternative source of supply. The sizes and colours of the exit signs shall be in accordance with good practice [4(7)]. The colour of the exit signs shall be green.

NOTE — This provision shall not apply to A-2 and A-4 occupancies less than 15 m in height.

The exit sign with arrow indicating the way to the escape route shall be provided at a suitable height from the floor level on the wall and shall be illuminated by electric light connected to corridor circuits. All exit way marking signs should be so installed that no mechanical damage shall occur to them due to moving of furniture or other heavy equipment. Further, all landings of floor shall have floor indicating boards prominently indicating the number of the floor.

Photo luminescent markings shall be pasted at internal hydrant boxes.

3.4.8 *Air Conditioning, Ventilation and Smoke Control*

3.4.8.1 Air conditioning and mechanical ventilation requirements of different rooms or areas in any occupancy shall be as given in Part 8 'Building Services, Section 1 Lighting and Natural Ventilation' and 'Section 3 Air conditioning, Heating and Mechanical Ventilation' of the Code.

Air conditioning and ventilating systems shall be so installed and maintained as to minimise the danger of spread of fire, smoke or fumes from one floor to other or from outside to any occupied building or structure.

Many high-rise buildings integrate smoke management systems into their conventional HVAC systems. In such installation, it requires special design considerations, including safe and adequate controls, acceptable and documented testing and regular maintenance systems.

Wherever batteries are provided, the same shall be segregated by 120 min fire rated construction. Ventilation to the room shall be provided as per manufacturer's instructions.

3.4.8.2 *Air handling unit*

3.4.8.2.1 From fire safety point of view, separate air handling units (AHU) for each floor shall be provided so as to avoid the hazards arising from spread of fire and smoke through the air conditioning ducts. The air ducts shall be separate from each AHU to its floor and in no way shall interconnect with the duct of any other floor. Within a floor it would be desirable to have separate air handling unit provided for each compartment.

Air handling unit shall be provided with effective means for preventing circulation of smoke through the system in the case of a fire in air filters or from other sources drawn into the system, and shall have smoke sensitive devices for actuation in accordance with the accepted standard [4(8)] and control.

3.4.8.2.2 Shafts or ducts, if penetrating multiple floors, shall be of masonry construction with fire damper in connecting ductwork or shall have fire rated ductwork with fire dampers at floor crossing. Alternatively, the duct and equipment may be installed in room having walls, doors and fire damper in duct exiting/entering the room of 120 min fire resistance rating. Such shafts and ducts shall have all passive fire control meeting 120 min fire resistance rating requirement to meet the objective of isolation of the floor from spread of fire to upper and lower floors through shaft/duct work.

NOTE — Zoned and compartmented HVAC systems are encouraged with an approach to avoid common exhaust shafts and fresh air intake shafts which will limit the requirement of such passive measure and fire rated duct work and dampers.

3.4.8.2.3 The air filters of the air handling units shall be made of non-combustible materials.

3.4.8.2.4 The air handling unit room shall not be used for storage of any combustible materials.

3.4.8.3 *Duct work*

3.4.8.3.1 Air ducts serving main floor areas, corridors, etc, shall not pass through the exits/exit passageway/ exit enclosure. Exits and lift lobbies, etc, shall not be used as return air passage.

3.4.8.3.2 As far as possible, metallic ducts shall be used even for the return air instead of space above the false ceiling.

3.4.8.3.3 Wherever the ducts pass through fire walls or floors, the opening around the ducts shall be sealed

with materials having fire resistance rating of the compartment. Such duct shall also be provided with fire dampers at all fire walls and floors unless such ducts are required to perform for fire safety operation; and in such case fire damper may be avoided at fire wall and floor while integrity of the duct shall be maintained with 120 min fire resistance rating to allow the emergency operations for fire safety requirements.

3.4.8.3.4 The ducting within compartment would require minimum fire resistance rating of 30 min. Such ducting material in substantial gauge shall be in accordance with good practice [4(9)]. If such duct crosses adjacent compartment/floor and not having fire dampers in such compartment/floor, it would require fire resistance duct work rating of 120 min. The requirements of support of the duct shall meet its functional time requirement as above.

3.4.8.3.5 The materials used for insulating the duct system (inside or outside) shall be of non-combustible type. Any such insulating material shall not be wrapped or secured by any material of combustible nature.

3.4.8.3.6 Inspection panels shall be provided in the ductwork to facilitate the cleaning accumulated dust in ducts and to obtain access for maintenance of fire dampers.

3.4.8.4 *Fire or fire/smoke dampers*

3.4.8.4.1 These dampers shall be evaluated to be located in supply air ducts, fresh air and return air ducts/ passages at the following points:

a) At the fire separation wall,
b) Where ducts/passages enter the vertical shaft,
c) Where the ducts pass through floors, and
d) At the inlet of supply air duct and the return air duct of each compartment on every floor.

3.4.8.4.2 Damper shall be of motorized type/fusible link. Damper shall be so installed to provide complete integrity of the compartment with all passive fire protection sealing. Damper should be accessible to maintain, test and also replace, if so required. Damper shall be integrated with Fire Alarm Panel and shall be sequenced to operate as per requirement and have interlocking arrangement for fire safety of the building. Manual operation facilities for damper operation shall also be provided.

3.4.9 *Heating*

3.4.9.1 Installation of chimney and heating apparatus shall be in accordance with good practice [4(10)].

3.4.9.2 *Boiler rooms*

3.4.9.2.1 Provisions of boiler and boiler rooms shall conform to *The Boilers Act,* 1923.

3.4.9.2.2 Further, the following additional aspects may be taken into account in the location of boiler room:

a) The boilers shall be installed in a fire resisting room of 180 min fire resistance rating.
b) Entry to this room shall be provided with a composite door of 120 min fire resistance rating.
c) The boiler room shall be provided with its dedicated natural or mechanical ventilation system. Mechanical ventilation system for the boiler room would be accepted with 120 min fire resistance rating ductwork, if it has interface with other mechanical areas. Ventilation system should not be allowed to be routed through electrical room area or through exit corridor/exits.
d) The oil tank for the boiler shall be provided with a dyked enclosure having a volumetric capacity of at least 10 percent more than the volume of the oil tank. The enclosure shall be filled with sand for a height of 300 mm.

3.4.10 *Glazing*

3.4.10.1 The glazing shall be in accordance with Part 6 'Structural Design, Section 8 Glass and Glazing' of the Code. The entire glazing assembly shall be rated to that type of construction as given in Table 1. This shall be applicable along with other provisions of this Part related to respective uses as specified therein. The use of glass shall not be permitted for enclosures of exits and exit passageway.

3.4.10.2 Glass facade shall be in accordance with the following:

a) For fully sprinklered buildings having fire separation of 9 m or more, tempered glass in a non-combustible assembly, with ability to hold the glass in place, shall be provided. It shall be ensured that sprinklers are located within 600 mm of the glass facade providing full coverage to the glass.

   NOTE — In case of all other buildings, fire resistance rating of glass facade shall be in accordance with Table 1.

b) All gaps between floor-slabs and facade assembly shall be sealed at all levels by approved fire resistant sealant material of equal fire rating as that of floor slab to prevent fire and smoke propagation from one floor to another.

c) Openable panels shall be provided on each floor and shall be spaced not more than 10 m apart measured along the external wall from centre-to-centre of the access openings. Such openings shall be operable at a height between 1.2 m and 1.5 m from the floor, and shall be in

the form of openable panels (fire access panels) of size not less than 1 000 mm × 1 000 mm opening outwards. The wordings, 'FIRE OPENABLE PANEL — OPEN IN CASE OF FIRE, DO NOT OBSTRUCT' of at least 25 mm letter height shall be marked on the internal side. Such panels shall be suitably distributed on each floor based on occupant concentration. These shall not be limited to cubicle areas and shall be also located in common areas/corridors to facilitate access by the building occupants and fire personnel for smoke exhaust in times of distress.

3.4.11 *Surface Interior Finishes*

3.4.11.1 The use of combustible surface finishes on walls (including facade of the building) and ceilings affects the safety of the occupants of a building. Such finishes tend to spread the fire and even though the structural elements may be adequately fire resistant, serious danger to life may result. It is, therefore, essential to have adequate precautions to minimise spread of flame on wall, facade of building and ceiling surfaces. The finishing materials used for various surfaces and decor shall be such that it shall not generate toxic smoke/fumes.

3.4.11.2 The susceptibility of various types of wall surfaces to fire is determined in terms of the rate of spread of flame. Based on the rate of spread of flame, surfacing material shall be considered as divided into four classes as follows {*see also* good practice [4(11)]}:

a) Class 1 Surfaces of very low flame spread.
b) Class 2 Surfaces of low flame spread.
c) Class 3 Surfaces of medium flame spread.
d) Class 4 Surfaces of rapid flame spread.

3.4.11.3 The uses for which surface materials falling into various classes shall be adopted in building construction are given below:

Class 1 (1)	*Class 2* (2)	*Class 3* (3)
May be used in any situation	May be used in any situation, except on walls, facade of the building, staircase and corridors	May be used only in living rooms and bed rooms (but not in rooms on the roof) and only as a lining to solid walls and partitions; not on staircases or corridors or facade of the building.

NOTE — Panelling (lining) shall be permitted in a limited area. It shall not be permitted in a vestibule.

3.4.11.4 Materials of Class 4 which include untreated wood fiberboards may be used with due fire retardant treatment as ceiling lining, provided the ceiling is at least, 2.4 m from the top surface of the floor below, and the wall surfaces conform to requirements of class [*see* Note *under* **3.4.11.3**]. Class 4 materials shall not be used in kitchens, corridors and staircases. Some materials contain bitumen and, in addition to risk from spread of fire, emit dense smoke on burning; such materials shall be excluded from use under these conditions and shall also not be used for construction of ceiling where the plenum is used for return air in air conditioned buildings.

3.4.11.5 When frames, walls, partitions or floors are lined with combustible materials, the surfaces on both sides of the materials shall conform to the appropriate class, because there is considerable danger from fire starting and rapidly spreading within the concealed cavity unknown to the occupants whose escape may be hampered thereby. For detailed information on materials and details of construction with their fire resistance rating, reference may be made to good practice [4(12)].

3.4.12 *Fire Command Centre (FCC)*

a) Fire command centre 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.
b) Fire command centre shall be constructed with 120 min rating walls with a fire door and shall be provided with emergency lighting. Interior finishes shall not use any flammable materials. All controls and monitoring of fire alarm systems, pressurization systems, smoke management systems shall happen from this room. Monitoring of integrated building management systems, CCTVs or any other critical parameters in building may also be from the same room.
c) Details of all floor plans along with the details of firefighting equipment and installations (2 sets laminated and bound) shall be maintained in fire command centre.
d) The fire staff in charge of the fire command centre shall be responsible for the maintenance of the various services and firefighting equipment and installations in coordination with security, electrical and civil staff of the building.

4 LIFE SAFETY

4.1 General

Every building shall be so designed, constructed, equipped, maintained and operated as to provide adequate means of egress to avoid undue danger to the life and safety of the occupants from fire, smoke, fumes or panic during the time period necessary for escape.

For high occupancy areas, it may be required to have annunciation, announcements and voice guided/aided system to direct the occupants towards safe egress routes, areas of comparative safety or exits, and to avoid situation of panic during distress.

Every main occupancy may have certain occupancies which may be incidental to the main occupancy. The exit requirements pertaining to such incidental occupancies from the floor of the occupancy to the level of exit discharge shall be calculated to meet the requirement of the actual occupancy of such type, to ensure adequate means of egress of the occupants.

See also **13** of Part 3 'Development Control Rules and General Building Requirements' of the Code for accessibility for elderly and persons with disabilities, for various requirements for enabling a smooth and safe egress.

4.2 General Exit Requirements

4.2.1 An exit may be a fire exit doorway; an internal staircase, exit passageway, external doorway, external staircase and these having access to the street or to a *Veranda* or to a refuge area or to the terrace or roof of a building. An exit may also include a horizontal exit leading to an adjoining building/fire compartment having its further access to unlocked/public exit at the same level.

4.2.2 Unless otherwise specified, lifts, escalators, moving walks and revolving doors shall not be considered as exits and shall not constitute any part of the required exit.

4.2.3 Every exit, exit passageway and exit discharge shall be continuously maintained free of all obstructions or impediments to full use in the case of fire or other emergency.

4.2.4 Every building having human occupancy shall be provided with exits sufficient to permit safe egress of occupants, in case of fire or other emergency.

4.2.5 In every building or structure, exits shall comply with the minimum requirements of this Part, except those not accessible for general public use.

4.2.6 No building shall be so altered as to reduce the number, width or protection of exits to less than that required.

4.2.7 For non-naturally ventilated areas, fire doors with 120 min fire resistance rating shall be provided and particularly at the entrance to lift lobby and stair well where a 'funnel or flue effect' may be created, inducing an upward spread of fire, to prevent spread of fire and smoke.

4.2.8 Exits shall be so arranged that they may be reached without passing through another occupied unit/passage in others control, if they pose challenge or restriction in means of egress.

4.2.9 Doors in exits shall open in the direction of exit. In case of assembly buildings (Group D) and institutional buildings (Group C-1), exit door shall not open immediately upon a flight of stair and all such entries to the stair shall be through a landing, so that such doors do not impede movement of people descending from a higher floor when fully opened (*see* Fig. 4A). While for other occupancies, such doors shall not reduce the pathway in the landing by more than half the width of such staircase (*see* Fig. 4B). Over-head or sliding doors shall not be installed.

4.2.10 At least half of the required exit stairs from upper floors (rounded to the next higher number) shall discharge directly to the exterior or through exit passageways.

4.2.11 Unless otherwise specified, all the exits and exit passageways to exit discharge shall have a clear ceiling height of at least 2.4 m. However, the height of exit door shall be at least 2.0 m (*see* Fig. 5).

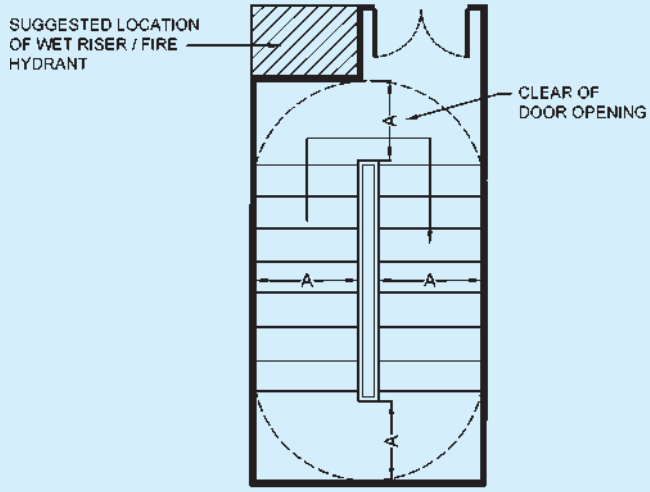
4.2.12 Where changes in elevation of more than 300 mm are encountered in the exits, ramps or sloped surfaces shall be used with handrails and floor finish materials that contrast with the adjacent finish materials.

4.2.13 The capacity of the means of egress required from any storey of the building shall not be reduced along the path of egress travel until arrival to the exit discharge.

4.2.14 The lifts, escalators, moving walks, turnstiles and revolving doors shall not be considered in determining the required capacity of means of egress for the individual floor(s) or the building.

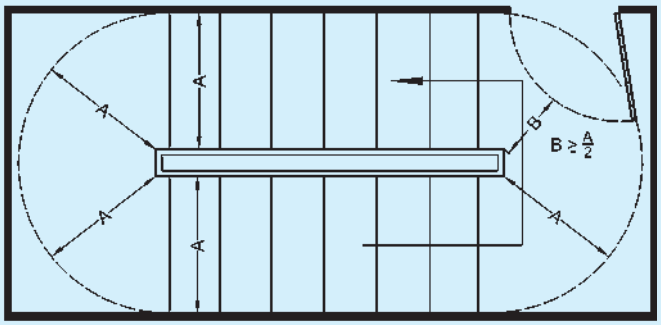
4.2.15 Turnstiles or similar devices that restrict travel to one direction or that are used to restrict unauthorized entry shall not be so placed as to obstruct any required means of egress. Alternative door openings of required exit width shall be available within 3 m of such devices, if installed.

4.2.16 Suitable means shall be provided so that all access controlled exit doors, turnstiles, boom barriers and other such exits shall automatically operate to open mode during emergencies like fire, smoke, acts of



NOTE — Door width shall be based on type of occupancy.

4A MINIMUM REQUIRED UNOBSTRUCTED CLEARANCE WITH DOOR LEAF ENCROACHING ON LANDING IN INSTITUTIONAL AND ASSEMBLY BUILDINGS



4B MINIMUM REQUIRED UNOBSTRUCTED CLEARANCE WITH DOOR LEAF ENCROACHING ON LANDING

FIG. 4 DOOR LOCATION AT LANDING IN FIRE EXITS

terrorism, etc, so that people can safely and quickly egress into safe areas outside. If required, a master controlling device may be installed at a strategic location to achieve this.

4.2.17 Penetrations into and openings through an exit are prohibited except those necessary like for the fire protection piping, ducts for pressurization and similar life safety services. Such openings as well as vertical passage of shaft through floors shall be protected by passive systems.

4.2.18 Walking surfaces in exit access shall comply with the following requirements for smooth exit:

a) Walking surfaces shall be nominally level.

b) The slope of walking surface in the direction of travel shall not exceed 1 in 20 unless the ramp requirements are met (*see* **4.4.2.4.3.5**).

c) Slope perpendicular to the direction of travel shall not exceed 1 in 48.

d) Walking surfaces shall be slip-resistant along the entire path of travel.

4.2.19 *Basement*

a) Basement exits shall be sufficient to provide for the capacity of the basement as determined in accordance with **4.4.2.1**. In no case shall there be less than two independent basement exits.

b) Basements having incidental occupancies to main occupancy shall be planned with exit requirements of the basements for the actual occupancy within the basement.

c) Where basement is used for car parking and also there is direct approach from any

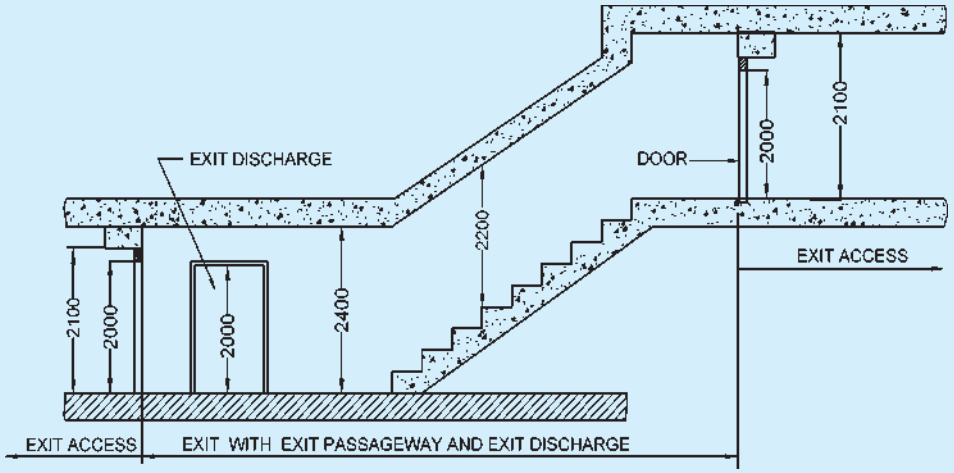


FIG. 5 MINIMUM HEAD ROOM MEASUREMENT

occupancy above to the basement, door openings leading to the basement shall need to be protected with fire doors with 120 min fire rating, except for exit discharge doors from the basements.

4.3 Occupant Load

For determining the exits required, the number of persons within any floor area or the occupant load shall be based on the actual number of occupants declared, but in no case less than that specified in Table 3. The occupant load of a mezzanine floor discharging to a floor below shall be added to that floor occupancy and the capacity of the exits shall be designed for the total occupancy load thus established.

The occupant load of each story considered individually

Table 3 Occupant Load
(*Clauses* 4.3 *and* 4.4.2.1)

Sl No.	Group of Occupancy	Occupant Load Factor (m^2/person) (*see* Note 1)
(1)	(2)	(3)
i)	Group A: Residential	12.50
ii)	Group B: Educational	4.00
iii)	Group C: Institutional (*see* Note 2):	
	a) Indoor patients area	15.00
	b) Outdoor patients area	10.0
iv)	Group D: Assembly:	
	a) Concentrated use without fixed seating	0.65
	b) Less concentrated use without fixed seating (*see* Note 3)	1.40
	c) Fixed seating	*see* Note 4
	d) Dining areas and restaurants with seating and table	1.80
v)	Group F: Mercantile:	
	a) Street floor and sales basement	3.00
	b) Upper sales floor	6.00
	c) Storage/warehouse, receiving and the like	20.00
vi)	Group E: Business	10.00
vii)	Group G: Industrial	10.00
viii)	Group H: Storage (*see* Note 5)	30.00
ix)	Group J: Hazardous	10.00

NOTES

1 Gross area shall be the floor area as defined in **2.35.** All factors expressed are in gross area unless marked net.

2 Occupant load in dormitory portions of homes for the aged, orphanages, insane asylums, etc, where sleeping accommodation is provided, shall be calculated at not less than 7.5 m^2 gross floor area/person.

3 These shall include gymnasium, table tennis room, billiard room and other gaming rooms, library, swimming pool and like.

4 In case of assembly occupancy having fixed seats, the occupant load shall be determined by multiplying the number of seats by 1.2.

5 Car parking areas under occupancy other than storage shall also be 30 m^2 per person.

shall be required to be used in computing the number of means of egress at each story, provided that the required number of means of egress is not decreased in the direction of egress travel.

The assembly occupancies and call centres shall be required to display, limiting occupant load details positioned in a conspicuous place near the entrance of each of such respective occupancy to avoid possible overcrowding and overloading. The display shall preferably be engraved on a metal plate of not less than 300 mm × 200 mm, with letters of height and width not less than 50 mm, with detail of occupancy, area and occupancy load (*see* figure below).

The capacity of any open mezzanine/balcony shall be added to the capacity of the floor below for the purpose of determining exit capacity.

MAXIMUM OCCUPANCY

____ PERSONS PERMITTED WITHIN THIS SPACE/ROOM

IT IS CONFIRMED THAT THE FIRE EXITS ARE PLANNED FOR EGRESS OF THE OCCUPANCY AS MENTIONED ABOVE AND OCCUPANCY MORE THAN THE ABOVE IS NOT PERMITTED IN THE SPACE/ROOM AS FOLLOWS:

SPACE/ROOM DETAIL: _____

FLOOR NO. _____

SIGN: _____ DATE: _____

(MANAGER/AUTHORIZED SIGNATORY)

4.4 Egress Components

Egress components to be considered are the number of exits to which access is provided, capacity of exit access, travel distance to an exit, the obviousness of the direction to an exit, and any hindrance including due to security issues involved.

4.4.1 *Exit Access*

a) A common path of travel is desirable in exit access which leads to two independent directions to separate exits.

b) *Capacity of exit access* — The width of corridors, aisles or ramps required for exit access shall be sufficient to ensure a smooth flow of occupants to the exit. Where a corridor is the only way of access to an exit, the corridor width shall not be less than the calculated exit width.

c) Objects like tables, chairs or any other temporary/permanent structures in exit access corridors shall be avoided as this may result in congestion and also impeding smooth flow of personnel during emergencies.

d) In order to ensure that each element of the means of egress can be effectively utilized, they shall all be properly lit and marked. Lighting shall be provided with emergency power back-up in case of power failures. Also, exit signs of adequate size, marking, location, and lighting shall be provided so that all those unfamiliar with the location of the exits may safely find their way.

e) Exit access to fireman's lift and refuge area on the floor shall be step free and clearly signposted with the international symbol of accessibility.

f) Exit access shall not pass through storage rooms, closets or spaces used for similar purpose.

g) The calculation of capacity of exit access shall be in accordance with **4.4.2.4**.

4.4.2 *Exits*

4.4.2.1 *Number of exits*

The minimum required number of exits in a building shall be determined based on occupant load (*see* Table 3) and width required per person (*see* Table 4) as appropriate to the type of exit for respective occupancies, subject to complying with maximum travel distance requirement (*see* Table 5).

4.4.2.2 *Arrangement of exits*

a) Exits shall be so located that the travel distance on the floor shall not exceed the distance given in Table 5.

b) Travel distance shall be measured from the most remote point within a storey or a mezzanine floor along the natural and un-obstructed path of horizontal or vertical egress travel to the door to an exit.

c) The dead end corridor length in exit access shall not exceed 6 m for educational, institutional and assembly occupancies. For other occupancies, the same shall be 15 m (*see* Fig. 6)

d) Exits shall be placed as remote from each other as possible and shall be arranged to provide direct access in separate directions from any point in the area served.

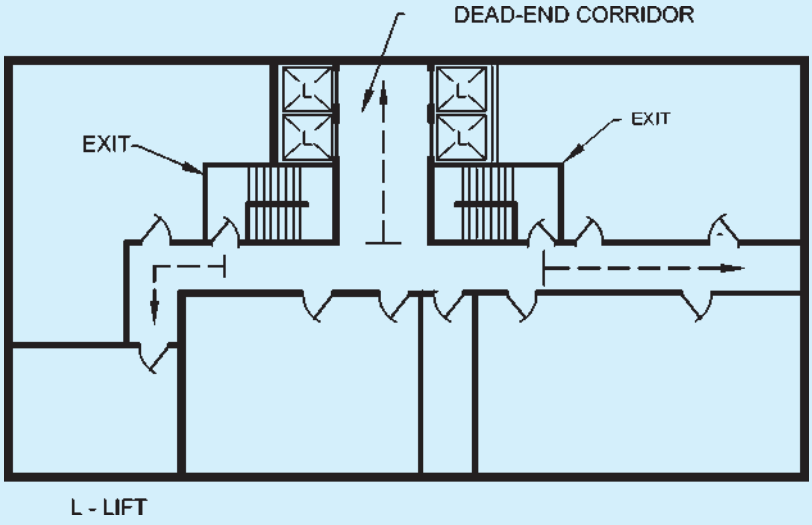


FIG. 6 DEAD END CORRIDOR

4.4.2.3 *Capacities of means of egress*

a) Exit capacity is the number of people that can pass through a stairway, and level components (door and corridor) and ramps. The total capacity of all the respective means of egress serving a floor shall be sufficient to allow egress of the entire population of the floor.

b) The unit of exit width, used to measure the capacity of any exit, shall be 500 mm. A clear width of 250 mm shall be counted as an additional half unit. Clear widths less than 250 mm shall not be counted for exit width.

c) Width per person for stairways, and level components and ramps shall be determined using the capacity factors in accordance with Table 4.

Table 4 Capacity Factors
[*Clauses* 4.4.2.1, 4.4.2.3(c) *and* 4.4.2.4.2(a)]

Sl No.	Occupancy Group		Width per Person mm	
			Stairways	Level Components and Ramps
(1)	(2)		(3)	(4)
i)	Residential	(Group A)	10	6.5
ii)	Educational	(Group B)		
iii)	Institutional	(Group C)	15	13
iv)	Assembly	(Group D)	10	6.5
v)	Business	(Group E)		
vi)	Mercantile	(Group F)		
vii)	Industrial	(Group G)		
viii)	Storage	(Group H)		
ix)	Hazardous	(Group J)	18	10

For example, if an exit doorway measures 1 000 mm in clear width, it would be defined as providing exit capacity for 1 000/6.5 occupants, that is, 153 persons (say 150 persons) and number of such exit doorways can then be calculated depending on the occupant load.

d) When calculating stairways, level components and ramps and other exit means, the capacity of the entire system shall have to be based upon the minimum capacity available from any part of the system. The corridor, if so provided shall also to be planned with consideration of exit access adequacy for the number of occupants. Further, consider the situation of doors opening to an exit stairway. If the stairway provides an exit capacity of 150 persons, and the doors leading into the stairway provide an exit capacity of 153 persons, the overall exit system would be considered to provide the minimum exit capacity of only 150 persons afforded by the stairway. The exit planning will be limited by the most restrictive exit calculation under the means of egress.

e) In the procedures for determining required egress capacity, the number of required means of egress is based on a floor-by-floor consideration, rather than the accumulation of the occupant loads of all the floors. However, the number of means of egress cannot decrease as an occupant proceeds along the egress path.

4.4.2.4 *Types of exit access and exits*

Various types of exit access and exits are doorways, corridors and passageways, horizontal exits, internal

Table 5 Travel Distance (Based on Occupancy and Construction Type)
(*Clauses* 4.4.2.1 *and* 4.4.2.2)

Sl No.	Occupancy Group	Maximum Travel Distance m	
		Types 1 and 2	Types 3 and 4
(1)	(2)	(3)	(4)
i)	Residential (Group A)	30.00	22.50
ii)	Educational (Group B)	30.00	22.50
iii)	Institutional (Group C)	30.00	22.50
iv)	Assembly (Group D)	30.00	30.00
v)	Business (Group E)	30.00	30.00
vi)	Mercantile (Group F)	30.00	30.00
vii)	Industrial (Group G)		
	G-1, G-2	45.00	
	G-3	22.50	*See* Note 3
viii)	Storage (Group H)	30.00	
ix)	Hazardous (Group J)	22.50	

NOTES

1 For fully sprinklered building, the travel distance may be increased by 50 percent of the values specified.

2 Ramp shall not be counted as an exit in case of basements below the first basement in car parking.

3 Construction of Type 3 or Type 4 is not permitted.

staircases, exit passageways, external staircases and ramps.

Requirements for each are as detailed below.

4.4.2.4.1 *Doorways*

a) Every exit doorway shall open into an enclosed stairway or a horizontal exit of a corridor or passageway providing continuous and protected means of egress (*see* Fig. 7 on unaccepted arrangement of doors in a stair).

b) No exit doorway shall be less than 1 000 mm in width except assembly buildings, where door width shall be not less than 2 000 mm (*see* Fig. 8). Doorways shall be not less than 2 000 mm in height.

c) Exit doorways shall be operable from the side which they serve, without the use of a key.

d) Mirrors shall not be placed on exit doors and in exits to avoid confusion regarding the direction of exit.

e) Revolving doors can be accepted as a component in a means of egress where the following requirements are fully complied with:

1) Doors shall be capable of collapsing to a book fold position with parallel egress paths, of width not less than 1 000 mm.

2) Doors shall not be located within 3 m of the foot or top of stairs or escalators. A dispersal area shall be provided between the stairs or escalators and the doors.

3) Each revolving door shall be provided with a hinged door in the same wall within 3 m thereof, with same exiting capacity.

4) Each revolving door shall be considered as capable of exiting only 50 persons.

f) All fire rated doors and assembly shall be provided with certificate and labels prominently indicating the manufacturer's identification, door details covering door type, serial/batch number, month and year of manufacture, fire resistance rating, etc. The doors and assembly shall be certified with all prescribed hardware such as hinges, locks, panic bars, door closer, and door viewers.

g) *Access controlled doors* — Access controlled doors and electromagnetic doors shall fall under this category. These shall meet the following requirements:

1) Doors shall have fire rating as per the requirements at the location of installation.

2) Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the doors in the direction of egress, and the doors shall remain unlocked until the automatic sprinkler system or fire-alarm system has been manually reset.

3) Loss of power to the part of the access control system that locks the doors shall automatically unlock the doors in the direction of egress.

4) A manual release device shall be provided in the readily accessible vicinity of the egress door with a signage 'PUSH TO EXIT' and when the same is operated, it shall result in direct interruption of power to the lock, independent of the access control system electronics.

h) *Turnstiles* — Turnstiles or similar devices that restrict travel to one direction or are used to collect fares or admission charges shall not be placed so as to obstruct any required means of egress unless door openings of required width are available within 3 m thereof.

Turnstiles or such similar devices shall also be disengaged through automatic or manual intervention to allow egress in the direction of exit.

j) Doors in folding partition shall not be treated as approved means of egress.

4.4.2.4.2 *Corridors and passageways of means of egress*

a) Corridors and passageways shall be of width not less than the calculated aggregate width

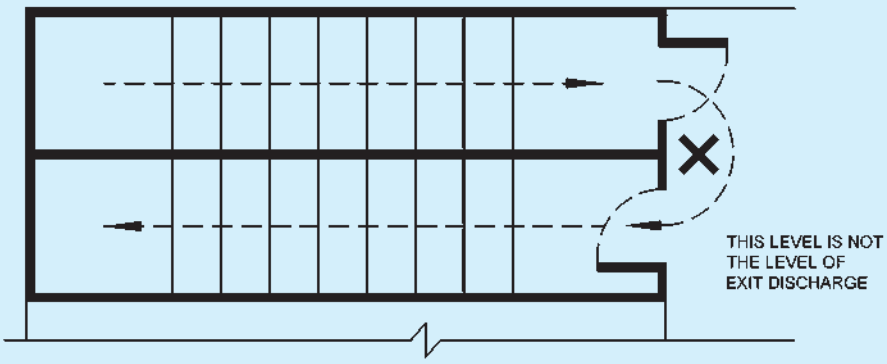


FIG. 7 UNACCEPTABLE ARRANGEMENT FOR ENCLOSING A STAIR SERVING AS A REQUIRED EXIT

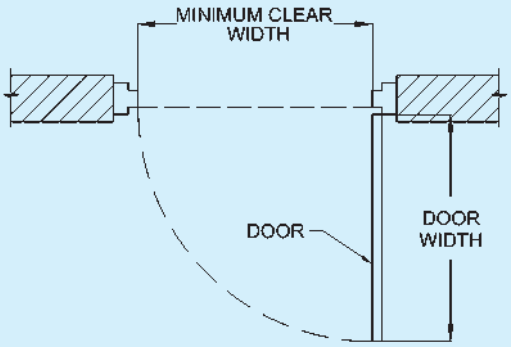


FIG. 8 MINIMUM CLEAR DOOR WIDTH

of exit doorways leading from them in the direction of travel to the exit (*see* Table 4 and Table 5).

b) In the case of buildings where there is a central corridor, which is part of exit access, the doors of rooms (except for rooms having assembly occupancy) shall open inwards to permit smooth flow of traffic in the corridor.

4.4.2.4.3 *Staircases*

4.4.2.4.3.1 *General*

The requirements of number of staircases shall supplement the requirement of different occupancies in **6.1** to **6.9**.

All buildings, as mentioned in **1.2**, shall have a minimum of two staircases. The actual number of staircases shall comply with the requirement of **4.4.2.1**.

All exit staircases shall discharge, at the level of exit discharge, to the exit discharge, either,

a) directly, or
b) through an exit passageway, or
c) through a large lobby.

At least 50 percent of the staircases shall discharge as per (a) and/or (b) above.

The minimum width of tread without nosing shall be 250 mm for staircase of residential buildings. This shall be minimum 300 mm for assembly, hotels, educational, institutional, business and other buildings. The treads shall be constructed and maintained in a manner to prevent slipping. The maximum height of riser shall be 190 mm for staircase of residential buildings (A-2) and 150 mm for other buildings. The number of risers shall be limited to 12 per flight.

The staircases may be internal staircases or external staircases.

4.4.2.4.3.2 *Internal staircases*

The internal staircases may be constructed with an external wall, or otherwise, and shall comply with the following:

a) Internal stairs shall be constructed of non-combustible materials throughout, and shall have fire resistant rating of minimum 120 min.
b) A staircase shall not be arranged round a lift shaft.
c) Exits shall not be used as a portion of a supply, return or exhaust air system serving adjoining areas. Any opening(s) shall not be permitted in walls or in doors, separating exits from adjoining areas.
d) No flue chimney, electromechanical equipment, air conditioning units, gas piping or electrical panels shall be allowed in the stairway.
e) Notwithstanding the detailed provision for exits in accordance with **4.2** and **4.3**, the following minimum width shall be provided for staircases for respective occupancies:

1)	Residential (A-2)	:	1.00 m
	NOTE — For row housing with 2 storeys, the minimum width shall be 0.75 m.		
2)	Residential (A-1, A-3 and A-4)	:	1.25 m

3) Residential hotel (A-5 and A-6) : 1.50 m
4) Assembly : 2.00 m

NOTE — The width of stairs may be accepted to be 1.50 m in case of assembly occupancy having less than 150 persons.

5) Educational : 1.50 m
6) Institutional : 2.00 m
7) All other occupancies : 1.50 m

f) A handrail shall be provided on one side of the staircase of width less than 1 500 mm, and on both sides of the staircase of width 1 500 mm and more. The projection of handrail(s) in the staircase width shall not be more than 115 mm. All other requirements of handrail shall be in accordance with Part 3 'Development Control Rules and General Building Requirements' of the Code.

g) Handrails may project inside the measured width by not more than 90 mm.

h) The design of staircase shall also take into account the following:
   1) The minimum headroom in a passage under the landing of a staircase and under the staircase shall be 2.2 m
   2) Access to exit staircase shall be through a fire door of a minimum 120 min fire resistance rating.
   3) No living space, store or other fire risk shall open directly into staircases.
   4) The exit (including staircases) shall be continuous from refuge floors or terrace level, as applicable, to the level of exit discharge.
   5) No electrical shafts/air conditioning ducts or gas pipes, etc, shall pass through or open in the staircases.
   6) Lifts shall not open in staircase.
   7) No combustible material shall be used for decoration/wall panelling in the staircase.
   8) Beams/columns and other building features shall not reduce the head room/ width of the staircase.
   9) The floor indication board, indicating the location/designated number of staircase, respective floor number and direction to exit discharge shall be placed inside the staircase, on the wall nearest to the fire door. It shall be of size not less than 300 mm × 200 mm (*see* Fig. 9).
   10) Individual floors shall be prominently indicated on the wall outside the staircase and facing it.
   11) All staircase shall terminate at the level of exit discharge. The access to the basement shall be by a separate staircase.
   12) Scissors type staircases shall not be treated as part of exit.

4.4.2.4.3.3 *Curved stairs*

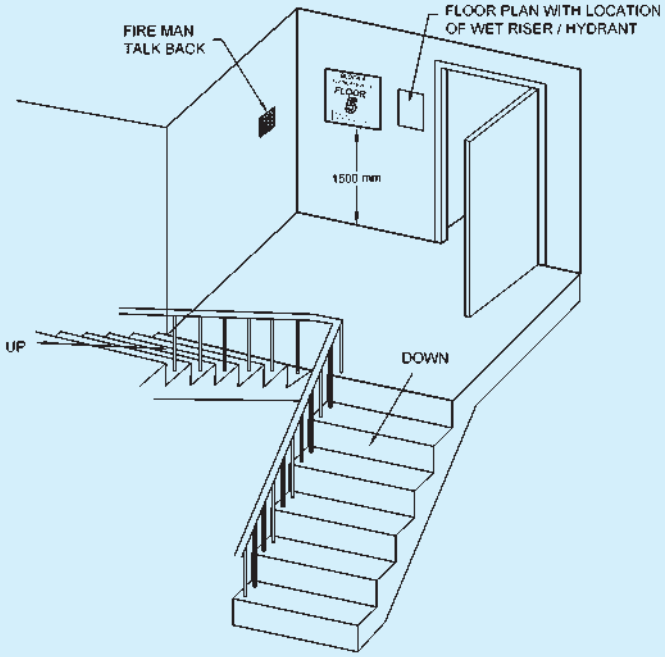
Curved stairs shall not be treated as part means of egress. However, these may be used as part of exit access provided the depth of tread is not less than 280 mm at a point 350 mm from the narrower end of the tread and the smallest radius is not less than twice the stair width.

4.4.2.4.3.4 *External staircases*

The external staircases are the staircases provided on the external wall/facade, and shall comply with the following:

a) External stairs shall always be kept in sound and usable condition.
b) All external stairs shall be directly connected to the ground.
c) Entrance to the external stairs shall be separate and remote from the internal staircase.
d) Where an external staircase is provided, it shall be ensured that the use of it at the time of fire is not prejudiced by smoke and flame from openings (for example, windows, doors) in the external face of the building. Care shall be taken to ensure that no external wall or window opening opens on to or close to an external stair. If such openings exists within 3 m from an external staircase, they shall be protected with fire rated doors/window assemblies with rating of at least 60 min (*see* Fig. 10).
e) The external stairs shall be constructed of non-combustible materials, and any doorway leading to it shall have minimum 120 min fire resistance.
f) No external staircase, shall be inclined at an angle greater than 45° from the horizontal.
g) External stairs shall have straight flight not less than 1 500 mm wide.
h) Handrails, to be provided on both sides, shall be of a height not less than 1 000 mm and not exceeding 1 200 mm. There shall be provisions of balusters with maximum gap of 150 mm.
j) The use of spiral staircase shall be limited to low occupant load and to a building not exceeding 9 m in height. A spiral staircase shall be not less than 1 500 mm in diameter and shall be designed to give adequate headroom.

9A EXAMPLE OF A STAIRWAY MARKING SIGN
[FLOOR INDICATION BOARD]



9B STAIR SIGN PLACEMENT

NOTE — Block/Wing/Building name are to be project specific. Staircase shown as '3' is intending to show the number assigned to the staircase. All exits preferably to be assigned with number/identification enabling occupants/fire man to declare location/position.

FIG. 9 SIGN MARKING AND REQUIREMENT IN EXIT

4.4.2.4.3.5 *Ramps*

a) Ramps shall comply with all the applicable requirements for staircases regarding enclosure, capacity (*see also* Table 4) and limiting dimensions, except where specified in **6.1** to **6.9** for special uses and occupancies.

b) The slope of a ramp shall not exceed 1 in 12 (8 percent).

c) Ramp(s) shall be surfaced with approved slip resistant materials that are securely attached. No perforations are permissible on ramp floors.

d) Any changes in travel direction in ramp shall be preceded by landings of 1.5 m × 1.5 m size.

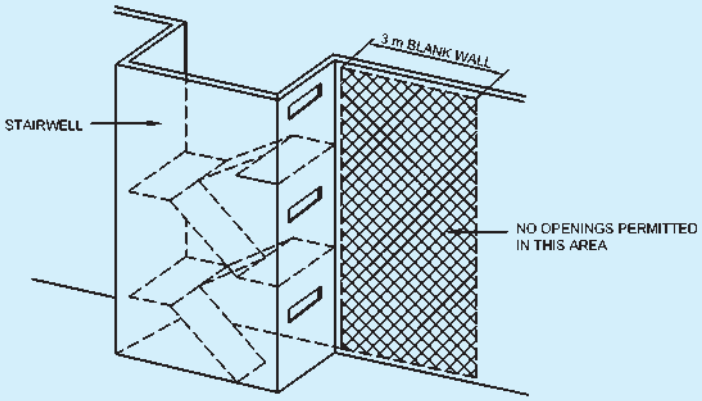
e) Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.

f) Outside ramps and landings shall be designed to minimise water accumulation on their surfaces.

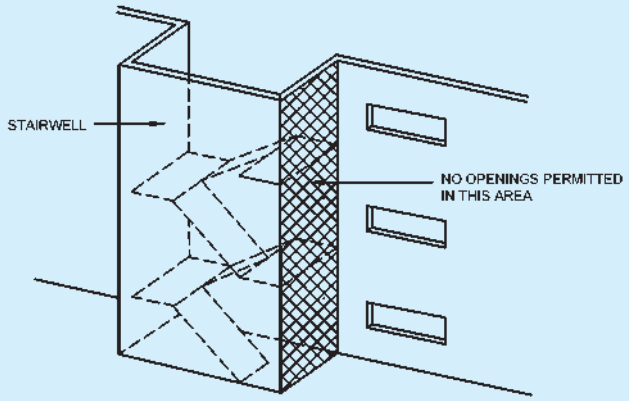
g) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp.

h) Every landing shall be not less than 1 500 mm long in the direction of travel.

j) Where the ramp is not part of an accessible route, the ramp landings shall not be required to exceed 1 250 mm in the direction of travel, provided that the ramp has a straight run.



10A LIMITATIONS OF OPENINGS NEAR STAIRWELL



10B OPENING RESTRICTIONS ON STAIRWELL WALLS

FIG. 10 OPENING RESTRICTIONS

k) Handrails shall be provided on all ramps on both sides (*see* **4.4.2.4.3.4**).

NOTE — Above requirements are not applicable to basement car parking ramps

The ramps shall, in addition, comply with the requirements given in **13** of Part 3 'Development Control Rules and General Building Requirements' of the Code.

4.4.2.5 *Smoke control of exits*

a) In building design, compartmentation plays a vital part in limiting the spread of fire and smoke. The design should ensure avoidance of spread of smoke to adjacent spaces through the various leakage openings in the compartment enclosure, such as cracks, openings around pipes ducts, airflow grills and doors. In the absence of proper sealing of all these openings, smoke and toxic gases will obstruct the free movement of occupants of the building through the exits. Pressurization of staircases is of great importance for the exclusion of smoke and toxic gases from the protected exit.

b) Pressurization is a method adopted for protecting the exits from ingress of smoke, especially in high-rise buildings. In pressurization, air is injected into the staircases, lobbies, etc, as applicable, to raise their pressure slightly above the pressure in adjacent parts of the building. As a result, ingress of smoke or toxic gases into the exits will be prevented. The pressurization of staircases and lift lobbies shall be adopted as given in Table 6.

The pressure difference for staircases shall be 50 Pa.

Pressure differences for lobbies (or corridors) shall be between 25 Pa and 30 Pa. Further, the pressure differential for enclosed staircase adjacent to such lobby (or corridors) shall be 50 Pa. For enclosed staircases adjacent to non-pressurized lobby (or corridors), the pressure differential shall be 50 Pa.

Table 6 Pressurization of Staircases and Lift Lobbies
[*Clauses* 4.4.2.5 (b) *and* E-2]

Sl No.	Component	Height of Building		
		Less than 15 m	15 m to 30 m	More than 30 m
(1)	(2)	(3)	(4)	(5)
i)	Internal staircase not with external wall	Pressurized except for residential buildings (A-2 and A-4)	Pressurized	Pressurized
ii)	Internal staircase with external wall	Pressurized except for residential buildings (A-2 and A-4) or Naturally ventilated	Naturally ventilated or Pressurized	Cross-ventilated or Pressurized
iii)	Lift lobby	Not required at ground and above. However lift lobby segregation and pressurization is required for lift commuting from ground to basement	Naturally ventilated or Pressurized[1)]	Cross-ventilated or Pressurized[1)]

NOTES
1 The natural ventilation requirement of the staircase shall be, achieved through opening at each landing, of an area 0.5 m^2 in the external wall. A cross ventilated staircase shall have 2 such openings in opposite/adjacent walls or the same shall be cross-ventilated through the corridor.
2 Enclosed staircase leading to more than one basement shall be pressurized.

[1)] Lift lobby with fire doors (120 min) at all levels with pressurization of 25-30 Pa is required. However, if lift lobby cannot be provided at any of the levels in air conditioned buildings or in internal spaces where funnel/flue effect may be created, lift hoistway shall be pressurized at 50 Pa. For building greater than 30 m, multiple point injection air inlets to maintain desired pressurization level shall be provided. If the lift lobby, lift and staircase are part of firefighting shaft, lift lobby necessarily has to be pressurized in such case, unless naturally ventilated.

c) Equipment and ductwork for staircase pressurization shall be in accordance with one of the following:
   1) Directly connected to the stairway by ductwork enclosed in non-combustible construction.
   2) If ducts used to pressurize the system are passed through shafts and grills are provided at each level, it shall be ensured that hot gases and smoke from the building cannot ingress into the staircases under any circumstances.

d) The normal air conditioning system and the pressurization system shall be designed and interfaced to meet the requirements of emergency services. When the emergency pressurization is brought into action, the following changes in the normal air conditioning system shall be effected:
   1) Any re-circulation of air shall be stopped and all exhaust air vented to atmosphere.
   2) Any air supply to the spaces/areas other than exits shall be stopped.
   3) The exhaust system may be continued provided,
      i) the positions of the extraction grills permit a general air flow away from the means of egress;
      ii) the construction of the ductwork and fans is such that, it will not be rendered inoperable by hot gases and smoke; and
      iii) there is no danger of spread of smoke to other floors by the path of the extraction system which can be ensured by keeping the extraction fans running.

e) For pressurized stair enclosure systems, the activation of the systems shall be initiated by signalling from fire alarm panel.

f) Pressurization system shall be integrated and supervised with the automatic/manual fire alarm system for actuation.

g) Wherever pressurized staircase is to be connected to unpressurized area, the two areas shall be segregated by 120 min fire resistant wall.

h) Fresh air intake for pressurization shall be away (at least 4 m) from any of the exhaust outlets/grille.

4.5 Compartmentation

4.5.1 *General*

a) It is important to limit the spread of a fire in any building. The usual method is to use fire barriers. In some instances these barriers need to be penetrated for ductwork, plumbing and electrical systems, and in such cases, use of passive fire protection measures shall be done so that the integrity of these barriers is not compromised.

b) Floor(s) shall be compartmented with area as given below**.**

4.5.2 All floors shall be compartmented/zoned with area of each compartment being not more than 750 m^2. The maximum size of the compartment shall be as follows, in case of sprinklered basement/building:

Sl No.	*Use*	*Compartmentation Area* m^2
(1)	(2)	(3)
i)	Basement car parking	3 000
ii)	Basements (other than car parking)	2 000
iii)	Institutional buildings: Subdivision C-1	1 800
iv)	Institutional buildings: Subdivision C-2 and C-3	1 125
v)	Mercantile and assembly buildings	2 000
vi)	Business buildings	3 000
vii)	All other buildings (Excluding low hazard and moderate hazard industrial buildings and storage buildings)[1)]	750

[1)] Compartmentation for low hazard and moderate hazard industrial buildings and storage buildings shall be done in consultation with local fire department.

In addition, there shall be requirement of a minimum of two compartments if the floor plate size is equal or less than the areas mentioned above. However, such requirement of minimum two compartments shall not be required, if the floor plate is less than 750 m^2.

Compartmentation shall be achieved by means of fire barrier having fire resistance rating of 120 min.

4.6 Smoke Control

4.6.1 *Smoke Exhaust and Pressurization of Areas Above Ground*

Corridors in exit access (exit access corridor) are created for meeting the requirement of use, privacy and layout in various occupancies. These are most often noted in hospitality, health care occupancies and sleeping accommodations.

Exit access corridors of guest rooms and indoor patient department/areas having patients lacking self preservation and for sleeping accommodations such as apartments, custodial, penal and mental institutions, etc, shall be provided with 60 min fire resistant wall and 20 min self-closing fire doors along with all fire stop sealing of penetrations.

Smoke exhaust system having make-up air and exhaust air system or alternatively pressurization system with supply air system for these exit access corridors shall be required.

Smoke exhaust system having make-up air and exhaust air system shall also be required for theatres/auditoria.

Such smoke exhaust system shall also be required for large lobbies and which have exit through staircase leading to exit discharge. This would enable eased exit of people through smoke controlled area to exit discharge.

All exit passageway (from exit to exit discharge) shall be pressurized or naturally ventilated. The mechanical pressurization system shall be automatic in action with manual controls in addition. All such exit passageway shall be maintained with integrity for safe means of egress and evacuation. Doors provided in such exit passageway shall be fire rated doors of 120 min rating.

Smoke exhaust system where provided, for above areas and occupancies shall have a minimum of 12 air changes per hour smoke exhaust mechanism. Pressurization system where provided shall have a minimum pressure differential of 25-30 Pa in relationship to other areas.

The smoke exhaust fans in the mechanical ventilation system shall be fire rated, that is, 250°C for 120 min.

For naturally cross-ventilated corridors or corridors with operable windows, such smoke exhaust system or pressurization system will not be required.

4.6.2 *Smoke Exhaust and Pressurization of Areas Below Ground*

Each basement shall be separately ventilated. Vents with cross-sectional area (aggregate) not less than 2.5 percent of the floor area spread evenly round the perimeter of the basement shall be provided in the form of grills, or breakable stall board lights or pavement lights or by way of shafts.

Alternatively, a system of mechanical ventilation system may be provided with following requirements:

a) Mechanical ventilation system shall be designed to permit 12 air changes per hour in case of fire or distress call. However, for

normal operation, air changes schedule shall be as given in Part 8 'Building Services, Section 3 Air conditioning, Heating and Mechanical Ventilation' of the Code.

b) In multi-level basements, independent air intake and smoke exhaust shafts (masonry or reinforced concrete) for respective basement levels and compartments therein shall be planned with its make-up air and exhaust air fans located on the respective level and in the respective compartment. Alternatively, in multi-level basements, common intake masonry (or reinforced cement concrete) shaft may serve respective compartments aligned at all basement levels. Similarly, common smoke exhaust/outlet masonry (or reinforced cement concrete) shafts may also be planned to serve such compartments at all basement levels. All supply air and exhaust air fans on respective levels shall be installed in fire resisting room of 120 min. Exhaust fans at the respective levels shall be provided with back draft damper connection to the common smoke exhaust shaft ensuring complete isolation and compartmentation of floor isolation to eliminate spread of fire and smoke to the other compartments/floors.

c) Due consideration shall be taken for ensuring proper drainage of such shafts to avoid insanitation condition. Inlets and extracts may be terminated at ground level with stall board or pavement lights as before. Stall board and pavement lights should be in positions easily accessible to the fire brigade and clearly marked 'AIR INLET' or 'SMOKE OUTLET' with an indication of area served at or near the opening.

d) Smoke from any fire in the basement shall not obstruct any exit serving the ground and upper floors of the building.

e) The smoke exhaust fans in the mechanical ventilation system shall be fire rated, that is, 250°C for 120 min.

f) The smoke ventilation of the basement car parking areas shall be through provision of supply and exhaust air ducts duly installed with its supports and connected to supply air and exhaust fans. Alternatively, a system of impulse fans (jet fans) may be used for meeting the requirement of smoke ventilation complying with the following:

   1) Structural aspects of beams and other down stands/services shall be taken care of in the planning and provision of the jet fans.
   2) Fans shall be fire rated, that is, 250°C for 120 min.
   3) Fans shall be adequately supported to enable operations for the duration as above.
   4) Power supply panels for the fans shall be located in fire safe zone to ensure continuity of power supply.
   5) Power supply cabling shall meet circuit integrity requirement in accordance with accepted standard [4(13)].

The smoke extraction system shall operate on actuation of flow switch actuation of sprinkler system. In addition, a local and/or remote 'manual start-stop control/switch' shall be provided for operations by the fire fighters.

Visual indication of the operation status of the fans shall also be provided with the remote control.

No system relating to smoke ventilation shall be allowed to interface or cross the transformer area, electrical switchboard, electrical rooms or exits.

Smoke exhaust system having make-up air and exhaust air system for areas other than car parking shall be required for common areas and exit access corridor in basements/underground structures and shall be completely separate and independent of car parking areas and other mechanical areas.

Supply air shall not be less than 5 m from any exhaust discharge openings.

4.7 Gas Supply

4.7.1 *Town Gas/LPG Supply Pipes*

Where gas pipes are run in buildings, the same shall be run in separate shafts exclusively for this purpose and these shall be on external walls, away from the staircases. Gas distribution pipes shall always be below the false ceiling. The length of these pipes shall be as short as possible. In the case of kitchen cooking range area, hood should have grease filters using metallic grill to trap oil vapours escaping into the fume hood

NOTE — For detailed information on gas pipe installations, reference may be made to Part 9 'Plumbing Services, Section 4 Gas Supply' of the Code.

4.7.2 *Thermal detectors*

These shall be installed into fume hoods of large kitchens for hotels, hospitals, and similar areas located in high rise buildings. Arrangements shall be made for automatic tripping of the exhaust fan in case of fire. If gas is used, the same shall be shut off. The voltage shall be 24 V or 100 V d.c. operated with external rectifier. The valve shall be of the hand re-set type and shall be located in an area segregated from cooking ranges. Valves shall be easily accessible. The hood shall have manual facility for steam or suitable hood extinguishing gas released depending on duty condition.

4.7.3 Gas cylinders and manifold shall need to be housed in a detached location with no other occupancy within distances prescribed in good practice [4(14)] thereof. There shall be an enclosure suitably ventilated. It is desirable to provide medium velocity spray nozzles which can be operated by quick opening valve situated away from the enclosure.

4.7.4 In the case of gas cylinders, if manifold has to be installed on podium/close to podium, the same shall be away from any air intakes/smoke exhaust openings/ any windows.

4.7.5 Pressure regulating stations shall be designed and installed at critical locations for excess flow shut off valves. Seismic shut off valve at the main distribution point shall be installed for buildings in D-6 occupancy and institutional occupancy above 15 m.

4.7.6 Gas meters shall be housed in a suitably constructed metal cupboard located in a well-ventilated space, keeping in view the fact that LPG is heavier than air and town gas is lighter than air.

4.7.7 Wherever LPG reticulation/cylinders are used in buildings above 100 m, gas leak detectors shall be provided at the usage points and monitored from fire command centre. The cables used for signaling shall be circuit integrity cables.

4.7.8 The gas lines shall not be installed through any electrical shafts, escape routes, refuge areas/refuge floors.

4.7.9 Kitchens working on LPG fuel shall not be permitted in basements.

4.8 Hazardous Areas, Gaseous, Oil Storage Yard, etc

Rooms containing high pressure boilers, refrigerating machinery, transformers or other service equipment subject to possible explosion shall not be located directly under or adjacent to exits. All such rooms shall be effectively cut-off from other parts of the building and shall be provided with adequate vents to the outside air.

All rooms or areas of high hazard in additions to those hereinbefore mentioned, shall be segregated or shall be protected with fire resistant walls having fire rating of 120 min as fire, explosion or smoke therefrom is likely to interfere with safe egress from the building. Further,

a) each building shall be provided with an approved outside gas shut-off valve conspicuously marked. The detailed requirements regarding safe use of gas shall be as specified in Part 9 'Plumbing Services, Section 4 Gas Supply' of the Code; and

b) all exterior openings in a boiler room or rooms contain central heating equipment, if located below opening in another storey or if less than 3 m from other doors or windows of the same building shall be protected by a fire assembly as in **3.4.5**. Such assemblies shall be fixed, automatic or self-closing.

4.9 Fire Detection and Alarm

a) The requirements of fire detection and alarm systems are covered for each occupancy in Table 7 and under **6.1** to **6.9** for annunciation to occupants in view of the ensuing vulnerability and to warn occupants early of the existence of fire, so as to facilitate orderly and safe egress.

b) Fire detection and alarm systems in buildings shall be so planned and programmed so as to enable operations of various systems and equipment to facilitate requirements leading to life safety, compartmentation and fire protection. These systems and equipment may include electromechanical systems such as air handling units; pressurization systems; smoke management systems; creation of compartmentation through the release of fire barrier, hold-up fire doors, etc; and monitoring of fire water storage tanks and pumps, pressures in hydrant and sprinkler system, etc. These planning and requirements shall be based on building occupancy and other requirements on case to case basis.

c) Voice evacuation systems shall employ Hindi, English and vernacular language using pre-recorded messages and integrate with fire alarm panels for alerting the zone of fire and surrounding zones/floors as required for annunciation (*see also* Table 7 and its Note 1).

d) Appropriate visual warning arrangement through visual strobes/beacons may be considered in appropriate situations particularly in public buildings, at required locations to ensure visual as well as alarm for persons with hearing impairment.

e) For assembly buildings, institutional buildings and all buildings above 30 m in height where fire alarm system is provided in accordance to Table 7, detectors shall also be provided inside the electrical shafts, and lift machine rooms, etc, besides occupancy areas.

f) Fire alarm panels shall be connected in peer to peer network or with redundant cables, run in different shafts. Each panel shall be able to work in standalone mode and master slave architecture may be used where required.

g) The fire detection system shall be in accordance with accepted standards [4(15)].

Table 7 Minimum Requirements for Fire Fighting Installations

[*Clauses* 4.9(a), 4.9(c), 4.9(e), 5.1.1(a), 5.1.1(d), 5.1.2.1, 5.1.3(a), E-7, H-2(f) *and* Table 2]

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
RESIDENTIAL BUILDINGS (A)													
a)	**Lodging and Rooming Houses (A-1)** (*see* Note 3)												
1)	Less than 15 m in height												
	i) Up to 15 rooms	R	NR	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	5 000 (*see* Note 5)	NR	NR
	ii) More than 15 and up to 30 rooms	R	R	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	5 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
	iii) More than 30 rooms	R	R	NR	NR	NR	R (*see* Note 4)	R (*see* Note 7)	NR	NR	10 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
b)	**One or two Family Private Dwellings (A-2)** (*see* Note 3)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
c)	**Dormitories (A-3) and Apartment Houses (A-4)**												
1)	Less than 15 m in height	R	R	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	5 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2)	15 m and above but not exceeding 35 m in height	R	R	NR	R	NR	R (*see* Note 4)	R (*see* Note 8)	NR	NR	25 000	NR	900
3)	Above 35 m but not exceeding 45 m in height	R	R	R	NR	NR	R (*see* Note 4 and Note 9)	R	NR	75 000	5 000	(*see* Note 10)	NR
4)	Above 45 m in height but not exceeding 60 m in height	R	R	R	NR	R	R	R	NR	150 000	10 000	(*see* Note 11)	NR
5)	Above 60 m in height	R	R	R	NR	R	R	R	R	200 000	10 000	(*see* Note 12 & Note 13)	NR
d)	**Hotels (A-5)**												
1)	Less than 15 m in height												
	i) Floor area not exceeding 300 m^2 on any of the floor	R	R	NR	NR	NR	R (*see* Note 4)	R	NR	NR	5 000 (5000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
	ii) Floor area exceeding 300 m^2 but not more 1 000 m^2 on any of the floor	R	R	R (*see* Note 7)	NR	NR	R (*see* Note 4)	R	R	10 000 for every 500 m^2 floor area subject to minimum of 50 000 (*see* Note 7)	10 000 (5000) (*see* Note 6)	(*see* Note 14 in case of provision of wet riser)	450 (450) (*see* Note 6)
	iii) Floor area exceeding 1 000 m^2 on any of the floor	R	R	R (*see* Note 15)	NR	R	R	R (*see* Note 1)	R	100 000 (*see* Note 15)	10 000 (*see* Note 4)	(*see* Note 15 and Note 14)	NR

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2)	15 m and above but not exceeding 30 m	R	R	R	NR	R	R	R	R	150 000	20 000	(*see* Note 11)	NR
3)	Above 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
e)	**Hotels (A-6)**	R	R	R	NR	R	R	R	R	250 000	20 000	(*see* Note 12)	NR
EDUCATIONAL BUILDINGS (B) (*see* Note 16)													
1)	Less than 15 m in height												
	i) Ground plus one or more storeys	R	R	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	10 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
2)	15 m and above but not exceeding 24 m in height	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	25 000	NR	900
3)	Above 24 m but not exceeding 30 m in height	R	R	R	NR	R	R (*see* Note 4)	R	NR	50 000	(5 000) (*see* Note 6)	(*see* Note 14)	NR
INSTITUTIONAL BUILDINGS (C) (*see* Note 16)													
a)	**Hospitals, Sanatoria and Nursing Homes (C-1)**												
1)	Less than 15 m in height with plot area up to 1 000 m^2												
	i) Up to ground plus one storey, with no beds	R	NR	NR	NR	NR	R (*see* Note 4)	R	NR	NR	(5 000) (*see* Note 6)	NR	(450) (*see* Note 6)

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	ii) Up to ground plus one storey with beds	R	R	NR	NR	NR	R (*see* Note 4)	R	NR	NR	5 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
	iii) Ground plus two or more storeys, with no beds	R	R	NR	R	NR	R (*see* Note 4)	R	R	NR	10 000 (5 000) (*see* Note 6)	NR	900 (450) (*see* Note 6)
	iv) Ground plus two or more storeys, with beds	R	R	R	NR	NR	R	R (*see* Note 1)	R	75 000	10 000	(*see* Note 14)	NR
2)	Less than 15 m in height with plot area more than 1 000 m^2	R	R	R	NR	R	R	R (*see* Note 1)	R	1 00 000	10 000	(*see* Note 14)	NR
3)	15 m and above but not exceeding 24 m in height	R	R	R	NR	R	R	R	R	150 000	20 000	(*see* Note 10)	NR
4)	Above 24 m and not exceeding 45 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
b)	**Custodial (C-2), and Penal and Mental (C-3)**												
1)	Less than 10 m in height												
	i) Up to 300 persons	R	R	NR	NR	NR	R (*see* Note 4)	R	NR	NR	10 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
	ii) More than 300 persons	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	15 000 (5 000) (*see* Note 6)	NR	900 (450) (*see* Note 6)

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2)	10 m and above but not exceeding 15 m in height	R	R	R	NR	R	R (*see* Note 4)	R	R	100 000	5 000 (5 000) (*see* Note 6)	(*see* Note 10)	NR
3)	15 m and above but not exceeding 24 m in height	R	R	R	NR	R	R	R	R	150 000	10 000	(*see* Note 11)	NR
4)	24 m and above but not exceeding 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
ASSEMBLY BUILDINGS (D) (*see* Note 16)													
a)	**Buildings (D-1 to D-5)**												
1)	Less than 10 m in height												
	i) Up to 300 persons	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	20 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
	ii) More than 300 persons	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	25 000 (5 000) (*see* Note 6)	NR	900 (450) (*see* Note 6)
2)	Above 10 m but not exceeding 15 m in height	R	R	R	NR	NR	R (*see* Note 4)	R (*see* Note 1)	R	100 000	5 000 (5 000) (*see* Note 6)	(*see* Note 10)	450 (450) (*see* Note 6)
3)	Above 15 m but not exceeding 24 m in height	R	R	R	NR	R	R	R	R	150 000	10 000	(*see* Note 10)	NR
4)	Above 24 m but not exceeding 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
b)	D-6	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 12)	NR
c)	D-7	For details *see* 6.4.4											

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
BUSINESS BUILDINGS (E)													
1)	Less than 10 m in height	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	10 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
2)	Above 10 m but not exceeding 15 m in height	R	R	R	NR	NR	R (*see* Note 4)	R	R	50 000	5 000 (5 000) (*see* Note 6)	(*see* Note 14)	450 (450) (*see* Note 6)
3)	Above 15 m and up to 24 m in height	R	R	R	NR	R	R	R	R	100 000	10 000	(*see* Note 10)	NR
4)	Above 24 m and up to 30 m in height	R	R	R	NR	R	R	R	R	150 000	20 000	(*see* Note 11)	NR
5)	Above 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 12)	NR
MERCANTILE BUILDINGS (F)													
a)	F-1 and F-2 (*see* Note 16)												
1)	Less than 15 m in height												
	i) Ground plus one storey, with total of all floor area not exceeding 500 m^2	R	R	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	5 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	ii) Ground plus one storey and total of all floor area exceeding 500 m^2	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	20 000 (5 000) (*see* Note 6)	NR	900 (450) (*see* Note 6)
	iii) More than ground plus one storey	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	25 000 (5 000) (*see* Note 6)	NR	900 (450) (*see* Note 6)
2)	Above 15 m but not exceeding 24 m in height	R	R	R	NR	R	R	R	R	100 000	10 000	(*see* Note 10)	NR
3)	Above 24 m but not exceeding 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
b)	**Underground shopping complex (F-3)**	R	R	R	NR	R	R	R	R	150 000	10 000	(*see* Note 11)	NR
INDUSTRIAL BUILDINGS (G) (*see* Note 17)													
a)	**Low Hazard (G-1)** (*see* Note 18)												
	i) Covered area up to 100 m^2	R	NR	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	5 000 (*see* Note 5)	NR	450 (*see* Note 5)
	ii) Covered area more than 100 m^2 and up to 500 m^2	R	R	NR	R (*see* Note 8)	NR	R (*see* Note 4)	NR	NR	NR	20 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Extinguisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	iii) Covered area more than 500 m^2 (for building height up to 15 m)	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	20 000 (5000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
	iv) Covered area more than 500 m^2 (for building height above 15 m)	R	R	R	NR	R	R (*see* Note 4)	R	R	75 000	5 000 (*see* Note 6)	(*see* Note 14)	NR
b)	**Moderate Hazard (G-2)** (*see* Note 18)												
	i) Covered area up to 100 m^2	R	R	NR	NR	NR	R	NR	NR	NR	10 000	NR	450
	ii) Covered area more than 100 m^2 and up to 500 m^2	R	R	NR	NR	NR	R	NR	NR	NR	20 000	NR	900
	iii) Covered area more than 500 m^2 and up to 1000 m^2 (for height up to 15 m)	R	R	NR	R	NR	R	R	R	NR	50 000	NR	900
	iv) Covered area more than 500 m^2 and up to 1000 m^2 (for height above 15 m)	R	R	R	NR	R	R	R	R	100 000	10 000	(*see* Note 14)	NR
	v) Covered area more than 1000 m^2	R	R	R	NR	R	R	R	R	150 000	20 000	(*see* Note 11)	NR

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Extinguisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
c)	**High Hazard (G-3)** (*see* Note 19)												
	i) Covered area up to 50 m^2	R	R	NR	NR	NR	R	NR	NR	NR	10 000	NR	900
	ii) Covered area more than 50 m^2 and up to 150 m^2	R	R	NR	NR	NR	R	R	R	NR	25 000	NR	900
	iii) Covered area more than 150 m^2 and up to 300 m^2	R	R	R	NR	NR	R	R	R	50 000	10 000	(*see* Note 14)	NR
	iv) Covered area more than 300 m^2 and up to 500 m^2	R	R	R	NR	R	R	R	R	100 000	20 000	(*see* Note 10)	NR
	v) Covered area more than 500 m^2	R	R	R	NR	R	R	R	R	150 000	20 000	(*see* Note 11)	NR
STORAGE BUILDINGS (H) (*see* Note 20)													
1)	Below 15 m in height and covered area less than 250 m^2	R	R	NR	NR	NR	R	NR	NR	NR	25 000	NR	900
2)	Below 15 m in height and covered area more than 250 m^2												
	i) Ground floor only	R	R	R	NR	R	R	R	R	50 000	10 000	(*see* Note 14)	450
	ii) Ground plus one floor	R	R	R	NR	R	R	R	R	75 000	10 000	(*see* Note 10)	450

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	iii) More than ground plus one floor	R	R	R	NR	R	R	R	R	100 000	10 000	(*see* Note 10)	450
3)	Multi-Level Car Parking (MLCP)	R	R	R	NR	R	R	R	NR	150 000	10 000	(*see* Note 11)	900
HAZARDOUS BUILDINGS (J) (*see* Note 20)													
1)	Up to 15 m in height												
	i) Single Storey Building	R	R	R	NR	R	R	R	R	Minimum 240 min firefighting requirements	NR	(*see* Note 21)	NR
	ii) More than one floor building but not exceeding 15 m	R	R	R	R	R	R	R	R	Minimum 240 min firefighting requirements	50 000	(*see* Note 21)	900

R – Required
NR – Not Required

NOTES

1 MOEFA System shall also include talk-back system and public address system for the occupancies given in the table for (d) (1) (iii) under A-5, (a) (1) (iv) and (a) (2) under C-1, and (a) (2) under D-1 to D-5, in all buildings 15 m and above in height, except for A-3 and A-4 occupancies where these shall be provided for buildings of height 24 m and above. These shall also be provided in car parking areas more than 300 m^2 and in multi-level car parking irrespective of their areas.

2 Automatic detection and alarm system is not required to be provided in car parking area. Such detection system shall however be required in other areas of car parking such as electrical rooms, cabins and other areas.

3 Buildings above 15 m in height are not to be permitted for occupancies A-1 and A-2.

4 Required to be installed in basement, if area of basement exceeds 200 m^2.

5 Required to be provided if basement area exceeds 200 m^2.

Table 7 — (*Concluded*)

6 Additional value given in parenthesis shall be added if basement area exceeds 200 m^2.

7 Required to be provided for buildings with more than two storeys (Ground + One).

8 Required to be provided for buildings with height above 15 m and above.

9 Sprinklers shall be fed water from both underground static water storage tank and terrace tank.

10 Provide required number of sets of pumps each consisting of one electric and one diesel pump (stand by) of capacity 2 280 litre/min and one electric pump of capacity 180 litre/min (*see* Fig. 11) (*see also* notes 22 and 23).

11 Provide required number of sets of pumps each consisting of two electric and one diesel pump (stand by) of capacity 2 280 litre/min and two electric pump of capacity 180 litre/min (*see* Fig. 12) (*see also* Notes 22 and 23).

12 Provide required number of sets of pumps each consisting of two electric and one diesel pump (stand by) of capacity 2 850 litre/min and two electric pump of capacity 180 litre/min (*see* Fig. 12) (*see also* Notes 22 and 23).

13 Lower levels in high rise buildings 60 m or above in height are likely to experience high pressure and therefore, it is recommended to consider multi-stage, multi-outlet pumps (creating pressure zones) or variable frequency drive pumps or any other equivalent arrangement.

14 Provide required number of sets of pumps each consisting of one electric and one diesel pump (stand by) of capacity 1 620 litre/min and one electric pump of capacity 180 litre/min (*see* Fig. 11) (*see also* Notes 22 and 23).

15 Required to be provided for buildings with more than one storey.

16 Buildings above 30 m in height not to be permitted for Group B, Group C, Group D and Group F occupancies.

17 The requirements given in this table for Group G Industrial Buildings are for small scale industry units. For other industries the requirements will have to be worked out on the basis of relevant Indian Standards and also in consultation with the local fire authorities.

18 Buildings above 18 m in height not to be permitted for G-1 and G-2 occupancies.

19 Buildings above 15 m in height not to be permitted for G-3 occupancies.

20 Buildings above 15 m in height not to be permitted for Group H and Group J occupancies. However, buildings above 45 m in height shall not be permitted for multi-level car parking (MLCP) occupancy.

21 Pump capacity shall be based on the covered area of the building.

22 One set of pumps shall be provided for each 100 hydrants or part thereof, with a maximum of two sets. In case of more than one pump set installation, both pump sets shall be interconnected at their delivery headers.

23 Alternative to provisions of additional set of pumps, the objective can be met by providing additional diesel pump of the same capacity and doubling the water tank capacity as required for one set of pumps.

24 As per the requirement of local authority dry riser may be used in hilly areas, industrial areas or as required.

Guidelines for selection of various types of fire detectors for different occupancies and their installation and maintenance shall be in accordance with good practice [4(16)] and the Part 12 'Asset and Facility Management' of the Code.

h) In buildings where automatic fire alarm system is provided, the following shall be monitored from fire alarm panel:

1) Water level in all tanks.
2) Hydrant and sprinkler pressures of respective zones as provided.
3) Pump 'ON/OFF' status.
4) All isolation valves, wherever provided with supervisory switch (non-padlock valves).
5) Other requirements to meet electro-mechanical services interface.

4.10 Fire Officer

4.10.1 A qualified Fire Officer with experience of not less than 3 years shall be appointed who will be available on the premises, for large educational complexes, business buildings with height 30 m and above, residential building with height 60 m and above, institutional buildings of 15 m and above, starred hotels and D-6 occupancy.

4.10.2 The Fire Officer shall,

a) maintain the firefighting equipment in good working condition at all times.
b) prepare fire orders and fire operational plans and get them promulgated.
c) impart regular training to the occupants of the buildings in the use of firefighting equipment provided on the premises and keep them informed about the fire emergency evacuation plan.
d) keep proper liaison with the city fire brigade.
e) ensure that all fire precautionary measures are observed at the times.

NOTE — Competent authority having jurisdiction may insist on compliance of the above rules in case of buildings having very large areas even if the height is less than 30 m.

4.11 Fire Drills and Fire Orders

Fire notices/orders shall be prepared to fulfil the requirements of firefighting and evacuation from the buildings in the event of fire and other emergency. The occupants shall be made thoroughly conversant with their action in the event of emergency, by displaying fire notices at vantage points and also through regular training. Such notices should be displayed prominently in bold lettering.

For guidelines for fire drills and evacuation procedures for high rise buildings, *see* Annex D.

5 FIRE PROTECTION

5.1 Fire Extinguishers/Fixed Firefighting Installations

5.1.1 All buildings depending upon the occupancy use and height shall be protected by fire extinguishers, hose reels, wet riser, down-comer, yard hydrants, automatic sprinkler installation, deluge system, high/medium velocity water spray, foam, water mist systems, gaseous or dry powder system, manual/automatic fire alarm system, etc, in accordance with the provisions of various clauses given below, as applicable:

a) These fire extinguishing equipment and their installation shall be in accordance with accepted standards [4(17)]. The extinguishers shall be mounted at a convenient height to enable its quick access and efficient use by all in the event of a fire incidence. The requirements of fire extinguishers/yard hydrant systems/wet riser/down-comer installation and capacity of water storage tanks and fire pumps, etc, shall be as specified in Table 7. The requirements regarding size of mains/risers shall be as given in Table 8. The typical arrangements of down-comer and wet riser installations are shown in Fig. 13. The wet riser shall be designed for zonal distribution ensuring that unduly high pressures are not developed in risers and hose-pipes.
b) First-aid firefighting appliances shall be provided and installed in accordance with good practice [4(18)]. The firefighting equipment and accessories to be installed in buildings for use in firefighting shall also be in accordance with the accepted standard [4(17)] and shall be maintained periodically so as to ensure their perfect serviceability at all times.
c) Valves in fixed firefighting installations shall have supervisory switch with its signalling to fire alarm panel or to have chain(s), pad lock(s), label and tamper-proof security tag(s) with serial number to prevent tampering/unauthorized operation. These valves shall be kept in their intended 'open' position.
d) In addition to wet riser or down-comer, first-aid hose reels shall be installed in buildings (where required under Table 7) on all the floors, in accordance with accepted standard [4(19)]. The first-aid hose reel shall be

connected directly to the riser/down-comer main and diameter of the hose reel shall not be less than 19 mm.

e) Wet risers shall be interconnected at terrace level to form a ring and cut-off shall be provided for each connection to enable repair/ maintenance without affecting rest of the system.

f) Pressure at the hydraulically remote hydrant and at the highest hydrant shall not be less than 3.5 bar. The pressure at the hydrants shall however not exceed 7.0 bar, considering the safety of operators. It may be planned to provide orifice plates for landing valves to control pressure to desired limit especially at lower levels; this could also be achieved through other suitable means of pressure reducing devices such as pressure controlled hydrant valves.

g) Hydrants for firefighting and hose reels shall be located in the lobby in firefighting shaft. Those hydrants planned to be provided near fire exit staircase on the floor shall be within 5 m from exit door in exit access. Such hydrant cabinet may finish with doors to meet interior finishes with requirement of glass panel to provide visibility to the installations inside and inscribed with the word: 'FIRE HOSE CABINET' of letter size 75 mm in height and 12 mm in width. Such door of the fire hose cabinet need not be fire resistant rated. The location of such cabinets shall be shown on floor plan and duly displayed in the landing of the respective fire exit staircase.

5.1.2 *Static Water Storage Tanks and Pump House*

5.1.2.1 *Static water storage tanks*

A satisfactory supply of water for the purpose of firefighting shall always be available in the form of underground/terrace level static storage tank with capacity specified for each building with arrangements or replenishment.

Water for the hydrant services shall be stored in an easily accessible surface/underground lined reservoir or above ground tanks of steel, concrete or masonry. The effective capacity of the reservoir above the top of the pump casing (flooded suction) for various types of occupancies shall be as indicated in Table 7.

Water for firefighting shall be stored in two or more interconnected compartments of equal size to facilitate cleaning and maintenance of the tanks without interrupting the water availability for firefighting.

To prevent stagnation of water in the static water storage tank, the suction tank of the domestic water supply shall be fed only through an overflow arrangement from the fire water storage tanks to maintain the level therein at the minimum specified capacity.

Alternatively, domestic and fire water can be stored in two interconnected compartments as mentioned above. The suction inlet(s) for the domestic water pumps shall be so located at an elevation that minimum water requirements for firefighting as stated in Table 7 will be always available for fire pumps.

The static storage water supply required for the above mentioned purpose shall entirely be accessible to the fire engines of the local fire service. Suitable number of manholes shall be provided for inspection, repairs, insertion of suction hose, etc. As an alternative to the arrangement of manholes to allow access from the top, suitable arrangement to enable efficient access to the tank by the firemen from the adjoining fire pump room having direct access from the ground level, shall be made. The underground fire water storage tank(s) shall not be more than 7 m in depth from the level having fire brigade draw-out connection, while the draw-out connection shall not be more than 5 m away from the tank wall.

The covering slab shall be able to withstand a total vehicular load of 45 t (or as applicable) equally divided as a four-point load when the slab forms a part of pathway/driveway.

The static water storage tank shall be provided with a fire brigade collecting head with 4 number 63 mm diameter (2 number 63 mm diameter for pump with capacity 1 400 litre/min) instantaneous male inlets arranged in a valve box at a suitable point at street level. The same shall be connected to the static tank by a suitable fixed galvanized iron pipe not less than 150 mm in diameter to discharge water into the tank when required at the rate of 2 250 litre/min, if tank is in the basement or not approachable for the fire engines.

Each of the static water storage tanks shall also be provided with a fire brigade draw out collecting head with 63 mm diameter instantaneous male draw out arranged in a valve box at a suitable point at street level. This draw out shall be connected to galvanized iron pipe of 100 mm diameter with foot valve arrangement in the tank.

5.1.2.2 *Firefighting pump house*

The requirements shall be as given below:

a) It is preferable to install the pump house at ground level. Pump house shall be situated so as to be directly accessible from the surrounding ground level.

b) Pump house shall be installed not lower than the second basement. When installed in the

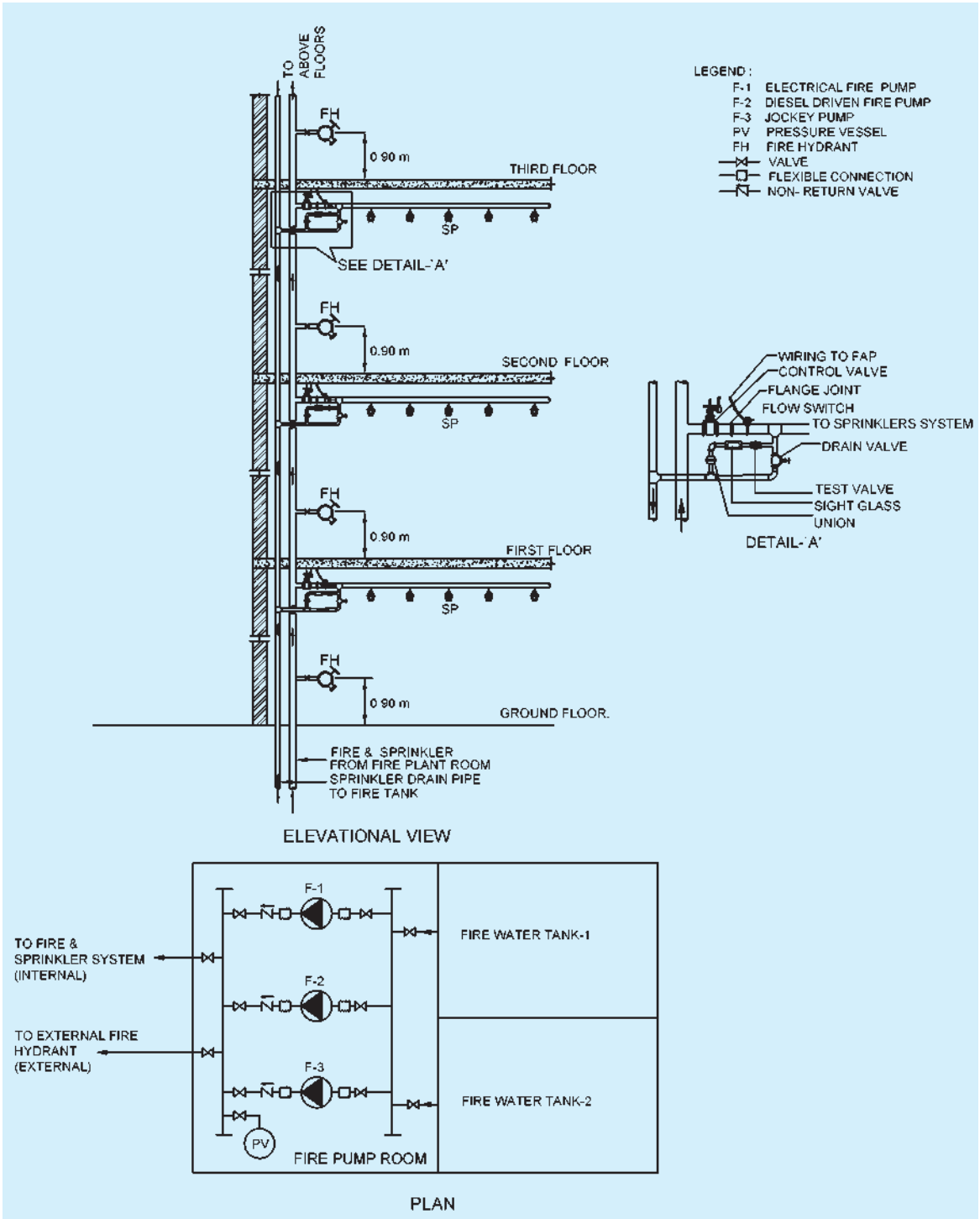


FIG. 11 TYPICAL SYSTEM OF PUMPING WITH ONE ELECTRIC, ONE DIESEL FIRE PUMP

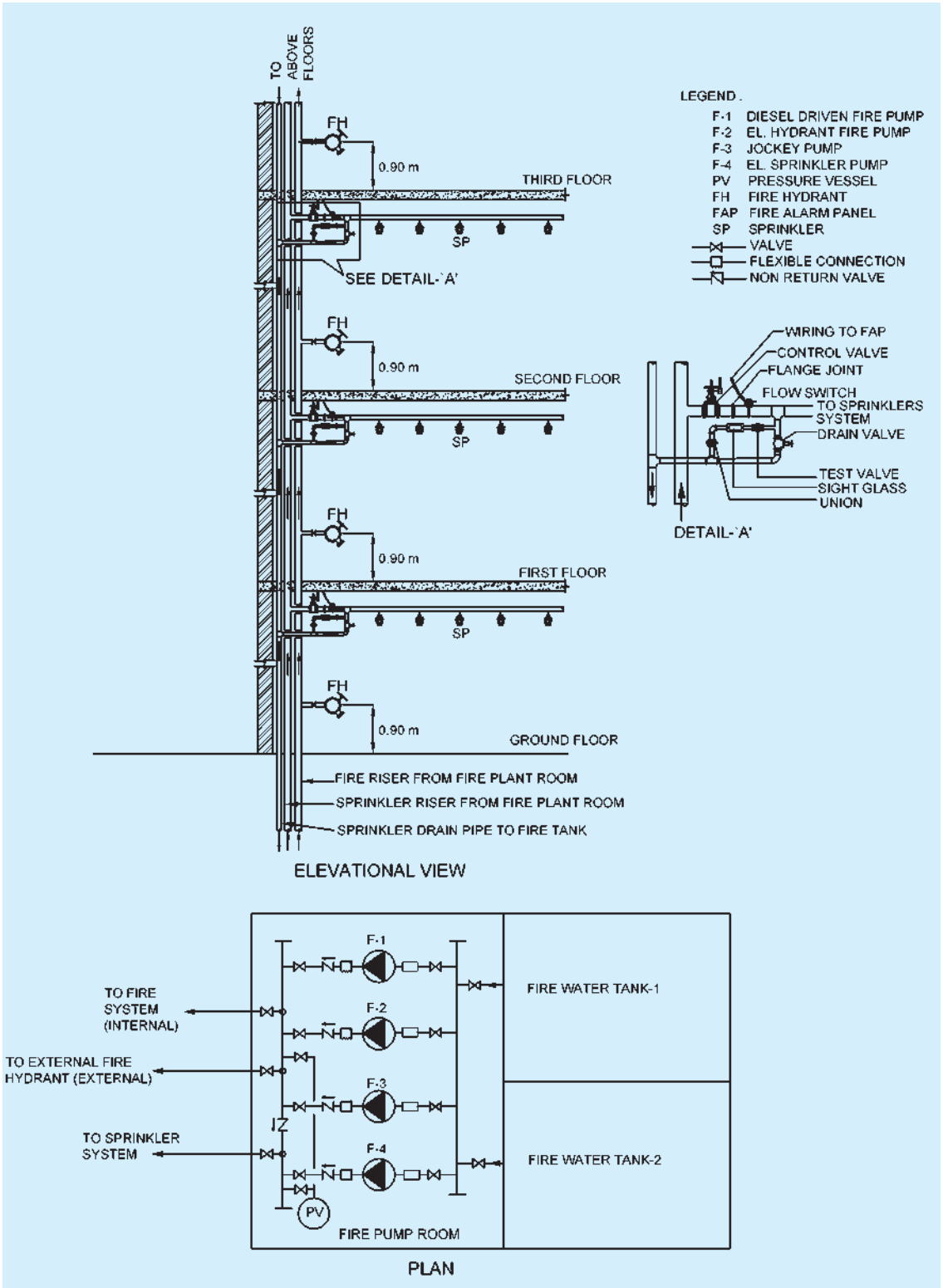


FIG. 12 TYPICAL SYSTEM OF PUMPING WITH TWO ELECTRIC, ONE DIESEL FIRE PUMP

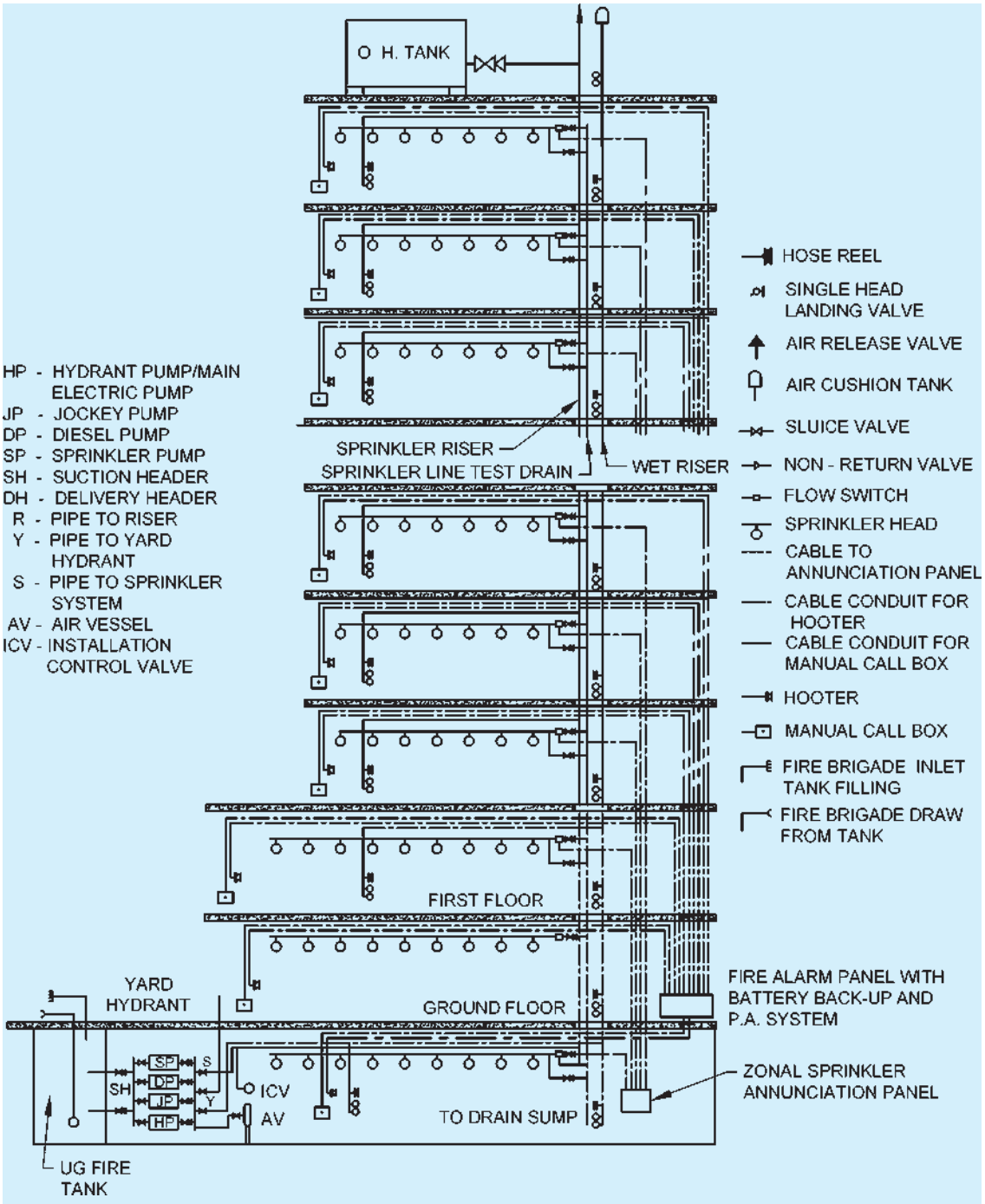


FIG. 13 TYPICAL ARRANGEMENT OF WET RISER AND TOTAL SPRINKLER SYSTEM OF BUILDING

Table 8 Size of Mains
[*Clause* 5.1.1(a)]

Sl No.	Size of the Mains mm	Type of Building	Remarks
(1)	(2)	(3)	(4)
i)	100 mm with single outlet landing valves	a) Residential building (A):	
		1) Dormitories	—
		2) Apartments	—
		3) Hotels	Up to 45 m height
		b) Educational buildings (B)	—
		c) Institutional buildings (C)	Up to 30 m height
		d) Assembly buildings (D)	—
		e) Business buildings (E)	Up to 45 m height
		f) Mercantile buildings (F)	—
		g) Industrial buildings (G)	Up to 15 m height
ii)	150 mm with single outlet landing valves	a) Hotels	Above 45 m height
		b) Starred hotels	—
		c) Institutional buildings (C)	Above 30 m height
		d) Business buildings (E)	Above 45 m height
		e) Industrial buildings (G)	Above 15 m height
		f) Storage buildings (H)	Up to 15 m height
		g) Hazardous buildings (J)	Up to 15 m height

basement, staircase with direct accessibility (or through enclosed passageway with 120 min fire rating) from the ground, shall be provided. Access to the pump room shall not require to negotiate through other occupancies within the basement.

c) Pump house shall be separated by fire walls all around and doors shall be protected by fire doors (120 min rating).

d) Pump house shall be well ventilated and due care shall be taken to avoid water stagnation.

e) No other utility equipment shall be installed inside fire pump room.

f) Insertions like flexible couplings, bellows, etc, in the suction and delivery piping shall be suitably planned and installed.

g) Installation of negative suction arrangement and submersible pumps shall not be allowed.

h) Pump house shall be sufficiently large to accommodate all pumps, and their accessories like PRVs, installation control valve, valves, diesel tank and electrical panel.

j) Battery of diesel engine operated fire pump shall have separate charger from emergency power supply circuit.

k) Exhaust pipe of diesel engine shall be insulated as per best engineering practice and taken to a safe location at ground level, considering the back pressure.

m) Fire pumps shall be provided with soft starter or variable frequency drive starter.

5.1.3 *Automatic Sprinkler Installation*

The requirements shall be as given below:

a) Automatic sprinklers shall be installed wherever required in terms of Table 7 throughout the building in accordance with good practice [4(20)].

b) If selective sprinklering is adopted, there is a real danger of a fire starting in one of the unsprinklered area gathering momentum spreading to other areas and reaching the sprinklered areas as a fully developed fire. In such an event, the sprinklers can be rendered useless or ineffective.

c) Automatic sprinklers shall be installed in false ceiling voids exceeding 800 mm in height.

d) Installation of sprinklers may be excluded in any area to be used for substation and DG set.

e) In areas having height 17 m or above such as in *atria*, sprinkler installations may be rendered ineffective and hence may be avoided.

f) Pressure in sprinkler system shall not exceed 12 bar or else high pressure sprinkler to be installed for above 12 bar operations.

g) The maximum floor area on any one floor to be protected by sprinklers supplied by any one sprinkler system riser from an installation control valve shall be based on system protection area limitations considering maximum floor area on any one floor to be 4 500 m^2 for all occupancies except industrial and hazardous occupancies, where Authorities

shall be consulted for advice based on type and nature of risk.

h) Sprinkler installation control valves, shall be installed inside the fire pump room.

j) For industrial buildings, such installation control valves may be installed outside the building and Authorities shall be consulted in situations where it is not possible to locate them inside the buildings. It is advisable to provide electrically operated siren for each valve outside the buildings in addition to water gongs in such case.

k) The sprinkler flow switches provided shall be monitored by fire alarm panel.

m) It is essential to make provisions for avoiding water from sprinkler/hydrant operation entering lifts and electrical rooms.

n) Ramps at all levels shall be protected with sprinklers.

5.1.4 *Automatic High Velocity and Medium Velocity Water Spray Systems*

Automatic high velocity water spray or emulsifying system shall be provided for protection of outdoor and/or indoor oil-cooled transformers as applicable in accordance with good practice [4(21)] where applicable (*see* Annex E). Also, medium velocity water spray system shall be provided for tankage (where applicable), conveyors, cable galleries and other occupancies listed in good practice [4(21)].

5.1.5 *Fixed Foam Installation*

Fixed foam generating system shall be provided for protection of oil storage area for boilers with its ancillary storage of furnace oils in basement. Fixed foam installations can be low, medium or high expansion types, which can be provided based on the type of fire hazards identified in the facility. High expansion foams are used for cable tunnels and other confined areas. Design and installation of foam systems shall be governed by good practice [4(22)].

5.1.6 *Gas Based Suppression System*

Gas based fire extinguishing installation shall be provided in accordance with good practice on premises where water or foam cannot be used for fire extinguishing because of the special nature of the contents of the buildings/areas to be protected where either the building(s) have very limited manpower or unmanned. The protection design for fixed carbon dioxide fire extinguishing system shall conform to good practice [4(23)] in all respects. For some special fire risk/essential applications, carbon dioxide may not be suitable and alternate provisions shall be made as per relevant standards (*see* **5.1.9**).

5.1.7 Firefighting equipment shall be suitably located and clearly marked by luminous signs.

5.1.8 *Automatic Water Mist Systems*

These systems involve the use of fine water sprays for the efficient extinguishment of fires. These systems may be provided to protect areas in buildings for the uses as specified in good practice [4(24)].

5.1.9 *Extinguishing Systems with Clean Agents*

Alternative systems for halon gas protection systems shall be provided where necessary as prescribed in this Part. These shall be in accordance with the accepted standards [4(25)].

5.2 Fire Detection and Alarm System

See **4.9**.

5.3 The fixed firefighting installations and systems shall be maintained in accordance with good practice [4(26)] and the Part 12 'Asset and Facility Management' of the Code.

6 ADDITIONAL OCCUPANCY WISE REQUIREMENTS

In addition to the general requirements on fire prevention given in **3**, the life safety requirements given in **4**, and the fire protection requirements given in **5**, the following additional requirements shall also be complied with for each type of occupancy.

For additional requirements for high rise buildings, the provisions as given in Annex E shall apply.

Atriums in building occupancies shall comply with the provisions as given in Annex F.

For fire protection requirements of commercial kitchen, cooking facilities with or without restaurants, the provisions of Annex G shall be referred.

6.1 Residential Buildings (Group A)

6.1.1 *Life Safety*

6.1.1.1 *Subdivision A–1*

a) All locking devices, which would impede or prohibit exit, such as chain type bolts, limited opening sliding type locks and burglar locks, which are not disengaged easily by quick-releasing catches, shall be prohibited.

b) All bathroom door locks or fasteners shall be designed to permit the opening of the locked or closed door from the outside in an emergency without the use of a special key.

c) No lodging or rooming house shall have its sole means of egress pass through any non-residential occupancy in the same building.

d) Rooming and lodging houses having floor area of 500 m^2 on any one or more floors shall have access to minimum two separate means of exits, at least one of which shall be so arranged as to have direct exit discharge.

6.1.1.2 *Subdivision A-3*

a) Requirements of **6.1.1.1** shall be applicable.

b) All sleeping rooms having occupancy of more than 10 persons shall have two separate and distinct exit access in different directions.

6.1.1.3 *Subdivision A-4*

In case of high rise apartments, of the minimum exits as specified in **4.4.2.4.3.1**, the naturally ventilated exit staircases may not require the provision of fire door. However, fire door shall be provided for all other staircases and pressurized staircases.

6.1.1.4 *Subdivision A-5*

a) Panic bars shall be provided in the fire exits. Panic bars shall be located at a height between 865 mm and 1 220 mm from the floor level.

b) All guest rooms and suites shall be protected by extended throw, quick response type sprinklers only. Also these areas shall be provided with audio-based detectors, having a sound level of at least 75 dB.

c) Horizontal-sliding doors shall not be used for door openings across corridors.

6.1.2 *Additional Precautions*

a) Flammable liquids for household purposes shall be kept in tightly stoppered or sealed containers. For the limits of quantities of flammable liquids to be allowed in various occupancies, reference may be made to appropriate regulations.

b) No stove or combustion heater shall be located directly under or immediately at the foot of stairs or otherwise so located as to block escape in case of malfunctioning of the stove or heater.

c) All kitchen exhaust fans, where provided, shall be fixed to an outside wall or to a duct of non-combustible material, which leads directly to the outside. The ducts shall not pass through areas having combustible materials. However, in case of centralized ducting, the duct shall be provided with adequate protection to limit the spread of fire.

d) Stores, engineering workshops, areas of high hazard, etc used for storage of substantial amount of flammable liquids shall be of 120 min fire resistance rating wall. Such areas shall be provided with fire doors, to be kept closed and shall be posted with a sign on each side of the door in 25 mm high block letters stating — 'FIREDOOR — KEEP CLOSED'.

6.2 Educational Buildings (Group B)

6.2.1 *Fire Prevention*

a) Buildings intended for educational occupancy shall not be used for storage of any hazardous material.

b) Gymnasiums, indoor stadiums and similar occupancies are permitted to have floors/ running tracks of wood, cinder, synthetic or the like.

6.2.2 *Life Safety*

a) Every room with a capacity of over 45 persons in area shall have at least two doorways. Exit doors shall be operated by panic bars except that doors leading from classrooms directly to the outside may be equipped with the same type of lock as is used on classroom doors leading to corridor, with no provision whatsoever for locking against egress from the classroom.

b) A building, which will have only the first floor and is accessible to not more than 20 pupils at any time, may be used for school purposes with the following exceptions:

   1) Exterior walls or parts of walls which are less than 900 mm from adjacent property lines shall have no openings therein.
   2) Classrooms may have only one exit not less than 900 mm wide.

c) Rooms or areas for use by the preschool, kindergarten, Class/Grade 1 students shall be located on ground floor/level of exit discharge. Rooms or areas occupied by Class/Grade II students shall be located not above one floor higher than ground floor/level of exit discharge.

d) Of the minimum exits as specified in **4.4.2.4.3.1**, the naturally ventilated exit staircases, may not require provision of fire door. However, fire door shall be provided for all other staircases and pressurized staircases.

6.2.3 *Additional Precautions*

a) Storage of volatile flammable liquids shall be prohibited and the handling of such liquids shall be restricted to science laboratories only.

b) All exterior openings in a boiler room or rooms containing central heating equipment,

if located below an opening in another storey or if less than 3 m from other doors or windows of the same building, shall be protected by a fire assembly as in **3.4.5**. Such assemblies shall be of fixed, automatic or self-closing type.

6.3 Institutional Buildings (Group C)

6.3.1 *Fire Prevention*

No combustible material of any kind shall be stored or used in any building or section thereof used for institutional occupancy, except as necessary to normal occupancy and use of the building.

6.3.2 *Life Safety*

a) The common path of travel shall be 30 m. The maximum dead end of corridor distance shall not exceed 6 m.

b) Principle of progressive horizontal evacuation is of paramount consideration for hospital patients particularly those lacking self-preservation. This calls for moving occupants from a fire affected area to an adjoining area at the same level through a fire resistant wall, to protect them from the immediate dangers of fire and smoke (*see* Fig. 14).

c) Progressive horizontal evacuation operates on the basis of evacuation from compartment to compartment and on use of adjacent compartments as temporary means of refuge. All compartments shall be divided with self-closing (door closers) fire doors with electromagnetic hold open. A coordinator shall be provided to sequence the closing of double leaf in case of emergency.

d) Doors in fire resistant walls shall be so installed that these may normally be kept in open position, but will close automatically. Corridor door openings shall be not less than 2.0 m in width of double swing double leaf type door. A coordinator shall be provided as above, for closing of double leaf in case of emergency.

e) Exits and other features for penal and mental institutions, and custodial institutions shall be the same as specified for hospitals [*see* **6.3.2** (g)], in so far as applicable. Reliable means shall be provided to permit the prompt release of inmates from any locked section in case of fire or other emergency.

f) All buildings or sections of buildings in penal and mental institution used for manufacturing, storage or office purposes shall have exits in accordance with the provisions of the Code for those occupancies.

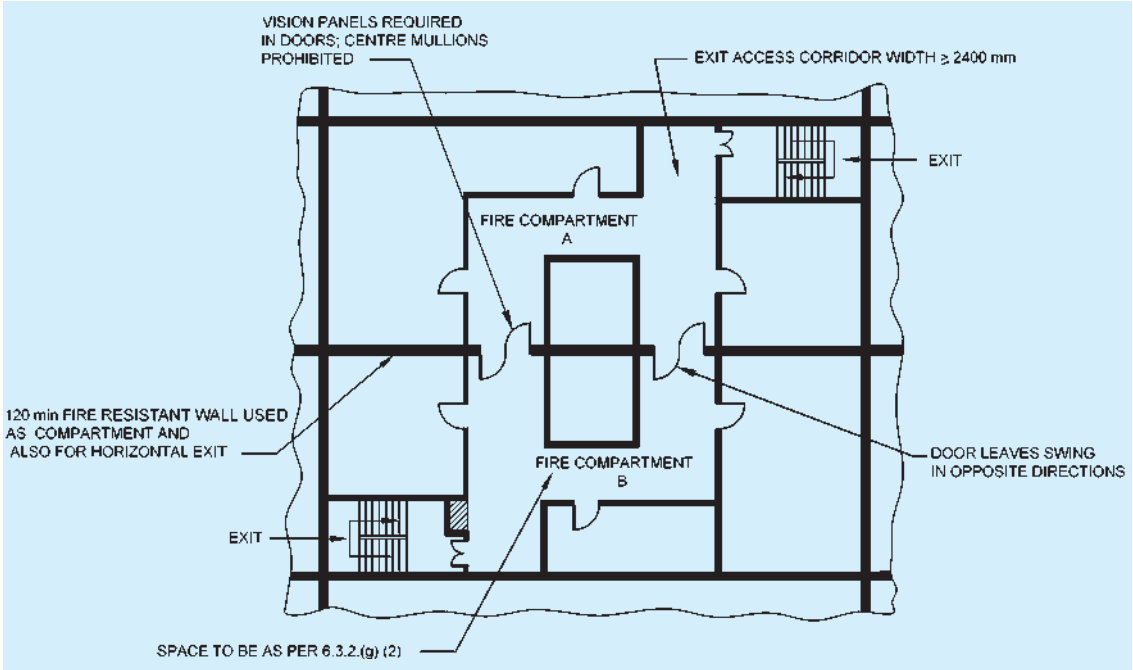


FIG. 14 PART PLAN INDICATING CONCEPT OF HORIZONTAL EXIT IN HOSPITAL

g) For hospitals (Subdivision C-1), the following shall also be complied with:

1) Compartmentation shall meet the requirement as per **4.5.2**.
2) Each compartment (*see* **4.5.2**) shall be able to accommodate, in addition to its own, the patients from adjoining compartment also considering 3.5 m^2 per person. If patients are not bed-ridden, a factor of 0.6 m^2 per person is recommended.
3) All critical patients and those incapable of self-preservation and having physical impairment shall be housed within 30 m height.
4) Other types of patients and occupancies incidental to the hospitals such as consultation rooms, nurses' stations, medical shops, canteens, etc may be housed at heights beyond 30 m but not more than 45 m.
5) Basement shall not be used to store flammables or for pathological or other laboratories particularly those involving usage of chemicals.
6) Operation theatres, delivery rooms, Intensive care units, recovery rooms, etc, that containing patients lacking self-preservation in case of emergencies shall be fire/smoke separated (120 min minimum rating) from all the adjoining areas.
7) Aisles, corridors, ramps, etc, through which patients are moved, shall have a minimum width of 2.4 m throughout. Aisles, corridors, and ramps in other areas not intended for the housing, treatment, or use of inpatients shall be not less than 1.5 m in width.
8) All exits from hospital or infirmary sections shall be not less than 2.0 m in width.
9) Minimum width of door of single or double occupancy patient room shall be 1.25 m while for the wards for 3 to 5 patient beds shall be 1.50 m, to permit movement of patients. The minimum width of door for wards for more than 5 patient beds and for areas necessarily requiring patient evacuation on bed (such as ICU, recovery units, delivery rooms, etc), shall have door width of 2.0 m. The width of 2.0 m may be reduced to minimum of 1.5 m where two such doors are provided in such areas.
10) Any sleeping accommodation or suite exceeding 100 m^2 in area shall have at least two doorways leading to the exit access corridors.
11) Floor surface of corridors shall not be inclined at a gradient steeper than 1 in 12 to the horizontal.
12) Exit access corridors from a compartment to another compartment shall be divided at the compartment intersection by a fire door of 120 min fire rating in the fire compartment wall.
13) Rooms designated for laboratory and the like shall not exceed 100 m^2 in area and if additional space is required, fire separation of 120 min shall be provided.
14) Storage of flammable liquids in laboratories or in any other area shall be not more than 3 litre for every 10 m^2 area.
15) Disposal of any equipment and other (particularly hazardous) materials shall be accomplished in the premises by a disposal specialist or at a safe location away from the health care facility by competent personnel using procedures established in concurrence with the safe practices.
16) A stretcher lift in a lift bank shall also act as fireman's lift meeting the requirements of Part 8 'Building Services, Section 5 Installation of Lifts, Escalators and Moving Walks, Subsection 5A Lifts' of the Code.

h) *Progressive evacuation strategy — See* Fig. 15, in which, as an example, the exit calculations at two locations shall be based on requirements of total occupancy for area (A, B and C) divided by 2 considering progressive evacuation strategy.

6.3.3 *Exception and Deviation*

It is recognized that in institutions or part of buildings housing various types of psychiatric patients, or used as mental institutions and penal institutions, it is necessary to maintain locked doors and barred windows; and to such extent the necessary provision in other sections of the code requiring the keeping of exits unlocked may be waived. It is also recognized that certain type of psychiatric patients are not capable of seeking safety without adequate guidance. In buildings where this situation prevails, reliable means for the rapid release of occupants shall be provided, such as remote control of locks, or by keying all locks to keys commonly used by attendants.

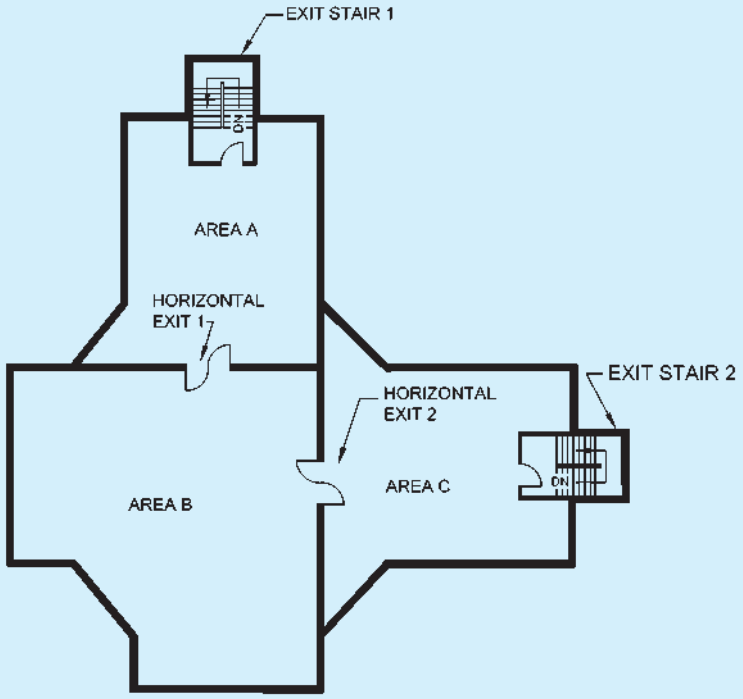


FIG. 15 MINIMUM OF TWO EXITS ACCESSIBLE FROM ALL PARTS OF FLOOR

6.4 Assembly Buildings (Group D)

6.4.1 *Fire Prevention*

6.4.1.1 The following shall be applicable:

a) Decorations of places of assembly shall be of non-flammable materials. Fabrics and papers used for such purpose shall be treated with an effective flame-retardant material. Stage settings made of combustible materials shall likewise be treated with fire retardant materials of Class 1 flame spread.

b) Gymnasiums, indoor stadiums and similar occupancies are permitted to have floors/ running tracks of wood, cinder, synthetic or the like.

6.4.1.2 *Additional fire prevention requirements for D-6 occupancy*

Building having D-6 mixed use assembly/mercantile occupancy will limit the height of the assembly/ mercantile occupancy portion of the buildings to 30 m. Above this height the buildings may be used for business or residential occupancies with 240 min separation. Independent exits shall be provided for such occupancy above 30 m and shall not interface with exits of assembly/mercantile occupancy.

6.4.2 *Life Safety*

6.4.2.1 The following shall be applicable:

a) Exit door width for assembly buildings shall not be less than 2.0 m.

b) Every place of assembly of sub-division D-1 shall have at least four separate exits as remote from each other as practicable.

c) Every place of assembly of sub-division D-2 shall have at least two separate exits as remote from each other as practicable and if of capacity over 600, at least three exits shall be provided with each exit not less than of 2.0 m width.

d) Clear aisles not less than 1.2 m in width shall be formed at right angles to the line of seating in such number and manner that no seat shall be more than seven seats away from an aisle. Rows of seats opening on to an aisle at one end only shall have not more than seven seats. Under the conditions, where all these aisles do not directly meet the exit doors, cross-aisles shall be provided parallel to the line of seating so as to provide direct access to the exit, provided that not less than one cross aisle for every 10 rows shall be required. The width of cross-aisles shall be minimum of 1 m. Steps shall not be placed in aisles to overcome differences in levels, unless the gradient exceeds 1 in 10.

e) The fascia of boxes, balconies and galleries shall have substantial railings not less than 1 000 mm high above the floor. The railings at the end of aisles extending to the fascia shall be not less than 1 100 mm high for the width of the aisle or 1.2 m high at the foot of steps.

f) Cross-aisles, except where the backs of seats on the front of the aisle project 600 mm or more above the floor of the aisle, shall be provided with railings not less than 900 mm high.

g) No turnstiles or other devices to restrict the movement of persons shall be installed in any place of assembly in such a manner as to interfere in any way with the required exit facilities.

h) In theatres and similar places of public assembly where persons are admitted to the building at a time when seats are not available for them and are allowed to wait in a lobby or similar space until seats are available, such use of lobby or similar space shall not encroach upon the required clear width of exits. Such waiting shall be restricted to areas separated from the required exit ways by substantial permanent partitions or fixed rigid railing not less than 1 050 mm high. Exits shall be provided for such waiting spaces on the basis of one person for each 0.3 m^2 of waiting space area. Such exits shall be in addition to the exits specified for the main auditorium area and shall conform in construction and arrangement to the general rules of exits given above.

j) No display or exhibit shall be so installed or operated as to interfere in any way with access to any required exit, or with any required exit sign.

k) All displays or exhibits of combustible material or construction and all booths and temporary construction in connection therewith shall be so limited in combustibility or protected as to avoid any undue hazard of fire which might endanger occupants before they have opportunity to use the available exits, as determined by the authority.

m) Places of assembly in buildings of other occupancy may use exits common to the place of assembly and the other occupancy, provided the assembly area and the other occupancy are considered separately, and each has exits sufficient to meet the requirements of the Code.

n) Exits shall be sufficient for simultaneous occupancy of both the places of assembly and other parts of the building.

p) For detailed information regarding cinema buildings, reference may be made to good practice [4(27)].

q) Seats in places of public assembly, accommodating more than 300 persons, shall be securely fastened to the floor, except as permitted in (r) below. All seats in balconies and galleries shall be securely fastened to the floor, except that in nailed-in enclosures, boxes with level floors and having not more than 14 seats, the seats need not be fastened.

r) Chairs not secured to the floor may be permitted in restaurants, night clubs and other occupancies where the fastening of seats to the floor may not be practicable, provided that in the area used for seating, excluding dance floor, stage, etc, there shall be not more than one seat for each 1.4 m^2 of floor area and adequate aisles to reach exits shall be maintained at all times. The arrangements shall be as follows in general:

   1) Rows of seats between aisles shall have not more than 14 seats.
   2) Rows of seats opening on to an aisle at one end only shall have not more than 7 seats.
   3) Seats without dividing arms shall have their capacity determined by allowing 450 mm per person.

s) The spacing of rows of seats from back to back shall be neither less than 850 mm nor less than 700 mm plus the sum of the thickness of the back and inclination of the back. There shall be a space of not less than 350 mm between the back of one seat and the front of the seat immediately behind it as measured between plumb lines.

t) *Lighting* — No open flame lighting devices shall be used in any place of assembly, except in the following cases:

   1) Where necessary for ceremonial purposes, the enforcing Authority may permit open flame lighting under such restrictions as are necessary to avoid danger of ignition of combustible materials or injury to occupants.
   2) Candles may be used on restaurant tables if securely supported on non-combustible bases and so located as to avoid danger of ignition of combustible materials.
   3) Open flame devices may be used on stages where they are a necessary part of

theatrical performance, provided adequate precautions, satisfactory to the Authority aretaken to prevent ignition of combustible materials.

6.4.2.2 *Life safety provisions for D-6 occupancy*

The following additional requirements shall be applicable:

a) Assembly occupancies of theatres, cinema halls and multiplexes shall be so located in the mall building that their exits will be separate and lead the occupant directly to exit discharge.

b) The common path of travel shall be 30 m. The maximum dead end of corridor distance shall not exceed 6 m.

c) The minimum width of an exit passageway shall be 2.0 m.

d) Where wheeled carts or buggies are used by customers, adequate provision shall be made for the transit and parking of such carts to minimise the possibility that they might obstruct means of egress. Any other storage or hindrances causing obstruction in exits shall be avoided.

e) Car parking facilities shall comply with Annex H. Car parking areas at upper levels adjacent to shops, food courts or multiplex shall be separated by 120 min fire rated construction and building elements.

f) 50 percent lifts in common areas in D-6 shall be with features and requirement of fireman's lift.

g) The manual call points shall be break glass and not pull stations.

h) Photoluminescent markings shall be done along the width and length of treads in all enclosed exits staircases. Exit directional arrow on the wall (in the direction of egress) shall be 175 mm × 50 mm.

j) Refuge area to be provided on the floor at or immediately above 18 m shall be not less than 10 percent of gross area of floor. Next refuge area to be at/on the floor immediately above 24 m. The refuge area shall be 10 percent of the respective floor, which may be divided into two or more separate refuge areas at each of the respective floors, with each being not less than 100 m^2. Refuge area shall also meet all the requirements of life safety as per **4**.

6.4.3 *Fire Protection*

a) Every stage equipped with fly galleries, grid irons and rigging for movable theatre type scenery, shall have a system of automatic sprinklers over and under such stage areas or spaces and auxiliary spaces, such as dressing rooms, store rooms and workshops, and the proscenium opening shall be provided with a fire resisting curtain, capable of withstanding a lateral pressure of 4 kN/m^2 over the entire area. The curtain shall have an emergency closing device capable of causing the curtain to close without the use of power and when so closed, it shall be reasonably tight against the passage of smoke.

b) The stage roof of every theatre using movable scenery or having a motion picture screen of highly combustible construction shall have a ventilator or ventilators in or above it, openable from the stage floor by hand and also opening by fusible links or some other approved automatic heat/smoke actuated device, to give a free opening equal to at least one-eighth the area of the floor of the stage.

c) The proscenium wall of every theatre using movable scenery of decorations shall have, exclusive of the proscenium opening, not more than two openings entering the stage, each not to exceed 2 m^2 and fitted with self-closing fire resistant doors.

d) Every place of assembly in which projection of motion pictures by light is made shall have the projection apparatus enclosed in a fire resisting fixed booth in accordance with good practice [4(27)], except that such booth shall not be required where no nitrocellulose motion picture film is used.

6.4.4 *Fire Protection and Firefighting System for Metro Stations* (*D-7 Occupancy*)

Fire and life safety requirements for metro stations and metro trainways shall be in accordance with Annex J and Annex K, respectively.

6.5 Business Buildings (Group E)

6.5.1 *Life Safety*

Not less than two exits shall be provided for every floor, including basements occupied for office purposes or uses incidental thereto.

6.5.2 *Fire Protection*

a) For Subdivision E-2, the requirement shall be provision of automatic fire detection alarm system, while for fire protection, CO_2 and/or foam based installation to be planned based on the requirements.

b) For Subdivision E-3, E-4 and E-5, the requirement shall be provision of automatic

fire detection alarm system, while for fire protection, any or combination of clean agents, mist technologies, hypoxic air technology, etc, may be planned for appropriate/special situations/locations. Electrical panels may be provided with CO_2/inert gas flooding system based on the requirement and reliability of power for the functional requirement and performance.

6.6 Mercantile Buildings (Group F)

6.6.1 *Life Safety*

6.6.1.1 Open air mercantile operations, such as open air markets, petrol filling stations, roadside stands for the sale of a farm produce and other outdoor mercantile operations shall be so arranged and conducted as to maintain free and unobstructed ways of travel at all times to permit prompt escape from any point of danger in case of fire or other emergency, but no dead-ends in which persons might be trapped due to display stands, adjoining buildings, fences, vehicles or other obstructions.

6.6.1.2 If such mercantile operations are conducted in roofed-over areas, these shall be treated as mercantile buildings, provided canopies over individual small stands to protect merchandise from the weather shall not be construed to constitute buildings for the purpose of the Code.

6.6.2 *Exception and Deviation*

Any mercantile occupancy, where goods of a highly hazardous nature are predominant, shall be considered under Group J occupancy for the purpose of the Code.

6.7 Industrial Buildings (Group G)

6.7.1 *Fire Prevention*

6.7.1.1 *Fire separating walls, fire separating floors and fire partitions*

Fire separating walls shall be provided between two buildings or between two blocks inside a building, having different fire hazards in accordance with the provisions of this Part. The areas having storage, manufacturing, hazardous activities such as paint store, oil storage, spray booths, etc, shall be separated from non-hazardous areas like administrative office, staff canteen, etc by fire rated walls/doors of 120 min fire resistance rating. The fire resistance rating of high hazardous areas like petrochemical, explosives shall be 240 min.

The fire separating wall where provided shall comply with the following requirements:

a) The separating wall shall be carried through the roof. This portion of the wall extending above the roof, known as 'screen wall' shall be of such a height (in no case less than 600 mm) that the horizontal distance at the level of the top of the screen wall between the roofs of the buildings/compartments being segregated is at least 6 m.

b) The screen wall shall be of not less than 230 mm in thickness if it is an extension of a masonry wall, and not less than 150 mm in thickness if it is an extension of a reinforced concrete wall.

c) The separating wall need not be extended as a screen wall if the roof of one or both of the buildings/blocks being segregated is of reinforced concrete construction (RCC).

d) In the case of buildings of unequal height, windows or other openings in the wall of the higher building overlooking the roof of the lower building and within 6 m, thereof, shall be protected by fire resistant glass assembly or by approved type fire doors unless the roof of the lower building is of reinforced concrete.

e) In case the eaves of the higher building fall within 6 m of the roof of the lower building such eaves should be cut-off and the screen wall raised as a parapet, 600 mm high over the roof of the higher building, unless the roof of the lower building is of RCC construction.

f) Fire separating walls shall also be extended outwards on both sides by at least 450 mm.

g) Doors and window openings in external walls within 3 m of the fire separating walls shall be protected by fire doors having a rating of at least 60 min and window openings may be protected by fire resistant glass assembly having same fire rating.

h) In the case of buildings/compartments having north-light roofs when a separating wall runs parallel to the axis of the north-light opening, the screen wall shall be carried through and 600 mm above the ridge of the north light. If, however, the separating wall is at right angles to the axis of the north-light opening, the saw tooth gaps shall be bricked up and the screen wall extended 600 mm above the ridge of the north light as well as beyond the extreme north-light opening.

j) Similarly, the thickness of the floor slabs in case of buildings having upper levels shall be designed to provide fire rating as mentioned above.

k) Storage areas shall be separated from the remainder of the building/block by fire walls.

m) Moderate and high hazard areas in industries to have two fire doors each having 180 min fire resistance rating.

6.7.2 *Life Safety*

6.7.2.1 In buildings used for aircraft assembly or other occupancy requiring undivided floor areas so large that the distances from points within the area to the nearest outside walls where exit doors could be provided are in excess of 45 m, requirements for distance to exits may be satisfied by providing stairs leading to exit tunnels or to overhead passageways. In cases where such arrangements are not practicable, the Authority may, by special ruling, permit other exit arrangements for single storeyed buildings with distances in excess of the maximum distances specified in **4**, if completely automatic sprinkler protection is provided and if the heights of ceiling curtain boards and roof ventilation are such as to minimise the possibility that employees will be overtaken by the spread of fire or smoke within 1.8 m of the floor level before they have time to reach exits, provided, however, that in no case may the distance of travel to reach the nearest exit exceed 65 m where smoke venting is required as a condition for permitting distances of travel to exits in excess of the maximum otherwise allowed.

6.7.2.2 The following shall apply to special purpose industrial occupancies:

a) Exits need be provided only for the persons actually employed; spaces not subject to human occupancy because of the presence of machinery or equipment may be excluded from consideration.

b) Where unprotected vertical openings are necessary to manufacturing operations, these may be permitted beyond the limits specified for industrial occupancy, provided every floor level has direct access to one or more enclosed stairways or other exits protected against obstruction by any fire in the open areas connected by the unprotected vertical openings or smoke therefrom.

6.7.2.3 The following shall apply to high hazard industrial occupancies:

a) From every point in every floor area, there shall be at least two exits accessible in different directions; where floor areas are divided into rooms, there shall be at least two ways of escape from every room, however small rooms, except toilet rooms, so located that the points of access thereto are out of or suitably shielded from areas of high hazard.

b) In addition to types of exits for upper floors specified for Group G occupancies, slide escapes may be used as required exits for both new and existing buildings.

NOTE — All high hazard industrial occupancies shall have automatic sprinkler protection or such other protection as may be appropriate to the particular hazard, including explosion venting for any area subject to explosion hazard, designed to minimise danger to occupants in case of fire or other emergency before they have time to utilize exits to escape.

6.7.3 *Additional Precautions*

a) In any room in which volatile flammable substances are used or stored, no device generating a glow or flame capable of igniting flammable vapour shall be installed or used, such a room shall be provided with a suitably designed exhaust ventilation system (*see* Annex M).

b) For detailed information on fire safety of certain individual (specific) industrial occupancies, reference may be made to good practice [4(28)].

c) Fire protection considerations for venting industrial occupancies shall be as in Annex M.

6.8 Storage Buildings (Group H)

6.8.1 *Life Safety*

6.8.1.1 Every area used for the storage of hazardous commodities shall have an exit within 22.5 m of any point in the area where persons may be present or 35 m where automatic sprinkler protection is provided.

6.8.1.2 Every storage area or space exceeding 1 400 m^2 gross area, or where more than 10 persons may be normally present shall have at least two exit access doors leading to the corridors in exit access, which can be readily opened. This shall not be subject to locking so long as any persons are inside and shall not depend on power operation. Exits in such cases shall be as remote from each other as practicable.

For warehouses, natural draft smoke venting shall utilize roof vents or vents in walls at or near the ceiling level; such vents shall be normally open, or, if closed, shall be designed for automatic opening in case of fire, by release of smoke sensitive devices.

6.8.1.3 The following special provisions shall apply to aircraft hangers:

a) Exits from aircraft hangers (storage or servicing areas) shall be provided at intervals of not more than 45 m on all exterior walls of aircraft hangers. There shall be a minimum of two exits serving each aircraft storage or servicing areas. Horizontal exits through interior fire walls shall be provided at intervals of not more than 30 m. 'Dwarf' or 'smash'

doors accommodating aircraft may be used to comply with these requirements. All doors designated as exits shall be kept unlocked in the direction of exit travel while the area is occupied.

b) Exits from mezzanine floors in aircraft storage or servicing areas shall be so arranged that the maximum travel to reach the nearest exits from any point on the mezzanine shall not exceed 22.5 m. Such exits shall lead directly to a properly enclosed stairwell discharging directly to the exterior or to a suitably cut-off area or to outside fire escape stairs.

6.8.1.4 The following special provisions shall apply to grain elevators:

a) There shall be at least one stair tower from basement to first floor and from the first floor to the top floor of workhouse which is enclosed in a dust tight non-combustible shaft.
b) Non-combustible doors of self-closing type shall be provided at each floor landing.
c) An exterior fire escape of the stair or basket ladder type shall be provided from the roof of the workshop to ground level or the roof of an adjoining annexe with access from all floors above the first.
d) An exterior fire escape of either the stair or basket ladder type shall be provided from the roof of each storage annexe to ground level.

6.8.1.5 For provisions relating to car parking facilities, *see* Annex H.

6.8.2 *Additional Precautions*

Requirements specified in **6.7.3** (a) shall apply to Group H occupancies also.

6.9 Hazardous Uses (Group J)

6.9.1 *Life Safety*

Requirements specified in **6.7.2.3** shall apply to Group J occupancies also.

6.9.2 *Additional Precautions*

The following requirements shall apply to all Group J occupancies, as applicable:

a) Hazardous buildings shall have vapour/flame/ember/spark detectors and explosion suppression systems depending on the type of fire hazard involved.
b) Each building where gas is employed for any purpose shall be provided with an approved outside gas shut-off valve conspicuously marked. The detailed requirements regarding safe use of gas shall be as specified in Part 9 'Plumbing Services, Section 4 Gas Supply' of the Code.
c) Each boiler room or room containing a heating plant shall be separated from the rest of the building by a separating wall.
d) In any room in which volatile flammable substances are used or stored, no device generating a spark, or glow flame capable of igniting flammable vapour shall be installed or permitted unless it is enclosed in a flameproof enclosure.
e) The use, handling, storage and sale of gasoline, fuel oil and other flammable liquids shall not be permitted in Group J occupancies unless such use, handling, storage and sale is in accordance with appropriate legislation in force.
f) All openings in exterior walls except wall vents shall be protected by a fire stop assembly as in **4** and they shall be fixed, automatic or self-closing. Wall vents having an area of not less than 100 cm^2 each shall be placed in the exterior walls near the floor line, not more than 1 800 mm apart horizontally. Each building shall be provided with a power driven fan exhaust system of ventilation which shall be arranged and operated so as to produce a complete change of air in each room every 3 min.
g) Each machine in dry-cleaning establishments which uses flammable liquid shall have an adequate steam line or any other suitable extinguishing agent directly connected to it, so arranged as to have the agent automatically released to the inside of each machine should an explosion occur in the machine.
h) Equipment or machinery which generates or emits combustible or explosive dust or fibres shall be provided with an adequate dust collecting and exhaust system.

ANNEX A

(*Clause* 3.1.8)

CALORIFIC VALUES OF COMMON MATERIALS

A-1 The calorific values of some common materials are given in Table 9 for guidance.

Table 9 Calorific Values of Common Materials
(*Clause* A-1)

Sl No.	Material	Calorific Value ($\times 10^3$ kJ/kg)[1)]	Wood Equivalent (kg/kg)
(1)	(2)	(3)	(4)
i)	Solid Fuels		
	a) Anthracite	28.6	1.66
	b) Bituminous coal	30.8	1.75
	c) Charcoal	28.4	1.61
	d) Coke (average)	27.5	1.56
	e) Peat	20.9	1.19
	f) Sub-bituminous coal	22.0	1.25
	g) Woods (hard or softwood)	17.6	1.00
ii)	Hydrocarbons		
	a) Benzene	39.6	2.25
	b) Butane	47.1	2.68
	c) Ethane	49.1	2.79
	d) Ethylene	47.7	2.71
	e) Fuel oil	41.6	2.36
	f) Gas oil	42.9	2.44
	g) Hexane	44.9	2.55
	h) Methane (natural gas)	52.8	3.00
	j) Octane	45.3	2.58
	k) Paraffin	39.6-44.0	2.3-2.5
	m) Pentane	46.0	2.61
	n) Propane	47.3	2.69
	p) Propylene	46.2	2.63
iii)	Alcohols		
	a) Ethyl alcohol	28.4	1.61
	b) Methyl alcohol	21.1	1.20
	c) Propyl alcohol	31.9	1.81
iv)	Polymers		
	a) Casein	23.1	1.31
	b) Cellulose	16.5	0.94
	c) Cellulose acetate	17.8	1.01
	d) Polyethylene	48.4	2.75
	e) Polypropylene	48.4	2.75
	f) Polystyrene	41.8	2.38
	g) Polyvinylchloride	20.9	1.19
	h) Polymethyl methacrylate	24.6	1.40
	j) Polyurethane	35.2	2.00
	k) Polyamide (nylon)	22.0	1.25
	m) Polyester	22.0	1.25
v)	Common Solids		
	a) Asphalt	38.3	2.13
	b) Bitumen	33.4	1.90
	c) Carbon	32.1	1.83
	d) Cotton (dry)	15.8	0.90
	e) Flax	14.3	0.81
	f) Furs and skins	18.7	1.06
	g) Hair (animal)	20.9	1.19
	h) Leather	17.6	1.00
	j) Ozokerite (wax)	43.3	2.46
	k) Paper (average)	15.4	0.88
	m) Paraffin wax	40.9	2.33
	n) Pitch	33.0	1.88
	p) Rubber	37.4	2.13
	q) Straw	13.2	0.75
	r) Tallows	37.6	2.14
	s) Tan bark	20.9	1.19
	t) Tar (bituminous)	35.2	2.00
	u) Wool (raw)	21.6	1.23
	w) Wool (scoured)	19.6	1.11
vi)	Foodstuffs		
	a) Barley	14.1	0.80
	b) Bran	11.0	0.63
	c) Bread	9.9	0.56
	d) Butter	29.5	1.68
	e) Cheese (cheddar)	18.1	1.03
	f) Corn meal	14.1	0.80
	g) Flour	14.1	0.80
	h) Margarine	29.5	1.68
	j) Oatmeal	15.8	0.90
	k) Rice	13.9	0.79
	m) Soya been flour	16.1	0.91
	n) Sugar	15.4	0.88
	p) Whole wheat	14.3	0.81
vii)	Miscellaneous		
	a) Acetone	29.7	1.69
	b) Acetaldehyde	25.1	1.43
	c) Formaldehyde	17.6	1.00
	d) Hydrogen	134.2	7.63
	e) Magnesium	24.0	1.36

[1)] 1 kJ is approximately equal to 1 Btu so the figures in the tables are also equivalent to Btu/kg.

ANNEX B

(*Clause* 3.1.8)

BROAD CLASSIFICATION OF INDUSTRIAL OCCUPANCIES INTO DIFFERENT DEGREE OF HAZARD

Light Hazard	Moderate Hazard	High Hazard
Abrasive Manufacturing Premises	Aluminium Factories	**SUB-CATEGORY (A)**
Aerated Water Factories	*Atta* and Cereal Grinding	Aircraft Hangers
Agarbatti Manufacturing	Bakeries and Biscuit Factories	Aluminium/Magnesium Powder Plants
Areca Nut Slicing and/or Betel nut Factories	*Beedi* Factories	Bituminised Paper and/or Hessian Cloth/Tar Felt Manufacturing
Analytical and/or Quality Control Laboratories	Bobbin Factories	Cotton Waste Factories
Asbestos Steam Packing and Lagging Manufacturing	Bookbinders, Envelopes and Paper Bag Manufacturing	Celluloid Goods Manufacturing
Battery Charging/Battery Service Stations	Cable Manufacturing	Chemical Manufacturing using raw materials having flash points below 23°C
Battery Manufacturing	Camphor Boiling	Cigarette Filter Manufacturing
Breweries	Candle Works	Cinema Films and T.V. Production Studios
Brick Works	Carbon Paper/Typewriter Ribbon Manufacturing	Coal and/or Coke and/or Charcoal Ball and Briquettes Manufacturing
Canning Factories	Cardboard Box Manufacturing	Collieries
Cardamom Factories	Carpenters, Wood Wool and Furniture Manufacturing	Cotton Seed Cleaning or De-linting Factories.
Cement Factories and/or Asbestos or Concrete Products Manufacturing	Carpet and Durries Factories	Distilleries
Ceramic Factories and	Cashewnut Factories	Duplicating/Stencil Paper Manufacturing
Crockery and Stoneware Pipe Manufacturing	Chemical Manufacturing using raw materials having flash points above 23°C	Fire-works Manufacturing.
Clay Works	Cigar and Cigarette Factories	Foam Plastics Manufacturing and/or Converting Plants.
Clock and Watch Manufacturing	Coir Factories	Godowns and Warehouses (Storing Combustible/Flammable Goods).
Coffee Curing Roasting and Grinding Premises	Coir Carpets, Rugs, Tobacco, Hides and Skin Presses	Grass, Hay, Fodder and *Bhoosa* (chaff) Pressing Factories
Condensed Milk Factories, Milk Pasteurising Plant and Dairies	Cold Storage Premises	Industrial Gas Manufacturing (Other than Inert/Halogenated Hydrocarbon Gases)
Confectionery Manufacturing	Cork Products Manufacturing	Jute Mills and Jute Presses
Electric Generating Houses (Hydro electric)	Dry Cleaning, Dyeing and Laundries.	Linoleum Factories
Electric Lamps (Incandescent and Fluorescent) and TV Picture Tube Manufacturing	Electric Substations/Distribution Stations	LPG Bottling Plants (Mini)
Electro Plating Works	Electric Generating Stations (Other than Underground Power houses)	Man Made Fibres (Acrylic Fibres/yarn Manufacturing)
Engineering Workshops	Enamelware Factories	Match Factories
	Filter and Wax Paper Manufacturing	
	Flour Mills	

Light Hazard	Moderate Hazard	High Hazard
Fruits and Vegetables Dehydrating and Drying Factories	Garages	Mattress and Pillow Making
Fruit Products and Condiment Factories	Garment Makers	Metal or Tin Printers (where more than 50 Percent of floor area is occupied as Engineering Workshop; this may be taken as ordinary hazard risk)
Glass and Glass Fibre Manufacturing	Ghee Factories (Other than Vegetable)	Oil Mills
Godowns and Warehouses Storing Non-combustible Goods only	Godowns and Warehouses (Other than those Under Light and High Hazard A Categories)	Oil Extraction Plants
Green Houses	Grain and/or Seeds Disintegrating and/or Crushing Factories	Oil Terminals/Depots handling flammable Liquids having flash point of 23° C and Below
Gold Thread/Gilding Factories	Grease Manufacturing	Paints and Varnish Factories
Gum and/or Glue and Gelatine Manufacturing	Hosiery, Lace, Embroidery and Thread Factories	Paper and Cardboard Mills having raw material yards
Ice, Ice Candy and Ice-cream Manufacturing	Incandescent Gas Mantle Manufacturing	Piers, Wharves and Jetties – Handling Extra Hazardous Materials
Ink (Excluding Printing Ink) Factories	Industrial Gas Manufacturing (Inert/Halogenated hydrocarbon gases)	Printing Ink Manufacturing.
Mica Products Manufacturing	Man-made Yarn/Fibre Manufacturing (Other than Acrylic Fibres/Yarn Manufacturing)	Rosin Lamp-Black and Turpentine Factories
Pottery Works	Manure and Fertilizer Works (Blending, Mixing and granulating)	Saw Mills
Poultry Farms	Mineral Oil Blending and Processing	Sponge Iron Steel Plants (Gas Based)
Salt Crushing Factories and Refineries	Oil and Leather Cloth Factories	Surgical Cotton Manufacturing
Stables	Oil Terminals/Depots Other than those Categorised under High Hazard A	Tarpaulin and Canvas Proofing Factories
Sugar Candy Manufacturing	Open storage of Flammable Liquids in Drums, Cans, etc	Turpentine and Rosin Distilleries
Sugar Factories and Refineries	Oxygen Plants	Tyre Retreading and Resoling Factories
Tanneries/Leather Goods Manufacturers	Paper and Cardboard Mills. without Raw Material Yards	**SUB-CATEGORY (B)**
Umbrella Assembling Factories	Piers, Wharves, Jetties and Dockyards other than those Categorized Under High Hazard A	Ammonia and Urea Synthesis Plants
Vermicelli Factories	Plastic Goods Manufacturing	CNG Compressing and Bottling Plants
Water Treatment/Filtration Plants and Water Pump Houses	Plywood/Wood Veneering Factories	Coal Based Methane Plants
Zinc/Copper Factories	Printing Press Premises	Explosive Factories
		NOTE — In case of complexes having separate plants having varying degrees of hazard, authority having jurisdiction shall be consulted to decide on level of protection to be provided.

Light Hazard	Moderate Hazard	High Hazard
	Pulverising and Crushing Mills	
	Rice Mills	
	Rope Works	
	Rubber Goods Manufacturing	
	Rubber Tyres and Tubes Manufacturing	
	Shellac Factories	
	Silk Filiatures	
	Soaps and Glycerine Factories	
	Spray Painting	
	Starch Factories	
	Tea Factories	
	Textile Mills	
	Tobacco (Chewing) and Pan-Masala Making	
	Tobacco Grinding and Crushing	
	Tobacco Redrying Factories	
	Woollen Mills	

NOTE — Any occupancy that is not covered in this annex shall be classified in the most appropriate class which resembles the proposed occupancy.

ANNEX C

(*Clauses* 3.3.2 *and* 3.3.3)

AVAILABLE DATA REGARDING FIRE RESISTANCE RATING OF VARIOUS BUILDING COMPONENTS

Table 10 Masonry Walls: Solid (Required to Resist Fire from One Side at a Time)
(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm), Excluding any Finish for a Fire Resistance (min) of									
		Load Bearing					Non-load Bearing				
		60	90	120	180	240	60	90	120	180	240
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	Reinforced cement concrete[1]	120 (25)[2]	140 (25)[2]	160 (25)[2]	200 (25)[2]	240 (25)[2]	—	—	—	—	—
ii)	Unreinforced cement concrete	150	175	—	—	—	—	—	—	—	—
iii)	No-fines concrete with:										
	a) 13 mm cement/sand or gypsum/sand	—	—	—	—	—	150	150	150	150	150
	b) 13 mm light weight aggregate gypsum plaster	—	—	—	—	—	150	150	150	150	150
iv)	Bricks of clay:										
	a) Without finish	90	100	100	170	170	75	90	100	170	170
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	75	90	90	90	100
v)	Bricks of sand lime:										
	a) Without finish	90	100	100	190	190	75	90	100	170	170
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	75	90	90	90	100
vi)	Blocks of concrete:										
	a) Without finish	90	100	100	—	—	75	90	100	140	150
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	75	75	75	90	100
	c) With 13 mm cement/sand or gypsum/sand	—	—	—	—	—	75	90	90	100	140
vii)	Blocks of lightweight concrete:										
	a) Without finish	90	100	100	140	150	75	75	75	125	140
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	50	63	75	75	75
	c) With 13 mm cement/sand or gypsum/sand	—	—	—	—	—	75	75	75	90	100
viii)	Blocks of aerated concrete:										
	a) Without finish	90	100	100	140	180	50	63	63	75	100
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	100	100	150	—	—	—	—	—

[1] Walls containing at least 1 percent of vertical reinforcement.
[2] Minimum thickness of actual cover to reinforcement.

Table 11 Masonry Walls: Hollow (Required to Resist Fire from One Side at a Time)

(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm), Excluding any Finish for a Fire Resistance (Min) of										
		Load Bearing					Non-load Bearing					
		60	90	120	180	240	30	60	90	120	180	240
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	Bricks of clay:											
	a) Without finish	170	170	170	200	200	75	75	90	100	170	170
	b) With 13 mm lightweight aggregate gypsum plaster	100	100	170	170	170	75	75	90	90	90	100
ii)	Blocks of concrete:											
	a) Without finish	—	—	—	—	—	90	125	125	140	140	150
	b) With 13 mm cement/sand or gypsum/sand	—	—	—	—	—	90	125	125	140	140	140
	c) With 13 mm lightweight aggregate gypsum plaster	190	200	200	—	—	75	90	90	100	125	125
iii)	Blocks of lightweight concrete:											
	a) Without finish	100	100	100	—	—	75	90	90	100	140	150
	b) With 13 mm cement/sand or gypsum/sand	—	—	—	—	—	75	75	75	100	140	140
	c) With 13 mm lightweight aggregate gypsum plaster	—	—	—	—	—	63	63	63	75	90	100

Table 12 Framed Construction, Load Bearing (Required to Resist Fire from One Side at a Time)

(*Clause* C-1)

Sl No.	Nature of Construction and Materials/Timber Studs at Centres not Exceeding 600 mm, Faced on Each Side with	Minimum Thickness (mm) of Protection for a Fire Resistance of 60 min
(1)	(2)	(3)
i)	Plasterboard layers with joints staggered, joints in outer layer taped and filled – Total thickness for each face	25
ii)	One layer of 12.7 mm plasterboard with a finish of lightweight aggregate gypsum plaster	13
iii)	Metal lath and plaster, thickness of plaster:	
	a) Sanded gypsum plaster (metal lathing grade)	22
	b) Lightweight aggregate gypsum plaster	13

Table 13 Framed Construction, Non-Load Bearing (Required to Resist Fire from One Side at a Time)
(*Clause* C-1)

Sl No.	Nature of Construction and Materials/Steel or Timber Frame at Centres not Exceeding 600 mm, Facings on Both Sides of	Stud Construction	Minimum Thickness (mm) of Protection for a Fire Resistance of			
			30 min	60 min	90 min	120 min
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Dry lining with materials fixed direct to studs, without plaster finish:					
	a) One layer of plasterboard with taped and filled joints	Timber or steel	12.7	—	—	—
	b) Two layers of plasterboard with joints staggered, joints in outer layer taped and filled – Total thickness for each face	Timber or steel	19	25	—	—
	c) One layer of asbestos insulating board with transverse joints backed by fillers of asbestos insulating board not less than 9 mm thick, or by timber	Timber or steel	9	12	—	—
	d) One layer of wood wool slabs	Timber	25	—	—	—
	e) One layer of chipboard or of plywood	Timber or steel	18	—	—	—
ii)	Lining with materials fixed direct to suds, with plaster finish:					
	a) Plasterboard of thickness:					
	1) With not less than 5 mm gypsum plaster finish	Timber or steel	9.5	—	—	—
	2) With not less than 13 mm gypsum plaster finish	Timber or steel	—	12.7	—	—
iii)	Wet finish:					
	a) Metal lath and plaster, thickness of plaster:					
	1) Sanded gypsum plaster	Timber or steel	13	—	—	—
	2) Lightweight aggregate gypsum plaster	Timber Steel	— —	13 13	19 —	25 —

Table 14 Framed External Walls Load Bearing (Required to Resist Fire from One Side at a Time)
(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a Fire Resistance of 60 min
(1)	(2)	(3)
i)	Timber studs at centres not exceeding 600 mm with internal linings of: Plasterboard layers with joints in outer layer taped and filled, total thickness of plasterboard	31

Table 15 Framed External Walls Non-Load Bearing
[Required to Resist Fire from Inside the Building (A)]
(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a Fire Resistance of					
		30 min	60 min	90 min	120 min	180 min	240 min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Steel frame with an external cladding of non-combustible sheets (excluding sheet steel), with a steel supporting framework and internal lining of:						
	a) Metal lath and plaster, thickness of plaster:						
	1) Sanded gypsum plaster (metal lathing grade)	13	13	—	—	—	—
	2) Lightweight aggregate gypsum plaster	10	13	15	15	15	19
	b) Two layer of plasterboard with joints staggered joints in outer layer taped and filled – Total thickness	21	32	—	—	—	—
	c) Plasterboard of thickness:						
	1) With not less than 5 mm gypsum plaster finish	12.7	—	—	—	—	—
	2) With not less than 13 mm gypsum plaster finish	9.5	—	—	—	—	—
	3) With not less than 10 mm lightweight aggregate gypsum plaster	9.5	—	—	—	—	—
	d) One layer of asbestos insulating board with transverse joints backed by fillers of asbestos insulating board not less than 9 mm thick, or by timber	9	9	12	12	12	12
	e) One layer of wood/wool slabs without finish	—	50	—	—	—	—
	f) One layer of compressed straw building slabs:						
	1) Without finish	50	—	—	—	—	—
	2) With not less than 5 mm gypsum plaster finish	—	50	—	—	—	—
	g) Aerated concrete blocks	50	50	63	63	75	100
	h) Bricks of clay:						
	1) Without finish	75	75	90	90	100	100
	2) With not less than 13 mm lightweight aggregate gypsum plaster	—	—	75	75	90	90

Table 16 Framed External Walls Non-Load Bearing
[Required to Resist Fire from Inside the Building (B)]
(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection to provide Sufficient Insulation to Achieve a Modified Fire Resistance of Up to 240 min
(1)	(2)	(3)
i)	Steel frame with an external cladding of sheet steel fully lapped, steel bolted and fixed to steel sheeting rails, with timber or steel supporting framework and internal lining of:	
	a) Metal lath and plaster, thickness of plaster:	
	1) Sanded gypsum plaster (metal lathing grade)	13
	2) Lightweight aggregate gypsum plaster	10
	b) One layer of plasterboard with joints taped and filled	12.7
	c) Plasterboard of thickness with not less than 5 mm gypsum plaster finish	9.5
	d) One layer of asbestos insulating board with transverse joints backed by fillers of asbestos insulating board not less than 9 mm thick, or by timber	9
	e) One layer of wood/wool slabs	25
	f) One layer of compressed straw building slabs	50
	g) One layer of chipboard or of plywood	18
	h) Aerated concrete blocks	50
	j) Bricks of clay	75
	k) Any internal decorative lining with a cavity fill independently supported and retained in position of mineral fibre insulating material (excluding glass) at a density of 48 kg/m^3	50

Table 17 Framed Walls Non-Load Bearing
[Required to Resist Fire from Inside the Building (C)]
(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a Fire Resistance of 90 min
(1)	(2)	(3)
i)	Timber frame with external cladding of weather boarding or external plywood, 9.5 mm with an internal lining of :	
	a) Plasterboard not less than 9.5 mm thick, finished with:	
	1) Gypsum plaster	13
	2) Lightweight aggregate gypsum plaster	10
	b) Plasterboard not less than 12.7 mm thick, finished with:	
	1) Gypsum plaster	10
	2) Lightweight aggregate gypsum plaster	10
	c) One layer of asbestos insulating board with transverse joints backed by fillers of asbestos insulating board not less than 9 mm thick,	9
	or by timber	12

Table 18 Reinforced Concrete Columns
(*Clause* C-1)

Sl No.	Nature of Construction and Materials		Minimum Dimensions (mm) Excluding any Finish, for a Fire Resistance of					
			30 min	60 min	90 min	120 min	180 min	240 min
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)
i)	Fully exposed	a) Width	150	200	250	300	400	450
		b) Cover	40	40	40	40	40	40
ii)	50 percent exposed	a) Width	125	160	200	200	300	350
		b) Cover	40	40	40	40	40	40
iii)	One face exposed	a) Thickness	100	120	140	160	200	240
		b) Cover	40	40	40	40	40	40

Table 19 Concrete Beams
(*Clause* C-1)

Sl No.	Nature of Construction and Materials		Minimum Dimensions (mm) Excluding any Finish, for a Fire Resistance of					
			30 min	60 min	90 min	120 min	180 min	240 min
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)
i)	Reinforced concrete (simply supported)	a) Width	200	200	200	200	240	280
		b) Cover	20	20	20	40	60[1)]	70[1)]
ii)	Reinforced concrete (continuous)	a) Width	200	200	200	200	240	280
		b) Cover	20	20	20	30	40	50[1)]
iii)	Prestressed concrete (simply supported	a) Width	100	120	150	200	240	280
		b) Cover	25	40	55[1)]	70[1)]	80[1)]	90[1)]
iv)	Prestressed concrete (continuous)	a) Width	80	100	120	150	200	240
		b) Cover	20	30	40	55[1)]	70[1)]	80[1)]

[1)] Require attention to the additional measures necessary to reduce the risk of spalling.

Table 20 Concrete Floors
(*Clause* C-1)

Sl No.	Nature of Construction and Materials		Minimum Dimensions (mm) Excluding any Finish, for a Fire Resistance of					
			30 min	60 min	90 min	120 min	180 min	240 min
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)
i)	Reinforced concrete (simply supported)	a) Thickness	75	95	110	125	150	170
		b) Cover	20	20	25	35	45[1)]	55[1)]
ii)	Reinforced concrete (continuous)	a) Thickness	75	95	110	125	150	170
		b) Cover	20	20	20	25	35	45[1)]

[1)] Require attention to the additional measures necessary to reduce the risk of spalling.

Table 21 Concrete Floors: Ribbed Open Soffit
(*Clause* C-1)

Sl No.	Nature of Construction and Materials		Minimum Dimensions (mm) Excluding any Finish, for a Fire Resistance of					
			30 min	60 min	90 min	120 min	180 min	240 min
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)
i)	Reinforced concrete (simply supported)	a) Thickness of floor	75	95	110	125	150	170
		b) Rib width	125	125	125	125	150	175
		c) Cover	20	20	35	45[1)]	55[1)]	65[1)]
ii)	Reinforced concrete (continuous)	a) Thickness of floor	75	95	110	125	150	170
		b) Rib width	125	125	125	125	150	175
		c) Cover	20	20	20	35	45[1)]	55[1)]

[1)] Require attention to the additional measures necessary to reduce the risk of spalling.

Table 22 Encased Steel Columns, 203 mm × 203 mm
(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Dimensions (mm) Excluding any Finish, for a Fire Resistance of				
		60 min	90 min	120 min	180 min	240 min
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Hollow protection (without an air cavity over the flanges):					
	a) Metal lathing with trowelled lightweight aggregate gypsum plaster[1)]	13	15	20	32	—
	b) Plasterboard with 1.6 mm wire binding at 100 mm pitch, finished with lightweight aggregate gypsum plaster not less than the thickness specified:					
	1) 9.5 mm plaster board	10	15	—	—	—
	2) 19 mm plaster board	10	13	20	—	—
	c) Asbestos insulating boards, thickness of board:					
	1) Single thickness of board, with 6 mm cover fillets at transverse joints	—	19	25	—	—
	2) Two layers, of total thickness	—	—	—	38	50
	d) Solid bricks of clay, composition or sand lime, reinforced in every horizontal joint, unplastered	50	50	50	75	100
	e) Aerated concrete blocks	60	60	60	—	—
	f) Solid blocks of lightweight concrete	50	50	50	60	75
	Hollow protection (with an air cavity over the flanges)					

Table 22 — (*Concluded*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
ii)	Asbestos insulating board screwed to 25 mm asbestos battens	12	19	—	—	—
iii)	Solid protections:					
	a) Concrete, not leaner than 1:2:4 mix (unplastered):					
	1) Concrete not assumed to be load bearing, reinforced[2)]	25	25	25	50	75
	2) Concrete assumed to be load bearing	50	50	50	75	75
	b) Lightweight concrete, not leaner than 1:2:4 mix (unplastered): concrete not assumed to be load bearing, reinforced[2)]	25	25	25	40	60

[1)] So fixed or designed, as to allow full penetration for mechanical bond.
[2)] Reinforcement shall consist of steel binding wire not less than 2.3 mm in thickness, or a steel mesh weighing not less than 0.5 kg/m^2. In concrete protection, the spacing of that reinforcement shall not exceed 200 mm in any direction.

Table 23 Encased Steel Beams, 406 mm × 176 mm (Protection Applied on Three Sides)

(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a Fire Resistance of					
		30 min	60 min	90 min	120 min	180 min	240 min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Hollow protection (without an air cavity beneath the lower flange):						
	a) Metal lathing with trowelled lightweight aggregate gypsum plaster[1)]	13	13	15	20	25	—
	b) Plasterboard with 1.6 mm wire binding[2)] at 100 mm pitch, finished with lightweight aggregate gypsum plaster not less than the thickness specified:						
	1) 9.5 mm plaster board	10	10	15	—	—	—
	2) 19 mm plaster board	10	10	13	20	—	—
	c) Asbestos insulating boards, thickness of board :						
	1) Single thickness of board, with 6 mm cover fillets at transverse joints	—	—	19	25	—	—
	2) Two layers, of total thickness	—	—	—	—	38	50
ii)	Hollow protection (with an air cavity below the lower flange):						
	a) Asbestos insulating board screwed to 25 mm asbestos battens	9	12	—	—	—	—
iii)	Solid protection :						
	a) Concrete, not leaner than 1:2:4 mix (unplastered):						
	1) Concrete not assumed to be load bearing, reinforced[3)]	25	25	25	25	50	75
	2) Concrete assumed to be load bearing	50	50	50	50	75	75
	b) Lightweight concrete[4)], not leaner than 1:2:4 (mix) unplastered	25	25	25	25	40	60

[1)] So fixed or designed, as to allow full penetration for mechanical bond.
[2)] Where wire binding cannot be used, expert advice should be sought regarding alternative methods of support to enable the lower edges of the plasterboard to be fixed together and to the lower flange, and for the top edge of the plasterboard to be held in position.
[3)] Reinforcement shall consist of steel binding wire not less than 2.3 mm in thickness or a steel mesh weighing not less than 0.5 kg/m^2. In concrete protection, the spacing of that reinforcement shall not exceed 200 mm in any direction.
[4)] Concrete not assumed to be load bearing, reinforced.

Table 24 Timber Floors – Tongued and Grooved Boarding, or Sheets of Tongued and Grooved Plywood or Wood Chipboard, of not Less than 21 mm Finished Thickness

(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection, for a Fire Resistance of		
		30 min	60 min	120 min
(1)	(2)	(3)	(4)	(5)
i)	37 mm (minimum) timber joists with a ceiling of:			
	a) Timber lathing and plaster, plaster of thickness	15	—	—
	b) Metal lathing and plaster, thickness of plaster:			
	1) Sanded gypsum plaster (metal lathing grade)	15	—	—
	2) Lightweight aggregate gypsum plaster	13	13	25
	c) One layer of plasterboard with taped and filled joints	12.7	—	—
	d) Two layers of plasterboard with joints staggered, joints in outer layer taped and filled total thickness	19	31	—
	e) One layer of plasterboard not less than 9.5 mm thick, finished with:			
	1) Gypsum plaster	5	—	—
	2) Sanded gypsum plaster	13	—	—
	3) Lightweight aggregate gypsum plaster	13	—	—
	f) One layer of plasterboard not less than 12.7 mm thick, finished with:			
	1) Gypsum plaster	5	—	—
	2) Lightweight aggregate gypsum plaster	10	—	—
	g) One layer of asbestos insulating board with any transverse joints backed by fillets of asbestos insulating board not less than 9 mm thick, or by timber	9	12	—

Table 25 Timber Floors – Tongued and Grooved Boarding, or Sheets of Tongued and Grooved Plywood or Wood Chipboard, of not Less than 15 mm Finished Thickness

(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection for a Fire Resistance of		
		30 min	60 min	120 min
(1)	(2)	(3)	(4)	(5)
i)	37 mm (minimum) timber joists with a ceiling of:			
	a) Timber lathing and plaster, plaster of thickness	15	—	—
	b) Metal lathing and plaster, thickness of plaster for:			
	1) Sanded gypsum plaster (metal lathing grade)	15	—	—
	2) Lightweight aggregate gypsum plaster	13	13	25
	c) One layer of plasterboard with taped and filled joints	12.7	—	—
	d) Two layers of plasterboard with joints staggered, joints in outer layer taped and filled total thickness	22	31	—
	e) One layer of plasterboard not less than 9.5 mm thick, finish with:			
	1) Gypsum plaster	5	—	—
	2) Sanded gypsum plaster	15	—	—
	3) Lightweight aggregate gypsum plaster	13	—	—
	f) One layer of plasterboard not less than 12.7 mm thick, finished with:			
	1) Gypsum plaster	5	—	—
	2) Lightweight aggregate gypsum plaster	10	—	—
	g) One layer of asbestos insulating board, with any transverse joints backed by fillets of asbestos insulating board not less than 9 mm thick, or by timber	9	12[1)]	—

[1)] Finished on top with 25 mm minimum thick glass fibre or mineral wool laid between joints.

Table 26 Timber Floors – Any Structurally Suitable Flooring of Timber or Lignocelluloses Boards

(*Clause* C-1)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm) of Protection, for a Fire Resistance of	
		30 min	60 min
(1)	(2)	(3)	(4)
i)	37 mm (minimum) timber joists with a ceiling of:		
	a) Timber lathing and plaster, plaster of thickness	15	—
	b) Metal lathing and plaster, thickness of plaster for :		
	1) Sanded gypsum plaster (metal lathing grade)	15	—
	2) Lightweight aggregate gypsum plaster	13	19
	c) One layer of plasterboard with joints taped and filled and backed by timber	12.7	—
	d) Two layers of plasterboard with joints staggered, joints in outer layer taped and filled total thickness	25	—
	e) Two layers of plasterboard, each not less than 9.5 mm thick, joints between boards staggered and outer layer finished with gypsum plaster	5	—
	f) One layer of plasterboard not less than 9.5 mm thick, finish with :		
	1) Sanded gypsum plaster	13	—
	2) Lightweight aggregate gypsum plaster	15	—
	g) One layer of plasterboard not less than 12.7 mm thick, finished with :		
	1) Sanded gypsum plaster	15	—
	2) Lightweight aggregate gypsum plaster	13	—
	h) One layer of asbestos insulating board with any transverse joints backed by fillets of asbestos insulating board not less than 9 mm thick, or by timber	12	—

ANNEX D

(*Clause* 4.11)

GUIDELINES FOR FIRE DRILL AND EVACUATION PROCEDURES FOR HIGH RISE BUILDINGS

D-1 INTRODUCTION

In case of fire in a high rise building, safe evacuation of its occupants may present serious problems unless a plan for orderly and systematic evacuation is prepared in advance and all occupants are well drilled in the operation of such plan. These guidelines are intended to assist them in this task.

D-2 ALARMS

Any person discovering fire, heat or smoke shall immediately report such condition to the fire brigade, unless he has personal knowledge that such a report has been made. No person shall make, issue, post or maintain any regulation or order, written or verbal, that would require any person to take any unnecessary delaying action prior to reporting such condition to the fire brigade.

D-3 DRILLS

D-3.1 Fire drills shall be conducted, in accordance with the Fire Safety Plan, at least once every three months for buildings during the first two years. Thereafter, fire drills shall be conducted at least once every six months.

D-3.2 All occupants of the building shall participate in the fire drill. However, occupants of the building, other than building service employees, are not required to leave the floor or use the exits during the drill.

D-3.3 A written record of such drills shall be kept on the premises for a three years period and shall be readily available for fire brigade inspection.

D-4 SIGNS AND PLANS

D-4.1 Signs at Lift Landings

A sign shall be posted and maintained in a conspicuous place on every floor at or near the lift landing in accordance with the requirements, indicating that in case of fire, occupants shall use the stairs unless instructed otherwise. The sign shall contain a diagram showing the location of the stairways except that such diagram may be omitted, provided signs containing such diagram are posted in conspicuous places on the respective floor.

A sign shall read 'IN CASE OF FIRE, USE STAIRS UNLESS INSTRUCTED OTHERWISE'. The lettering shall be at least 12.5 mm block letters in red and white background. Such lettering shall be properly spaced to provide good legibility. The sign shall be at least 250 mm × 300 mm, where the diagram is also incorporated in it and 62.5 mm × 250 mm where the diagram is omitted. In the latter case, the diagram sign shall be at least 200 mm × 300 mm. The sign shall be located directly above the call-button and squarely attached to the wall or partition. The top of the sign shall not be above 2 m from the floor level.

D-4.2 Floor Numbering Signs

A sign shall be posted and maintained within each stair enclosure on every floor, indicating the number of the floor, in accordance with the requirements given below.

The numerals shall be of bold type and at least 75 mm high. The numerals and background shall be in contrasting colours. The sign shall be securely attached to the stair side of the door.

D-4.3 Stair and Lifts Identification Signs

Each stairway and each lift bank shall be identified by an alphabetical letter. A sign indicating the letter of identification shall be posted and maintained at each lift landing and on the side of the stairway door from which egress is to be made, in accordance with the requirements given in **4.4.2.4.3.2**(h)(9).

D-4.4 Stair Re-entry Signs

A sign shall be posted and maintained on each floor within each stairway and on the occupancy side of the stairway where required, indicating whether re-entry is provided into the building and the floor where such re-entry is provided, in accordance with the requirements given below.

The lettering and numerals of the signs shall be at least 12.5 mm high of bold type. The lettering and background shall be of contrasting colours and the signs shall be securely attached approximately 1.5 m above the floor level.

D-5 FIRE SAFETY PLAN

D-5.1 A format for the Fire Safety Plan shall be as given in **D-9.10.**

D-5.2 The applicable parts of the approved Fire Safety Plan shall be distributed to all tenants of the building by the building management when the Fire Safety Plan has been approved by the Fire Authority.

D-5.3 The applicable parts of the approved Fire Safety Plan shall then be distributed by the tenants to all their employees and by the building management to all their building employees.

D-5.4 In the event there are changes from conditions existing at the time the Fire Safety Plan for the building was approved, and the changes are such so as to require amending the Fire Safety Plan, within 30 days after such changes, an amended Fire Safety Plan shall be submitted to the fire brigade for approval.

D-6 FIRE COMMAND CENTRE

A Fire Command Centre shall be established in the building (*see* **3.4.12**).

D-7 COMMUNICATIONS AND FIRE ALARM

A means of communication and fire alarm for use during fire emergencies shall be provided and maintained by the owner or person in charge of the building.

D-8 FIRE SAFETY PLAN FORMAT

D-8.1 Building Address

Street and Pin Code Number……

Telephone Number……..

D-8.2 Purpose and Objective

D-8.2.1 *Purpose*

To establish method of systematic, safe and orderly evacuation of an area or building by and of its occupants in case of fire or other emergency, in the least possible time, to a safe area by the nearest safe means of egress; also the use of such available fire appliances (including sounding of alarms) as may have been provided for controlling or extinguishing fire and safeguarding of human life.

D-8.2.2 *Objective*

To provide proper education as a part of continuing employee indoctrination and through a continuing written programme for all occupants, to ensure prompt reporting of fire, the response of fire alarms as designated, and the immediate initiation of fire safety procedures to safeguard life and contain fire until the arrival of the fire brigade.

D-8.3 Fire Safety Director

a) Name
b) Regularly assigned employment — Title
c) Regularly assigned location
d) How is he notified when at regular location?
e) How is he notified when not at regular location?
f) Normal working hours
g) Duties of Fire Safety Director (*see* **D-9.1**)

D-8.4 Deputy Fire Safety Director

a) Name
b) Regularly assigned employment — Title
c) Regularly assigned location
d) How is he notified when at regular location?
e) How is he notified when not at regular location?
f) Normal working hours
g) Duties of Deputy Fire Safety Director (*see* **D-9.2**)

D-8.5 Fire Wardens and Deputy Fire Wardens

a) Are their names on organization charts for each floor and/or tenancy?
b) Submit typical completed organization chart for Fire Drill and Evacuation Assignment.
c) Duties of Fire Wardens and Deputy Fire Wardens (*see* **D-9.3**).

D-8.6 Building Evacuation Supervisor

a) Name
b) Regularly assigned employment — Title
c) Regularly assigned location
d) How is he notified when at regular location ?
e) How is he notified when not at regular location?
f) Normal working hours
g) Duties of Building Evacuation Supervisor (*see* **D-9.4**).

D-8.7 Fire Party

a) Submit a completed organization chart for Fire Parties naming person in charge, and his title in the building.
b) Indicate standards of selection from building employees based on background and availability.
c) How are they notified?
d) How are they notified when they are not at their regular locations?
e) Means of responding
f) Duties of each member of Fire Party (*see* **D-9.5**).

D-8.8 Occupants Instructions

Distribution of instructions of all tenants, tenants' employees and building employees (*see* **D-9.6)**.

D-8.9 Evacuation Drills

a) Frequency of drills
b) How conducted?
c) Participation? Who participated? How?
d) Controls and supervision
e) Recording of details of drills

D-8.10 Fire Command Station

a) Location
b) Requirements:
   1) Adequate illumination
   2) Adequate communication to mechanical equipment room and lifts control room on each floor
   3) Copy of Fire Safety Plan
   4) Copy of Building Information Form
   5) Representative floor plans showing location of signs, floor remote station, communications, etc

D-8.11 Signs

a) Signs at lifts landings, Floor diagrams
b) Floor numbering
c) Stairway identification
d) Lifts identification
e) Stair re-entry

D-8.12 Fire Prevention and Fire Protection Programme

See **D-9.7**.

D-8.13 Building Information Form

see **D-9.8**

D-8.14 Representative Floor Plan

See **D-9.9**

D-8.15 Fire Safety Plan Prepared by

See **D-9.10**

a) Date when prepared, and
b) Date when revised

D-9 DUTIES

D-9.1 Fire Safety Director's Duties

D-9.1.1 Be familiar with the written Fire Safety Plan providing for fire drill and evacuation procedure in accordance with orders on the subject.

D-9.1.2 Select qualified building service employees for a Fire Party and organize, train and supervise such fire brigade.

D-9.1.3 Be responsible for the availability and state of readiness of the Fire Party.

D-9.1.4 Conduct fire and evacuation drills.

D-9.1.5 Be responsible for the designation and training of a Fire Warden for each floor, and sufficient Deputy Fire Wardens for each tenancy in accordance with orders on the subject.

D-9.1.6 Be responsible for a daily check for the availability of the Fire Wardens, and see that up-to-date organization charts are posted.

NOTE — If the number of Fire Wardens and Deputy Fire Wardens in the building is such that it is impractical to individually contact each one daily, a suggested method to satisfy the requirements is to make provisions for the Fire Warden, or a Deputy Fire Warden in the absence of the Fire Warden, to notify the Fire Safety Director when the Fire Warden or required number of Deputy Fire Wardens are not available. In order to determine the compliance by the Fire Warden and Deputy Fire Wardens, when this method is used, the Fire Safety Director shall make a spot check of several different floors each day.

D-9.1.7 Notify the owner or some other person having charge of the building when any designated individual is neglecting his responsibilities contained in Fire Safety Plan. The owner or the other person in-charge of the building shall bring the matter to the attention of the firm employing the individual. If the firm fails to correct the condition, the fire department shall be notified by the owner/person in charge of the building.

D-9.1.8 In the event of fire, shall report to the fire command centre to supervise, provide for and coordinate with respect to the following:

a) Ensuring that the fire department has been notified of any fire or fire alarm.
b) Manning of the fire command station.
c) Direction of evacuating procedures as provided in the Fire Safety Plan.
d) Report on conditions on fire floor for information of fire department on their arrival.
e) Advising the fire department officer in-charge in the operation of the Fire Command Centre.

D-9.1.9 Be responsible for the training and activities of the Building Evacuation Supervisor.

D-9.2 Deputy Fire Safety Director's Duties

a) He is the subordinate to the Fire Safety Director.
b) He shall perform duties of Fire Safety Director in his absence.

D-9.3 Fire Warden's and Deputy Fire Warden's Duties

The tenant or tenants of each floor shall, upon request of the owner or person in charge of buildings, make responsible and dependable employees available for

designation by the Fire Safety Director as Fire Warden and Deputy Fire Wardens.

D-9.3.1 Each floor of a building shall be under the direction of a designated Fire Warden for the evacuation of occupants in the event of fire. He shall be assisted in his duties by the Deputy Fire Wardens. A Deputy Fire Warden shall be provided for each tenancy. When the floor area of a tenancy exceeds 700 m^2 of occupiable space, a Deputy Fire Warden shall be assigned for each 700 m^2 or part thereof.

D-9.3.2 Each Fire Warden and Deputy Fire Warden shall be familiar with the fire safety plan, the location of exits and the location and operation of any available fire alarm system.

D-9.3.3 In the event of fire, or fire alarm the Fire Warden shall ascertain the location of the fire, and direct evacuation of the floor in accordance with directions received and the following guidelines:

a) The most critical areas for immediate evacuation are the fire floor and floors immediately above. Evacuation from the other floors shall be instituted when instructions from the fire Command Centre or conditions indicate such action. Evacuation shall be *via* uncontaminated stairs. The Fire Warden shall try to avoid stairs being used by the Fire department. If this is not possible, he shall try to attract the attention of the Fire department personnel before such personnel open the door to the fire floor.

b) Evacuation to two or more levels below the fire floor is generally adequate. He shall keep the fire command station informed regarding his location.

c) Fire Wardens and their deputies shall see that all occupants are notified of the fire, and that they proceed immediately to execute the Fire Safety Plan.

d) The Fire Warden on the fire floor shall, as soon as practicable, notify the Fire Command Centre of the particulars.

e) Fire Wardens on floors above the fire shall, after executing the Fire Safety Plan, notify the Fire command station of the means being used for evacuation and any other particulars.

f) In the event that stairways serving fire floor and/or floors above are unusable due to contamination or cut-off by fire and/or smoke or that several floors above fire involve large numbers of occupants who must be evacuated, consideration may be given to using lifts in accordance with the following:

   1) If the lifts servicing his floor also service the fire floor, they shall not be used. However, lifts may be used if there is more than one bank of lifts, and he is informed from the Fire Command Centre that one bank is unaffected by the fire.

   2) If lifts do not service the fire floor and their shafts have no openings on the fire floor, they may be used, unless directed otherwise.

   3) Lifts manned by trained building personnel or firemen may also be used.

   4) In the absence of a serviceable lift, the Fire Warden shall select the safest stairway to use for evacuation on the basis of the location of the fire and any information received from the Fire Command Centre. The Fire Warden shall check the environment in the stairs prior to entry for evacuation. If it is affected by smoke, alternative stair shall be selected, and the Fire Command Centre notified.

   5) The Fire Warden shall keep the Fire Command Centre informed of the means being employed for evacuation by the occupants of his floor.

g) Ensure that an alarm has been transmitted.

D-9.3.4 *Organization Chart for Fire Drill and Evacuation Assignment*

A chart designating employees and their assignments shall be prepared and posted in a conspicuous place in each tenancy and on each floor of a tenancy that occupies more than one floor and a copy shall be in the possession of the Fire Safety Director.

D-9.3.5 Keep available an updated listing of all personnel with physical disabilities who cannot use stairs unaided. Make arrangements to have these occupants assisted in moving down the stairs to two or more levels below fire floor. If it is necessary to move such occupants to a still lower level during the fire, move them down the stairs to the uppermost floor served by an uninvolved lifts bank and then evacuate them to the street floor by lifts. Where assistance is required for such evacuation, notify Fire Safety Director.

D-9.3.6 Provide for Fire Warden identification during fire drills and fires, such as using armband, etc.

D-9.3.7 Ensure that all persons on the floor are notified of fire and all are evacuated to safe areas. A search must be conducted in the lavatories to ensure all are out. Personnel assigned as searchers can promptly and efficiently perform this duty.

D-9.3.8 Check availability of applicable personnel on organization chart and provide for a substitute when the position on a chart is not covered.

D-9.3.9 After evacuation, perform a head count to ensure that all regular occupants known to have occupied the floor have been evacuated.

D-9.3.10 When alarm is received, the Fire Warden shall remain at a selected position in the vicinity of the communication station on the floor, in order to maintain communication with the Fire Command Centre and to receive and give instructions.

D-9.4 Building Evacuation Supervisor's Duties

A Building Evacuation Supervisor is required at all times other than normal working or business hours when there are occupants in the building and there is no Fire Safety Director on duty in the building.

D-9.4.1 He should be capable of directing the evacuation of the occupants as provided by the Fire Safety Plan.

D-9.4.2 During fire emergencies, the primary responsibility of the Building Evacuation Supervisor shall be to man the Fire Command Centre, and the direction and execution of the evacuation as provided in the Fire Safety Plan. The Building Evacuation Supervisor's training and related activities shall be under the direction of the Fire Safety Director in accordance with these rules, and the Fire Safety Plan. Such activities shall be subject to fire department control.

D-9.5 Fire Party Duties

On receipt of an alarm for fire, the Fire Party shall,

a) report to the floor below the fire to assist in evacuation and provide information to the Fire Command Centre.

b) after evacuations of fire floor, endeavour to control spread of fire by closing doors, etc.

c) attempt to control the fire until arrival of the fire department, if the fire is small and conditions do not pose a personal threat.

d) leave one member on the floor below the fire to direct the fire department to the fire location and to inform them of conditions.

e) on arrival of the fire department, the Fire Party shall report to the Fire Command Centre for additional instructions.

f) have a member designated as runner, who shall know the location of the nearest telephone, and be instructed in its use. Such member shall immediately upon receipt of information that there is a fire or evidence of fire, go to the telephone, transmit an alarm and await the arrival of the fire department and direct them to the location of the fire.

NOTE — A chart designating employees and their assignments shall be prepared.

D-9.6 Occupant's Instructions

a) The applicable parts of the approved Fire Safety Plan shall be distributed to all tenants of the building by the building management when the Fire Safety Plan has been approved by the Fire Commissioner.

b) The applicable parts of the approved Fire Safety Plan shall then be distributed by the tenants to all their employees and by the building management to all their building employees.

c) All occupants of the building shall participate and cooperate in carrying out the provisions of the Fire Safety Plan.

D-9.7 Fire Prevention and Fire Protection Programme

a) A plan for periodic formal inspections of each floor area, including exit facilities, fire extinguishers and housekeeping shall be developed. A copy of such plan be submitted.

b) Provision shall be made for the monthly testing of communication and alarm systems.

D-9.8 Building Information Form

It shall include the following information:

a) Building address……Pin Code…..

b) Owner or person in-charge of building — Name, Address and Telephone Number.

c) Fire Safety Director and Deputy Fire Safety Director's Name and Telephone Number.

d) Certificate of occupancy. Location where posted, or duplicate attached.

e) Height, area, class of construction.

f) Number type and location of fire stairs and/ or firefighting shaft.

g) Number, type and location of horizontal exits or other areas of refuge.

h) Number, type, location and operation of lifts and escalators.

j) Interior fire alarms, or alarms to central stations.

k) Communications systems and/or walkie-talkie, telephones, etc.

m) Standpipe system; size and location of risers, gravity or pressure tank, fire pump, location of siamese connections, name of employee with certificate of qualification and number of certificate.

n) Sprinkler system; name of employee with Certificate of Fitness and certificate number. Primary and secondary water supply, fire pump and areas protected.

p) Special extinguishing system, if any, components and operation.

q) Average number of persons normally employed in building (Daytime and night time).

r) Average number of persons with disabilities in building and their location (Daytime and night time).

s) Number of persons normally visiting the building (Daytime and night time).

t) Service equipment such as:
   1) Electric power, primary, auxiliary;
   2) Lighting, normal, emergency, type and location;
   3) Heating, type, fuel, location of heating unit;
   4) *Ventilation* — with fixed windows, emergency means of exhausting heat and smoke;
   5) *Air conditioning systems* — Brief description of the system, including ducts and floors serviced;
   6) Refuse storage and disposal;
   7) Firefighting equipment and appliances, other than standpipe and sprinkler system; and
   8) Other pertinent building equipment.

u) Alternations and repair operations, if any, and the protective and preventive measures necessary to safeguard such operations with attention to torch operations.

w) Storage and use of flammable solids, liquids and/or gases.

y) Special occupancies in the building and the proper protection and maintenance thereof. Places of public assembly, studios, and theatrical occupancies.

D-9.9 Representative Floor Plan

A floor plan, representative of the majority or the floor designs of the entire building, shall be at the Command Post, in the main lobby, under the authority of the Fire Safety Director. One copy of a representative floor plan shall be submitted to the Fire department with the Fire Safety Plan.

D-9.10 Fire Safety Plan

In planning, evaluate the individual floor layouts, the population of floors, the number and kinds of exits, the zoning of the floor by area and occupants. Determine the movement of traffic by the most expeditious route to an appropriate exit and alternative route for each zone, since under fire conditions one or more exits may not be usable. This format should be used in the preparation of the Fire Safety Plan. Nothing contained in this Fire Safety Plan format shall be construed as all inclusive. All rules and other requirements shall be fully complied with.

D-9.11 Personal Fire Instruction Card

All the occupants of the building shall be given a Personal Fire Instruction Card giving the details of the floor plan and exit routes along with the instruction to be followed in the event of fire. A typical Personal Fire Instruction Card shall be as follows:

PERSONAL FIRE INSTRUCTION CARD

SEAL

NAME OF THE ORGANIZATION

ADDRESS OF THE ORGANIZATION

NAME:_____

DESIGNATION:_____

FLOOR NO. : _____

DATE : _____

FIRE WARDEN

INSTRUCTIONS

FOR YOUR OWN SAFETY YOU SHOULD KNOW

1. Two push button fire alarm boxes are provided per floor. You should read the operating instructions.
2. You should read the operating instructions on the body of the fire extinguishers provided on your floor.
3. The nearest exit from your table.
4. Your assembly point on ground floor (check with your Fire/Deputy Fire Warden).
5. FOR YOUR OWN PROTECTION YOU SHOULD REPORT TO YOUR FIRE/ DEPUTY FIRE WARDEN
   a) If any exit door/route is obstructed by loose materials, goods, boxes, etc.
   b) If any staircase door, lift lobby door does not close automatically, or does not close completely.
   c) If any push button fire alarm point, or fire extinguisher is obstructed, damaged or apparently out of order.

IF YOU DISCOVER A FIRE

1) Break the glass of the nearest push button fire alarm and push the button.
2) Attack the fire with extinguishers provided on your floor. Take guidance from your Wardens.
3) Evacuate, if your Warden asks you to do so.

IF YOU HEAR EVACUATION INSTRUCTIONS

1) Leave the floor immediately by the nearest staircase as directed.
2) Report to your Warden, at your predetermined assembly point outside the building.
3) Do not try to use lifts.
4) Do not go to cloakroom.
5) Do not run or shout.
6) Do not stop to collect personal belongings.
7) Keep the lift lobby and staircase doors shut.

YOUR ASSEMBLY POINT IS …….

ANNEX E

(*Clauses* 5.1.4 *and* 6)

ADDITIONAL REQUIREMENTS FOR HIGH RISE BUILDINGS

E-1 GENERAL

High rise buildings (15 m and above in height) shall receive special attention with respect to fire and life safety particularly with regard to planning, design, execution, maintenance and training so that the intended provisions of this Code are well implemented. These get further accentuated as the buildings go taller; some of the key aspects are as follows:

a) Staging and evacuation requirements of occupants.
b) Stack effect posing challenges towards pressurization and smoke exhaust.
c) Zoning of firefighting system to meet functional requirements of hydraulic pressure and flow.
d) Challenges experienced by fire personnel in reaching the place of fire and towards evacuation.

Aspects to mitigate these challenges require innovative approach, interaction with local fire authorities and meaningful strategic planning towards maintenance and fire drills.

E-2 EGRESS AND EVACUATION STRATEGY

One firefighting shall be planned for each residential building/tower, in an educational building/ block, and for each compartment of institutional, assembly, business and mercantile occupancy types. For other occupancy types, requirement of firefighting shaft shall be ascertained in consultation with the local fire authority. The firefighting shaft shall necessarily have connectivity directly to exit discharge or through exit passageway (having 120 min fire resistance walls) to exit discharge.

Staircase and fire lift lobby of a firefighting shaft shall be smoke controlled as per **4.4.2.5** and Table 6.

It is recommended that the pressurization requirement for staircase in firefighting shaft and for other fire exit staircases in buildings greater than 60 m in height be evaluated to limit the force required to operate the door assembly (in the direction of door opening) to not more than 133 N to set the door leaf in motion. The aspect of pressurization, door area/width and door closure shall be planned in consideration to the above.

E-3 FIRE SAFETY REQUIREMENTS FOR LIFTS

The provisions as given in **7.1** to **7.2.4** under fire safety requirements of lifts in high rise buildings in Part 8 'Building Services, Section 5 Installation of Lifts, Escalators and Moving Walks, Subsection 5A Lifts' of the Code shall be applicable.

E-4 HORIZONTAL EXITS/REFUGE AREA

A horizontal exit shall be through a fire door of 120 min rating in a fire resistant wall. Horizontal exit require separation with the refuge area or adjoining compartment through 120 min fire barrier. The adjoining compartment of the horizontal exit should allow unlocked and ease of egress and exits for the occupants using defend in place strategy.

Requirements of horizontal exits are as under:

a) Width of horizontal exit doorway shall be suitable to meet the occupant load factor for egress.

b) Doors in horizontal exits shall be openable at all times from both sides.

c) All doors shall swing in the direction of exit travel. For horizontal exits, if a double leaf door is used, the right hand door leaf shall swing in the direction of exit travel.

d) Refuge area shall be provided in buildings of height more than 24 m. Refuge area provided shall be planned to accommodate the occupants of two consecutive floors (this shall consider occupants of the floor where refuge is provided and occupants of floor above) by considering area of 0.3 m^2 per person for the calculated number of occupants and shall include additionally to accommodate one wheelchair space of an area of 0.9 m^2 for every 200 occupants, portion thereof, based on the occupant load served by the area of refuge or a minimum of 15 m^2, whichever is higher, shall be provided as under:

   1) 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.

   2) Refuge area(s) shall be provided at/or immediately above 24 m and thereafter at every 15 m or so.

   The above refuge area requirement for D-6 occupancy requirement shall however be in accordance with **6.4.2.2.**

e) A prominent sign bearing the words 'REFUGE AREA' shall be installed at the entry of the refuge area, having height of letters of minimum 75 mm and also containing information about the location of refuge areas on the floors above and below this floor. The same signage shall also be conspicuously located within the refuge area.

f) Each refuge area shall be ventilated and provided with first aid box, fire extinguishers, public address speaker, fire man talk back, and adequate emergency lighting as well as drinking water facility.

g) Refuge areas shall be approachable from the space they serve by an accessible means of egress.

h) Refuge areas shall connect to firefighting shaft (comprising fireman's lift, lobby and staircase) without having the occupants requiring to return to the building spaces through which travel to the area of refuge occurred.

j) The refuge area shall always be kept clear. No storage of combustible products and materials, electrical and mechanical equipment, etc shall be allowed in such areas.

k) Refuge area shall be provided with adequate drainage facility to maintain efficient storm water disposal.

m) Entire refuge area shall be provided with sprinklers.

n) Where there is a difference in level between connected areas for horizontal exits, ramps of slope not steeper than 1 in 12 shall be provided (and steps should be avoided).

NOTE — Refuge area provided in excess of the requirements shall be counted towards FAR.

High rise apartment buildings with apartments having balcony, need not be provided with refuge area; however apartment buildings without balcony shall provide refuge area as given above. Refuge areas for apartment buildings of height above 60 m while having balconies shall be provided at 60 m and thereafter at every 30 m. The refuge area shall be an area equivalent to 0.3 m^2 per person for accommodating occupants of two consecutive floors, where occupant load shall be derived on basis of 12.5 m^2 of gross floor area and additionally 0.9 m^2 for accommodating wheel chair requirement or shall be 15 m^2, whichever is higher.

E-5 ELECTRICAL SERVICES

The specific requirements for electrical installations in multi-storeyed buildings given in Part 8 'Building Services, Section 2 Electrical and Allied Installations' of the Code and Section 7 of National Electrical Code 2011 shall be followed.

Wherever transformers are planned at higher floors, the HT cables shall be routed through a separate shaft having its own fire resistance rating of 120 min. Wherever HT generators are planned centrally at ground or first basement level, redundant transformers and HT cables shall be planned for buildings above 60 m in height.

E-6 FIRE PROTECTION

For residential occupancies above 120 m in height and other occupancies above 60 m in height, the sprinklers shall be fed from the main and an alternate/standby riser with suitable isolation valves. The entire sprinkler system shall be designed in accordance with good practice [4(20)].

Where the height of the building exceeds 150 m to 175 m, fire water static storage and pumps shall be required to be provided at 160 m to 180 m and thereafter at intermediate floors at higher levels enabling efficient and functional firefighting installations. The static fire

water storage tanks located at such levels shall have capacity at minimum half of the storage of underground static water storage tank prescribed in Table 7. Such tanks shall be supplemented with water supplies through one working and one standby pump of capacity 2 850 litre/min with two risers at alternate locations feeding to such fire water static storage tanks. The fire pump's requirement and capacity shall also be derived for occupancy type as per Table 7 substituting the diesel pump with electrical pump. The fire pump room at such level shall have dedicated connectivity through passageway (with 120 min integrity) from the firefighting shaft. Such fire pump room shall have 120 min fire resisting wall and provided with adequate ventilation with talk-back connectivity to the main fire pump room and Fire Command Centre.

For high rise buildings, seismic bracings shall be considered for firefighting installations depending on seismic vulnerability of the region and the type of occupancy.

E-7 FIRE AND LIFE SAFETY AUDIT

a) Fire and life safety audit shall be carried out for all buildings having a height of more than 15 m.

b) Such audits shall preferably be conducted by a third party auditor having requisite experience in fire and life safety inspections.

c) Frequency of such audits shall be once in two years.

E-8 HELIPAD

For high rise buildings above 200 m in height, provision for helipad is recommended for specific requirements like landing of fire equipment, and support facilities or other emergencies.

ANNEX F

(*Clause* 6)

ATRIUM

F-1 ATRIUM REQUIREMENTS

a) In order for an atrium to be permitted in buildings, the following shall be complied:

   1) Atrium shall be permitted in buildings of Type 1 and Type 2 construction only.

   2) The use of combustible furnishings and decorations on the floor of the atrium shall be limited and sparsely distributed.

b) Smoke detectors shall be provided on the underside of each floor protruding into the atrium, at the atrium roof and adjacent to each return air intake from the atrium. Within atrium space, beam type or aspirating type smoke detectors shall be used to ensure detection of smoke, considering factors such as stratification of smoke.

c) Where the ceiling of the atrium is more than 17 m above the floor, water based protection (automatic sprinklers) at the ceiling of atrium is not required.

d) Hydrants shall be available at the floor of the atrium and also at the adjoining upper spaces/floors of the atrium.

   Sprinklers are required to be installed for coverage of glass areas of retail, tenant and other areas adjoining the exit access corridor and atrium. Sprinklers shall be at a distance of 450 mm to 600 mm enabling cooling of such glass and limiting the extent of fire and smoke to the atrium (*see* Fig. 16). This provision does not allow similar sprinkler installation arrangement to offset fire compartmentation requirements, in which case fire barrier is required as per relevant provisions of this Part.

e) Atrium in business occupancy shall be planned with 6 air changes per hour (ACPH) while atrium in hotels and assembly occupancy shall be planned with 8 ACPH smoke extraction system.

   Such air changes shall be planned in atrium for a height of 15 m from the top.

f) Smoke exhaust fans shall be capable of operating effectively at 250°C for 120 min.

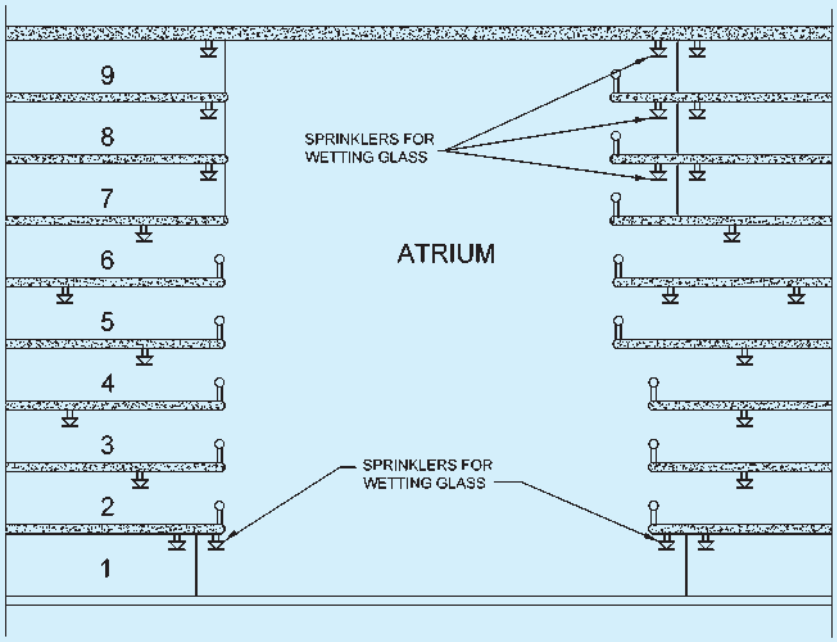


FIG. 16 SPRINKLER PROTECTION OF GLASS FOR FLOOR OPEN TO ATRIUM

g) Makeup air supply points shall be located beneath the smoke layer and on the lower levels connected by the atrium.

h) Makeup air shall be provided by fans, openings to outside to allow infiltration, or the combination thereof.

j) It is recommended that makeup air be designed at 85 percent to 95 percent of the exhaust flow rate, not including the leakage through these small paths.

k) The makeup air shall not cause door-opening force to exceed allowable limits.

m) The makeup air velocity shall not exceed 1.02 m/s where the makeup air could come into contact with the plume unless a higher makeup air velocity is supported by engineering analysis.

n) Atrium smoke management system fans shall be provided with emergency power.

p) If so required by the Authority, an engineering analysis should be performed which demonstrates that the smoke system for the atrium is designed to keep the smoke layer interface 1 800 mm above the highest occupied floor level of exit access, open to the atrium, for a period equal to 1.5 times the calculated egress time or 20 min, whichever is greater.

ANNEX G

(*Clause* 6)

COMMERCIAL KITCHENS

G-0 GENERAL

The provisions given herein are applicable to those commercial kitchens serving in centrally air conditioned buildings such as kitchens of starred hotels, food courts, malls, banquet halls and restaurants.

Electricity, gas and in some cases solid fuels such as wood or charcoal are the energy sources used to power a commercial kitchen.

The potential hazards posed by the commercial cooking facilities are as follows:

a) *On cooking appliances using oil as fuel* — The oil can self-ignite due to overheating of the cooking appliances or through open flames.

b) Full grease residues trapped in the hoods due to non-cleaning of filters and dusts periodically and exhaust ventilation system can ignite through overheated air flues or open flames.

c) Faulty electrical equipment and electrical installation are more likely to spark, and failure of thermostat and safety switches that may lead to overheat and consequent fire.

d) Flammable materials in the vicinity of open flames or heat sources

G-1 TERMS ASSOCIATED WITH COOKING OPERATIONS

a) *Types of restaurants/food preparation facilities* — Buffet restaurants, cafeterias, coffee shops, entertainment facilities (nightclubs, dinner theatres), and ethnic, fast food, speciality and traditional restaurants, corporate canteens, casinos, educational facilities, schools and universities, hospitals, care homes, mental homes and prisons.

b) *Ventilation/grease extraction equipment* — Exhaust hoods, grease removal devices, exhaust ductwork, exhaust fans, dampers and other ancillary components or systems that are involved in the capture, containment, and control of grease-laden cooking effluent.

c) *Cooking appliances* — Ranges, deep fat fryers, microwave ovens, griddles, grills, pressurized fryers, potato chip fryers, woks, broilers, doughnut fryers, barbecue/smokers, ovens, *Tandoors*, steam kettles, appliances initializing grease and cooking oils, etc.

G-2 FIRE PROTECTION SYSTEMS

a) A kitchen fire suppression system needs to be installed whenever cooking appliances are using LPG/PNG/oil/electricity and/or dry fuel like wood or charcoal for cooking and/or can ignite the exhaust or fat for cooking and/or can ignite the ventilation system. Cooking equipment that produces grease-laden vapours and that might be a source of ignition of grease in the hood, grease removal device, or duct shall be protected by fire-suppression equipment.

b) The initial fire hazard is the cooking appliance itself. However, once the exhaust ventilation system is involved in fire due to propagation from the appliances, the exhaust system becomes the more severe hazard due to the potential of fire propagation outside the cooking space.

c) The requirement for kitchen fire suppression systems shall be directly linked to measurements that actually represent the risk. Some other contributory factors could be but not necessarily — connected load (kW), area occupied by kitchen equipment, volume of cooking oil and other flammables, inter distances between equipment, cooking media, etc.

d) Grease laden hoods can be ignited by heat penetrating the outside of the kitchen hood. Any penetration to the outside of a hood, shall be either welded or fitted with an approved sealing device so as not to allow cooking grease and oil to migrate to the outer portion of the hood.

e) If sprinkler protection is specified for a building, it needs careful consideration of the likely consequences if certain portion of the building is omitted from the scope of protection, for example, no water should get on the cooking appliances (especially the fryer). Removing this protection from a high hazard area logically requires this area to be protected by a more suitable solution, dedicated to this special hazard.

G-3 FIRE SEPARATION REQUIREMENTS

a) Where a kitchen is required for the preparation of food and/or where 'open flame' cooking appliances are used and/or where fryers

(with no open flames) are used, the kitchen shall be separated from other parts of the same building by compartment wall and floor having fire resistance of at least 60 min.

b) Food serving areas shall be fire separated from the kitchens/cooking areas by fire rated elements having a resistance of at least 60 min. Doors shall have fire resistance of 60 min rating and fitted with automatic self-closing device.

c) In open type kitchen cooking area, sitting area needs to be segregated by 60 min fire rated glass or drop fire curtains [*see also* **G-3**(d) and **G-5.2**(b)].

d) Where the flue or exhaust duct passes through the compartment wall or floor, the flue or duct shall be encased by non-combustible construction and no damper shall be permitted to be installed in such flue or duct. Also such flue or ductwork shall be clear from combustible materials.

e) If the commercial kitchen/cooking is situated in a building that is not sprinkler protected, the floor area of the kitchen/cooking shall not exceed 50 m^2.

f) Commercial kitchen/cooking using LPG as fuel for the 'open flame' cooking activities shall not be allowed to be located at the basements. As regards LPG cylinder storage, attention is drawn to good practice [4(14)] and Part 8 'Building Services, Section 2 Electrical and Allied Installations' of the Code for compliance requirements

g) It is advisable to locate the kitchen/cooking operations on the external periphery of the building so that in the event of mechanical ventilation failure, it can be naturally ventilated.

G-4 Life safety and egress requirements shall be governed by the requirements under life safety (*see* **4**). In case the requirements under this annex differs from those under **4**, this annex shall take precedence.

G-5 FIRE SAFETY REQUIREMENTS

G-5.1 General

a) The following equipment must always be kept in working condition:

1) Cooking equipment,
2) Hoods,
3) Exhaust ducts (if provided),
4) Fans,
5) Fire extinguishing systems,
6) Fire detection and alarm system, and
7) Gas leakage detectors (if gas is used as fuel).

b) An automatic fixed suppression system shall be installed to protect all cooking equipment producing grease laden vapours and that might be a source of ignition of grease in the hood, grease removal device.

c) Fire-suppression equipment shall be provided for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems.

d) All fire suppression systems and components installed shall be in accordance with relevant Indian and/or International Standards.

G-5.2 Protection of Cooking Equipment (General)

a) Cooking equipment shall be protected with the following:

1) Automatic wet chemical fire suppression system for the protection of hoods (OR) other equivalent approved systems like water mist applications for kitchen fires.
2) Automatic sprinkler system for non-cooking areas (not in the vicinity of cooking areas or inside hoods).
3) Exhaust ducts shall be protected by automatic high temperature sprinklers designed as per good practice [4(20)].

b) Due diligence shall be exercised before considering protection with sprinkler/water mist installation particularly for the protection of fryers. No sprinklers shall be provided within 3 m of cooking equipment and kitchen hoods. Area sensitive to sprinklers shall be protected with wet chemical suppression systems or other approved systems for the type of protection. Water mist systems, if approved for use for the type of application (that is, commercial cooking equipment) by fire tests, may also be considered.

c) Kitchen hoods independent suppression systems shall discharge wet chemicals to all areas of a kitchen range extract hood that is potentially coated in grease. The system shall also discharge over deep fat cooking pans or other potential fire source. The system shall be activated by heat detectors located above the appliances/within hoods and in the entrance to exhaust duct. Additional detectors behind equipment in the duct may be

necessary. These may be of fusible link type. Extinguishing systems shall also incorporate manually actuating devices which shall be located in easily accessible locations in the means of egress.

d) The operational sequence shall be as follows:
   1) On detection of fire in the hood and upon actuation of fire suppression system, any power or gas supplies serving the kitchen equipment must be cut-off and isolated automatically.
   2) Pressure regulating stations shall be designed and installed at critical locations for excess flow shut off valves.
   3) Seismic shut off valve at the main distribution point shall also be provided.
   4) The exhaust fan shall not stop and continue operating, even after activation of the system. The supply fan shall switch off.
   5) Gas leakage detectors shall be provided in all kitchens that link to a gas solenoid valve for emergency shut off. Suitable gas detection system (based on type of gas used LPG or PNG) integrated with fire detection and alarm system must be provided in addition to heat/multi-criteria detectors and sprinklers.
   6) Manually operating devices shall immediately activate fire suppression system, which in turn shall shut off other systems like fuel supply/power supply, etc. Manual system shall operate mechanically and not rely on electrical power for activation, unless this is from an emergency power source as described in this Code.
   7) In the event of the kitchen hood system being activated, an alarm should be sounded. The system must also be interfaced with the fire detection and alarm system.

e) Fire extinguishers in the vicinity of cooking area and the hoods shall be suitable for the type of fire.

G-5.3 Cooking Equipment Exhaust Ventilation

a) Hoods/ducts containing automatic fire suppression systems are protected areas; therefore, these hoods are not considered obstructions to overhead sprinkler systems and shall not require floor coverage underneath thereof.

b) Sprinkler installation shall comply with various provisions contained in accepted standard [4(28)]. The temperature rating of sprinklers shall be so selected that it is 30°C above the anticipated maximum temperature within cooking/kitchen areas. Sprinklers provided inside the exhaust ducts shall be of 141°C temperature.

c) Provision of cleaning of the kitchen exhaust every six months to ensure that the carbon soot accumulated in the exhaust duct is cleaned to avoid the chances of outbreak of fire shall be made.

d) Independent exhaust ducts shall be provided for equipment using dry fuel like wood/ charcoal which produce spark and are likely to ignite the grease which might have accumulated in the common duct. Alternatively, approved spark arrestors may be provided before the duct from equipment using dry fuel meets the main duct. These spark arrestors shall be so provided that these are easily accessible and removable for cleaning.

G-5.4 Cooking Equipment

a) Cooking equipment (such as deep fat fryers, rangers, griddles, and broilers) that may be a source of ignition shall be provided in accordance with the provision of **G-5.2**(a).

b) The operation of any sprinkler within the kitchen or cooking area shall automatically shut off all sources of fuel and heat to all equipment requiring protection. Any gas appliance not requiring protection but located under ventilating equipment shall also be shut off. All shutdown devices shall be of the type that requires manual resetting prior to fuel or power being restored.

c) An approved indicating valve (flow indicating switch) shall be installed in the water supply line feeding to the sprinklers protecting the cooking and extraction ventilating system.

d) A system test connection shall be provided to verify proper operation of equipment specified in item **G-5.2**(d)(4).

e) Sprinklers shall be inspected at least twice in a year and cleaned, if found coated with grease and other particles during their use and thus their thermal sensing elements desensitized.

f) Any penetrations to the outside of a hood, be either welded or fit with a sealing device (certified by national/international approval bodies) to not allow cooking grease, oil to migrate to the outer portion of the hood. The fitment arrangements shall be of approved type. Gaskets for the panels shall be certified to withstand a temperature of 815.6°C (1 500°F).

g) Grease strip shall be readily available for efficient and regular cleaning of concrete or paved floors of kitchen and restaurant and also the drainage areas.

h) The hood or that portion of a primary collection means designed for collecting cooking vapours and residues shall be constructed of and be supported by steel not less than 1.09 mm (No. 18 MSG) in thickness or stainless steel not less than 0.94 mm (No. 20 MSG) in thickness or other approved material of equivalent strength and fire and corrosion resistance.

j) All seams, joint, and penetrations of the hood enclosure that direct and capture grease-laden vapours and exhaust gases shall have a liquid tight continuous external weld to the hood's lower outermost perimeter.

k) Grease filters shall be of steel rigid construction that will not distort or crush under normal operation handling and cleaning conditions. They shall be so arranged that all exhaust air passes through the grease filters. Filters shall be easily accessible and removable for periodic cleaning.

m) Grease filters shall be installed at an angle not less than 45° from the horizontal.

n) Grease filters shall be equipped with a grease drip tray beneath their lower edges and shall have a suitable minimum depth needed to collect grease. The grease drip trays shall be pitched to drain into an enclosed metal container having a capacity not exceeding 3.8 litre.

p) The exhaust ducts shall be constructed of and supported by carbon steel not less than 1.37 mm (No. 16 MSG) in thickness or stainless steel not less than 1.09 mm (No. 18 MSG) in thickness.

G-5.5 Rooftop Terminations — Exhaust Systems

a) The exhaust system shall terminate either outside the building with a fan or duct or through the roof or to the roof from outside with minimum 3 m of horizontal clearance from the outlet to the adjacent buildings, property lines and air intakes.

b) There shall be a minimum of 1.5 m of horizontal clearance from the outlet (fan housing) to any combustible structure.

c) There shall be a vertical separation of 1.0 m below any exhaust outlets for air intakes within 3.0 m of the exhaust outlet.

ANNEX H

[*Clauses* 6.4.2.2 *and* 6.8.1.5]

CAR PARKING FACILITIES

H-1 The provisions given in **H-2** to **H-5** shall apply to parking structures of the closed or open type, within buildings above or below grade.

H-2 GENERAL

a) Where both parking and repair operations are conducted in the same building, the entire building shall comply with the requirements for Group G occupancies, unless the parking and repair sections are effectively separated by separation walls of 120 min.

b) Floor surfaces shall be non-combustible, sloping towards drains to remove accumulation of water.

c) Those parts of parking structures located within, immediately above or below, attached to, or less than 3 m away from a building used for any other purpose shall be separated by fire resistant walls and floors having fire resistance rating of not less than 120 min. This shall exclude those incidental spaces which are occupied by cashier, attendant booth or those spaces used for toilets, with a total area not exceeding 200 m^2.

d) Vehicle ramps shall not be considered as exits unless pedestrian facilities are provided.

e) Other occupancies like fuel dispensing, shall not be allowed in the building. Car repair facilities, if provided, shall be separated by 120 min fire resistant construction.

f) In addition to fire protection requirements as per Table 7, appropriate fire detection and suppressions systems shall be provided for the protection of hydraulic oil tank and pumps located below ground level for operation of car lifts.

g) Means of egress shall meet the requirements specified in **4**.

H-3 OPEN PARKING STRUCTURES (INCLUDING MULTI-LEVEL PARKING AND STILT PARKING)

a) The term open parking structure specifies the degree to which the structure's exterior walls must have openings. Parking structures that meet the definition of the term open parking structure provide sufficient area in exterior walls to vent the products of combustion to a greater degree than an enclosed parking structure.

b) A parking structure having each parking level wall openings open to the atmosphere, for an area of not less than 0.4 m^2 for each linear metre of its exterior perimeter shall be construed as open parking structure. Such openings shall be distributed over 40 percent of the building perimeter or uniformly over two opposing sides. Interior wall lines shall be at least 20 percent open, with openings distributed to provide ventilation, else, the structure shall be deemed as enclosed parking structures.

NOTE — A car park located at the stilt level of a building (not open to sky) can be considered an open or an unenclosed car park if any part of the car park is within 30 m of a permanent natural ventilation opening and any one of the following is complied with towards the permanent natural ventilation requirement:

i) 50 percent of the car park perimeter shall be open to permanent natural ventilation.

ii) At least 75 percent of the car park perimeter is having the 50 percent natural ventilation opening.

c) All stilt parking are required to be provided with sprinkler system where such buildings are required to be sprinklered.

d) Open parking structures are not required to be provided with compartmentation.

e) Open car parking (open to sky) within building complex having fire hydrant system shall also need to be protected with yard hydrant installation system in accordance with good practice [4(29)].

H-4 ENCLOSED PARKING STRUCTURES

a) Those car parking structures which are enclosed on all sides and on top, not falling within the definition of open car parking [*see* **H-3**(b)] and also those situated in the basements shall be known as enclosed car parking structures.

b) All sprinklers in car parking shall be standard response type with minimum K-Factor of 80, area coverage of 9 m^2 and designed as per good practice [4(20)].

c) For basement car parking, compartmentation can be achieved, with fire barrier or with water curtain nozzle (K-23) or with combination thereof. Automatic deluge system comprising deluge valve, piping, nozzles, etc shall be used to zone the compartment in case of water curtain system. In case of water curtain, existing water storage shall be supplemented by water demand for water curtain nozzles for 60 min considering the largest compartment's perimeter out of all compartments of car parking in any of the basements.

d) The water supply for the water curtain nozzles shall be through independent electric pump of adequate capacity (flow and head) with piping/riser for the water supply to the nozzles.

e) The water curtain shall be operated by the actuation of flow switch actuating sprinkler system.

f) For smoke ventilation requirement of car parking, *see* **4.6.2**.

g) All fire exit doors from the car parking to exits shall be painted green and shall display exit signage.

H-5 AUTOMATED CAR PARKING UTILIZING MECHANICAL OR COMPUTERIZED/ ROBOTIC MEANS

a) Automated car parking structure can be of open parking type or enclosed types.

b) Automated car parking facilities pose more hazard compared to manual parking due to following reasons:

1) High density of cars due to close stacking-one over another.

2) Lack of provision on fire separation/ compartmentation-horizontal or vertical leading to rapid fire spread.

3) Non-availability of any person to notice/ control the fire in initial stages.

4) Limited access to firefighting personnel.

5) Extensive height and depth involved with highly combustible load.

c) Fire escape staircases, at least 1 250 mm wide shall be provided at appropriate locations so

that no place is more than 45 m from the nearest staircase. Horizontal walkways, at least 1 000 mm wide for access to all the areas shall be provided at every parking level.

d) Travel distance and means of egress shall be governed by the respective sections of this Code.

e) The hazardous areas like DG sets, transformers, HT/LT panels for the parking lot shall be suitably segregated from other areas as per requirements given in this Code and all such areas shall be protected by suitable automatic fire suppressions systems.

ANNEX J

(*Clause* 6.4.4)

FIRE AND LIFE SAFETY REQUIREMENTS FOR METRO STATIONS

J-1 APPLICATION AND SCOPE

The provisions of this annex relates to the buildings constructed as part of the metro stations/metro rail systems.

J-2 TERMINOLOGY ASSOCIATED WITH METRO FACILITIES

For the purpose of this annex, the terminologies given at **2.43** shall apply.

J-3 GENERAL

J-3.1 Classification

Metro stations can be classified under 'Assembly occupancies'. These shall include any station building or part thereof, permanent or temporary, through which people transit for the duration of time required to enter the building and board the train to depart the station platform or to alight from the train and depart from the station building.

J-3.2 Sub-classification

Metro stations can be further classified under the following headings:

a) Elevated and enclosed stations,
b) Elevated and open stations, and
c) Underground stations.

NOTE — The above shall include all open and enclosed Metro Stations along with their associated ancillary structures and train depots. Elevated shall mean to include 'at-grade' stations as well.

J-3.3 Fire Zones

Metro stations, that is, mass rapid transit may be constructed within Fire Zone No. 1, 2 or 3, as per the transportation requirement.

J-3.4 Type of Construction

Metro stations shall conform to Type 1 or Type 2 or combinations of Types 1 and 2 non-combustible constructions, as defined in **3.3**.

J-4 LIFE SAFETY REQUIREMENTS

J-4.1 Occupant Load

a) Main occupant load in a transit station is the platform occupant load, on which basis the life safety provisions of transit stations are designed. Occupant loads in transit stations are mainly a function of the train carrying capacities rather than the areas of a station.
b) For calculating platform occupant loads for a multiline, multilevel or multiplatform station, maximum occupant load for each platform shall be considered separately for determining the egress capacity from that platform.
c) At levels where egress routes from separate platforms converge, occupant loads of all platforms shall be considered to calculate egress capacity from that level. Simultaneous loads shall be considered for all egress routes passing through each level of that station.
d) Platform occupant load shall be based on the greater of the AM or PM 'peak hour loads' generated by the system and train loads.

e) Peak hour load shall be converted to peak minute loads by dividing by 50 and multiplying further by a system surge factor varying from 1.15 to 1.5, as defined by the transit system authority. Surge factor may require to be further enhanced where increased footfalls are anticipated like stations catering to sports complex, etc.

f) Platform occupant load shall be determined by factoring in the peak hour entraining loads at platform edges and train loads, in emergency evacuation scenario, as defined here:

1) *Train on fire* — It is assumed that a train loaded to crush capacity travelling in peak direction at peak hour has caught fire, and as per the operating procedure it is brought to the next station, whereupon it shall require to be evacuated.

2) The train in this case being called the 'incident train' and the platform on which it is arriving being called 'incident platform' of the 'incident station'.

3) Passengers waiting on all the platforms of the 'incident station' shall require to be evacuated as well.

4) Number of passengers shall be determined as defined in (g) below.

5) Only one source of fire, that is, train fire shall be assumed at a time.

6) It is assumed that the train on non-incident platform shall not stop at the incident station and shall stop only at previous/ next station.

g) Platform occupant load, for emergency evacuation scenario, shall be the addition of two headway entraining loads for peak direction platform, one headway entraining load for off-peak direction platforms and one crush train load.

NOTE — *See also* **J-4.1**(b) and **J-4.1**(c).

h) *Occupancy in non-public areas*:

1) Use of designated non-public areas by station staff whose work assignments require their presence in the station structures shall be permitted.

2) Unmanned plant rooms and any other areas where usual occupancy is less than10 persons at any given time shall be treated as unoccupied areas.

j) *Segregation with non-transit occupancy*:

Non-transit occupancies, of area up to 250 m^2, shall be permitted to be accommodated within the station building. Occupant load of areas under non-transit occupancies shall be in accordance with Table 3.

J-5 EGRESS PROVISIONS

J-5.1 Evacuation Time

a) *Means of egress — Public areas* — Egress from metro station shall be designed to facilitate the evacuation of a pre-defined platform occupant load to a designated point of safety in pre-defined emergency scenario(s), as defined by the transit system authority.

b) *Evacuation time from platform* — Enough egress capacity shall be provided to evacuate the platform occupant load within 4 min from enclosed stations and within 5.5 min from open stations.

c) *Evacuation time to point of safety* — Further, station design should permit evacuation of the remotest person on platform to a point of safety within 6 min in case of enclosed stations and within 8 min in case of open stations.

NOTE — Evacuation time specified in (b) and (c) may be modified based on actual engineering analysis by evaluating material heat release rates, station geometry and emergency ventilation systems.

d) For open stations where the concourse is below or protected from the platform by distance or materials as determined by an appropriate engineering analysis, that concourse shall be permitted to be defined as a point of safety.

e) For enclosed stations equipped with an emergency ventilation system and where the emergency ventilation system provides protection for the concourse from exposure to the effects of a train fire at the platform as confirmed by engineering analysis, that concourse is permitted to be defined as a point of safety.

J-5.2 General Arrangement

a) Means of egress from each station platform shall be provided so that they are equally distributed as far as possible, in capacity and placement, throughout the length of platform.

b) There shall be at least two means of egress remote from each other.

c) Means of egress may however be allowed to converge at concourse or subsequent levels with sufficient capacity to achieve the required evacuation time.

d) As far as possible, all the egress capacity required for emergency evacuation shall be provided with the unenclosed stairs and escalators which are used for normal circulation.

J-5.3 Travel Distance

The maximum travel distance on the platform to a point at which a means of egress route leaves the platform shall not be more than 100 m. This shall however be subject to fulfilling the egress requirements specified in **J-5.2**.

J-5.4 Means of Egress

J-5.4.1 *Non-public Areas*

Means of egress from unoccupied non-public areas shall be permitted to be merged into public means of egress.

J-5.4.2 *Non-transit Occupancies*

Separate means of egress shall be provided for such non-transit occupancies which are segregated from the station public area to ensure independent evacuation from either occupancy. Such means of egress may be allowed to converge beyond station concourse area with the approval of the competent authority.

J-5.4.3 *Platform, Corridors, Ramps*

Platforms, corridors and ramps serving as means of egress shall be designed as per following criteria:

a) A minimum clear width of 1 200 mm shall be provided along all platforms, corridors, and ramps serving as means of egress.
b) In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm shall be deducted at each sidewall, and 450 mm shall be deducted at platform edges that are open to the trainway.
c) The maximum means of egress capacity of platforms, corridors, and ramps shall be computed at 0.082 0 people/mm-min.
d) The maximum means of egress travel speed along platforms, corridors, and ramps shall be computed at 38.0 m/min.
e) The means of egress travel speed for concourses and other areas where a lesser pedestrian density is anticipated shall be computed at 60.0 m/min.

J-5.4.4 *Stairways*

a) Unenclosed stairs and escalators shall be permitted to be counted as contributing to the means of egress capacity in stations.
b) Minimum widths of such unenclosed staircases shall be 1 800 mm for unidirectional stairs, and 2 400 mm for bi-directional stairs.
c) Wall or floor mounted railings on both sides shall be permitted on stairs without affecting the widths stated in (b) above by more than 300 mm.
d) Enclosed stairs in the means of egress shall be minimum 1 200 mm wide.
e) Capacity and travel speed for stairs shall be computed at 0.055 5 people/mm-min and 14.6 m/min, respectively.

J-5.4.5 *Escalators*

a) Escalators shall not account for more than one-half of the means of egress capacity at any one level.
b) In calculating the egress capacity of escalators,
   1) one escalator at each level shall be considered as being out of service, and
   2) the escalator chosen shall be the one having the most adverse effect upon egress capacity.
c) Where escalators are permitted as a means of egress in stations, the following criteria shall be complied with:
   1) The escalators shall be constructed of non-combustible materials (exceptions like rollers and handrails shall be permitted with the approval of the Competent Authority).
   2) Escalators running in the direction of egress shall be permitted to remain operating.
   3) Escalators running reverse to the direction of egress shall be capable of being stopped either locally by a manual stopping device at the escalator or remotely by a manual stopping device at a remote location or remotely as part of a pre-planned evacuation response. A stopped escalator shall be counted as equivalent to 1 m wide staircase.
d) Where provision is made for remote stopping of escalators counted as means of egress, one of the following shall apply:

   The stop shall be delayed until it is preceded by a minimum 15 s audible signal or warning message sounded at the escalator; wherein (1) the signal or message shall have a sound intensity that is at least 15 dBA above the average ambient sound level for the entire length of the escalator, (2) the signal shall be

distinct from the fire alarm signal, and (3) the warning message shall meet audibility and intelligibility requirements.

OR

Where escalators are equipped with the necessary controls to decelerate in a controlled manner under the full rated load, the stop shall be delayed for at least 5 s before beginning deceleration, and the deceleration rate shall be no greater than 0.052 m/s^2.

e) Escalators with or without intermediate landings shall be acceptable as a means of egress, regardless of vertical rise.

f) Escalators exposed to the outdoor environment shall be provided with slip-resistant landing and floor plates.

g) Stopped escalators shall be permitted to be started in the direction of egress in accordance with the requirements for stopping of escalators described in **J-5.4.5**(c)(3) and **J-5.4.5**(d).

h) Capacity and travel speed for escalators shall be computed at 120 people/min and 18.5 m/min (vertical component of travel speed), respectively.

J-5.4.6 *Lifts*

Lifts meeting the following requirements shall be counted as one of the means of egress in stations.

J-5.4.6.1 *Capacity of lifts*

Where lifts are counted as contributing to the means of egress capacity,

a) lifts shall have minimum 60 min fire resistance rating;

b) they shall account for no more than 50 percent of the required egress capacity;

c) at least one lift shall be considered out of service, and one lift shall be reserved for fire service; and

d) the capacity of each lift shall be the carrying capacity of the lifts within 30 min.

J-5.4.6.2 *Holding area for lifts*

Lifts counted as one of the means of egress from any level of a station shall be accessed through holding areas or lobbies at that level, which shall be designed as follows:

a) The holding areas or lobbies shall be separated from the platform by a smoke tight fire separation having a fire resistance rating of at least 60 min but not less than the time required to evacuate the holding area occupant load.

b) At least one stair shall be accessible from the holding area.

c) The holding area shall be sized to accommodate one person per 0.2 m^2.

d) If the holding area includes portions of the platform, the area within 600 mm of the trainway shall not be considered in the calculation.

e) Upon activation of smoke control in the platform or adjacent trainway areas, the holding area shall be pressurized to a minimum of 25 Pa.

f) The holding area shall be provided with emergency voice alarm devices with two-way communication to the system operations control centre.

J-5.4.6.3 *Design features of lifts*

Lifts counted as one of the means of egress shall be designed as follows:

a) Shaft enclosures shall be constructed as fire separations having a 120 min fire resistance rating.

b) The design shall limit water flow into the shaft.

c) No more than two lifts used for means of egress or fire department access shall share the same machine room or lifts pit.

d) Machine rooms shall be separated from each other by fire separation having a minimum fire resistance rating of 120 min.

e) The lifts shall be connected to back-up power supply.

f) During emergency evacuation, the lifts shall travel only between the incident level and a point of safety.

J-5.4.7 *Doors and Gates*

The egress capacity for doors and gates in a means of egress serving public areas shall be computed as,

a) 60 people per minute (p/min) for single leaf doors and gates,

b) 0.082 people/mm-min for bi-parting multi-leaf doors and gates measured for the clear width dimension, and

c) gates in a means of egress shall be designed in accordance with the requirements for doors serving as a means of egress.

J-5.4.8 *Fare Barriers*

a) Fare barriers complying with following provisions shall be permitted in the means of egress serving the stations. Such barriers shall be designed to release, permitting unimpeded

travel in the direction of egress under all the following conditions:

1) Power failure or ground fault condition,
2) Activation of the station fire alarm signal, and
3) Manual activation from a switch in a constantly attended location in the station or operations control centre.

b) Fare barriers that do not comply with the requirements of **J-5.4.8**(a) shall be permitted in the means of egress where barriers in the equipment are designed to provide egress when a horizontal force not exceeding 66 N is applied in the egress direction.

c) Gate-type fare barriers in the means of egress shall meet the following criteria:

1) Each unit shall provide a minimum of 450 mm clear width at and below a height of 1 000 mm and 530 mm clear width above that height.
2) Each unit shall be credited with a capacity of 50 p/min for egress calculations.
3) Fare barriers shall be designed so that their failure to operate properly will not prohibit movement of passengers in the direction of emergency egress.

J-5.4.9 *Horizontal Exits*

Horizontal exits shall be permitted for up to 100 percent of the number of horizontal exits and required egress capacity provided that not more than 50 percent of the number and required capacity is into a single building and provided they comply with the following provisions:

a) Width of the horizontal exit shall at least be same as that of the exit doorways;
b) A horizontal exit shall be equipped with at least one fire/smoke door of minimum 60 min fire resistance, of self-closing type. Further, it should have direct connectivity to the egress staircase for evacuation.
c) Where there is a difference in level between connected areas for horizontal exits, ramps, slope not more than 1 in 12 shall be provided.
d) Doors in horizontal exits shall be able to open at all times from both sides.

J-5.4.10 *Platform Screen and Edge Door*

Horizontal sliding platform screen or platform edge doors shall be permitted to separate the platform from the trainway in stations provided that the doors permit emergency egress from the train to the platform regardless of the stopping position of the train; and the doors provide egress when a force not exceeding 220 N is applied from the train side of the doors. The doors shall be designed to withstand positive and negative pressures caused by passing trains.

J-5.4.11 *Access for Fire Brigade Personnel*

A dedicated access staircase for firemen shall be provided in each underground station. This access shall be arranged so as to provide uninterrupted access from ground level to station concourse and platform levels. If continuous access is not feasible, smoke sealed lobbies shall be provided at concourse or other intermediate levels and such lobbies shall be protected with fire doors of adequate rating. Firemen staircases shall be maintained under positive pressure at all times.

J-5.4.12 Emergency and escape lighting and illumination of means of all exits shall comply with the various provisions under **3.4.7** in all respects.

J-6 FIRE SEPARATION AND COMPARTMENTATION

J-6.1 Fire compartments shall be provided in transit stations in accordance with the provisions of this Section. Fire ratings of various occupancies within open stations and enclosed stations shall be as indicated in Table 27.

J-6.2 Further transit station shall be divided into fire compartments by means of compartment walls and compartment floors by a fire separation of at least 120 min between following occupancies:

a) Public areas and non-public areas,
b) Transit and non-transit areas, and
c) Ancillary areas located beneath and within 3 m of the trainway in open stations

J-6.3 No fire separation shall be required for occupancies like ticketing offices, toilets, other offices and the like.

J-6.4 Incidental kiosks inside stations for other purposes like commercial use, etc shall be fire separated (120 min rating) from the station building, if areas occupied by such occupancies exceed 6 m^2.

J-6.5 Fire Doors

Fire doors shall comply with the following requirements:

a) Fire doors shall be constructed of non-combustible material having appropriate fire resistance, and two fire doors may be fitted in an opening if each door by itself is capable of closing the opening and the two doors together achieve the required level of fire resistance.
b) All fire doors shall be fitted with an automatic self-closing device, of same fire rating as of the door, which is capable of closing the door

Table 27 Fire Ratings for Mass Rapid Transit Station Occupancies
(*Clause* J-6.1)

Sl No.	Occupancies	Fire Rating of Enclosures h		Fire Rating of Doors h	
		Open Station	Enclosed Station	Open Station	Enclosed Station
(1)	(2)	(3)	(4)	(5)	(6)
i)	Auxiliary substation, electrical UPS/battery room	2	3	1.5	3
ii)	Signalling equipment room, telecom equipment room, S&T (signalling and train control) UPS/battery room, electrical cable shafts, S&T cable shafts	2	2	1.5	1.5
iii)	Environmental control system (ECS) plant room, tunnel ventilation room, firemen's staircase, emergency equipment store, CDMA room, GSM room, sewage ejector room, sump pump room, chiller plant room, pump room, DG panel room	2	2	1.5	1.5
iv)	Station manager room, cash and ticket supervisor room, security room, stores, cleaners room, refuse storage, toilets, plumbing shafts, staff mess rooms, distribution board room and the like.	1	2	0.5	1.5

from any angle and against any latch fitted to the door.

c) Any fire door fitted within an opening which is provided as a means of escape shall be capable of being opened manually, not be held open by any means other than by an electromagnetic or electro-mechanical device which can be activated by the presence of smoke and/or the fire alarm system, provided that this shall not apply in the case of fire doors opening into pressurised exit staircases.

J-6.6 Smoke Compartmentation

a) Smoke compartments shall be created to ensure that in case of a fire scenario, the escape routes are not full of smoke and a safe passage is provided to fire fighters to reach fire location.

b) Smoke barriers shall be provided within the ceiling at platform and concourse levels at locations and spacing as determined by the engineering analysis and shall be designed to withstand temperatures up to 250°C for 60 min.

c) Smoke barriers shall also be provided around all openings containing staircases, escalators and lifts in public areas connecting platform to levels above or below them.

d) All smoke compartments created within the station areas shall be designed with segregated smoke extraction systems.

J-7 OTHER SPECIFICS REGARDING SAFETY REQUIREMENTS

a) Materials used as interior wall and ceiling and other decorative features in enclosed stations shall be non-combustible.

b) For protection against intrusion of flammable and combustible liquids and flooding of underground transit systems, any structure including emergency egress or access stairs or vent or fan shaft structure utilized for ventilation of underground system shall be permitted to be terminated at grade, provided that the level at which it is terminated is at least 450 mm above the surrounding ground level/footpath level.

c) Emergency ventilation fans, their motors, and all related components exposed to the exhaust airflow shall be designed to operate in an ambient atmosphere of 250°C for a minimum of 60 min.

d) Operation of the emergency ventilation system components shall be initiated from the central supervising station.

e) All types of kiosks like ticketing booth, information counter, commercial, if any, etc, shall be constructed with non-combustible materials.

f) Enclosed stations shall be provided with back-up power connected to lighting, protective signalling systems, emergency communication system, and fire command centre.

g) Emergency lighting shall be provided throughout the station as per **3.4.7.1**.

h) Voice evacuation/public address system shall be provided throughout the station, and ancillary buildings as per requirements.

j) Equipment rooms shall be protected by fire suppression systems as per relevant standards.

k) Emergency command centres and emergency response procedures shall be in place.

m) Evacuation shall take place under the guidance and control of authorized, trained system employees or other authorized personnel as warranted under an emergency situation.

n) Adequate warning signs, directional signs, exit signs shall be provided throughout the facility.

J-8 BACK-UP OR EMERGENCY POWER SUPPLY

The back-up/emergency power supply shall have a capacity to cater all critical loads such as emergency lighting, protective signalling system, communication system, fire station and control room, lifts providing required egress capacity, etc.

J-9 FIRE PROTECTION FACILITIES

The following requirements shall apply to all open and enclosed metro stations above grade. Provisions for underground stations are not covered hereunder.

J-9.1 Details of Protection and Facilities Required

J-9.1.1 *Pumping Arrangements*

Each station shall be provided with two pumps having a minimum discharge of 1 620 litre/min with different prime movers. It is possible to provide two electrically driven pumps, if assured back-up power is available for driving the pumps. Jockey pump having a capacity of 180 litre/min shall also be provided to take care of minor system leakages. Electrical wiring for the pumps shall be routed from outside the station buildings in any case (*see also* **J-9.1.9**).

J-9.1.2 *Extinguishers*

a) Water CO_2 type, CO_2/ABC types, shall be provided in each platform and distributed in such a way that extinguisher is available within a travel distance of 30 m from any point.

b) Water CO_2 type, CO_2/ABC types, shall be provided in each concourse for every 300 m^2 floor area and distributed in such a way that extinguisher is available within a travel distance of 30 m from any point.

c) At least one extinguisher shall be provided for each equipment room and other enclosures for every 300 m^2 floor area.

J-9.1.3 *Small Bore Hose Reels*

a) One hose reel shall be provided for every 1 000 m^2 floor area of station platform or part thereof subject to a travel distance of 45 m to the nearest hose reel.

b) One hose reel shall be provided for every 1 000 m^2 floor area concourse or part thereof subject to a travel distance of 45 m to the nearest hose reel.

c) If equipment rooms are covered with hose reels for concourse and platform, it is acceptable.

J-9.1.4 *Fire Alarm System*

a) Provisions of detection system shall be purely based on judgement in metro stations. Detectors are required to be provided only in areas where there are false ceiling(s), false floor(s) and areas for equipment rooms. Wherever there are false ceilings, the detectors shall be provided both above and below false ceiling giving due consideration to depth of false ceiling/flooring. However, in concourse, the detectors below false ceiling may not be effective due to heights/cross ventilation and therefore may not be provided. In other areas, because of high heights and cross-ventilations, detectors will not be effective and hence they can be dispensed. A conventional detection system shall suffice at a normal station.

b) Manual call station(s) shall be provided at central location(s) on each platform (near emergency plunger) and at least two on the concourse, on each sidewall. When the concourse is in two halves, at least one manual call station shall be provided on each side.

J-9.1.5 *Clean Agent Suppression System*

Main panels like HT, LT and main power distribution, DG change over and main supply panels for the station shall be protected with the above system. Suitable detection mechanism shall be provided for triggering the system automatically.

J-9.1.6 *Provision of Hydrants and Wet Risers*

a) Minimum two hydrants shall be provided at each platform with hose box containing two lengths of hose pipes 15 m each with a nozzle (coverage about 45 m). Location of hydrants shall be staggered for better coverage. The hydrants shall cover the entire length of the platform when two hose pipes are coupled to the landing valves and used. If not fully covered, additional hydrant(s) shall be provided.

b) Minimum two hydrants shall be provided for each concourse with hose box containing two lengths of hose pipes 15 m each with a nozzle subject to travel distance of 30 m to reach the nearest hydrant. Commercial areas, if any, shall also be covered with the provision of hydrants as stated above. If equipment rooms

and other areas are covered within 30 m of the hydrants, the same are acceptable.

c) Hydrants shall be provided at each entry to the station at ground and upper levels near staircase. At least one hydrant for parking area shall be provided subject to a travel distance of 30 m to the nearest hydrant.

J-9.1.7 *Automatic Sprinkler System*

Sprinklers are required to be provided only in the commercial areas and any combustible storage area within the station (*see also* **J-9.1.9**).

J-9.1.8 *Water Requirement*

a) For stand-alone metro stations, exclusive water requirement for the fire protection system for the installed pumping capacity as stated in **J-9.1.1** shall be at least 50 000 litre.

b) However, when commercial areas are present within metro stations, firefighting facilities shall need augmentation as in **J-9.1.9**.

J-9.1.9 In case of other type of occupancy like commercial areas inside metro stations and combustible storage area, if any within the station, the pumping/ water requirements shall be provided as per the Table 28.

Water capacity stated in the Table 28 shall be stored in two equal and interconnected compartments. Size of the main header shall not be less than 150 mm in all cases.

Entire fire protection system shall be designed and installed as per the relevant Indian Standards.

Table 28 Water Capacity
(*Clause* J-9.1.9)

Sl No.	Area Occupied by Commercial Occupancies	Hydrant Pump Capacity	Sprinkler Pump Capacity	Jockey Pumps	Common Standby Pump	Water Capacity
	m^2	litre/min	litre/min	litre/min	litre/min	litre
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Up to and including 300	← 2 280 (Common pump) →		180	2 280	75 000
ii)	More than 300 and up to 1 000	← 2 850 (Common pump) →		180	2 850	100 000
iii)	More than 1 000	2 850	2 850	180 each	2 850	200 000

ANNEX K

(*Clause* 6.4.4)

FIRE AND LIFE SAFETY REQUIREMENTS FOR METRO TRAINWAYS

K-1 APPLICATION

Provisions of this annex shall apply to all portions of underground, elevated and at-grade metro trainway including tail buffer tracks and sidings not intended to be occupied by the passengers. These provisions may be amended, if required, as per the approval of the Competent Authority.

K-2 USE AND OCCUPANCY

K-2.1 Passengers shall be allowed to enter the trainway only in the case it becomes necessary to evacuate a train.

K-2.2 Passenger evacuation from train onto the trainway shall take place only under the guidance and control of authorized, trained system employee or other authorized personnel as warranted under an emergency situation.

K-2.3 Warning signs in accordance with **K-4.4.1** shall be posted at locations where unauthorized personnel might trespass.

K-3 CONSTRUCTION

K-3.1 Construction Type

K-3.1.1 *Cut and Cover*

Where trainways are to be constructed by cut and cover method, perimeter walls, base and roof slabs and other

related constructions shall be of not less than Type 1 or Type 2 or combination of Types 1 and 2 non-combustible constructions as defined in this Part. The type of construction shall be further determined by an engineering analysis of potential fire exposure hazards to the structure.

K-3.1.2 *Bored Tunnels*

Where trainway sections are to be constructed by a tunnelling method through earth, unprotected steel liners, reinforced concrete, shotcrete, or equivalent shall be permitted to be used.

K-3.1.3 *Rock Tunnels*

Where trainway sections are to be constructed by a tunnelling method through rock, steel bents with concrete liner, if lining is required, shall be permitted to be used.

K-3.1.4 *Underwater Tunnels*

Underwater tunnels shall be not less than Type 2 constructions.

K-3.1.5 *Mid Tunnel Ventilation Shaft and Trainway Exit structures*

Mid tunnel ventilation shafts and trainway emergency egress or access stairs shall not be less than Type 1 construction.

K-3.1.6 *At-Grade Construction*

Materials used for at-grade construction shall not be less than Type 2 materials. The type of construction shall be further determined by an engineering analysis of potential fire exposure hazards to the structure.

K-3.1.7 *Elevated Viaduct or Portals*

All elevated structures necessary for trainway support and all structures and enclosures on or under the trainway shall be of not less than Type 1 or Type 2 or combination of Type 1 and Type 2 construction. The type of construction shall be further determined by an engineering analysis of potential fire exposure hazards to the structure.

K-3.2 Protection against Intrusion of Flammable and Combustible Liquids and Flooding of Enclosed Trainway

Any structure including emergency egress or access stairs or vent or fan shaft structure utilized for ventilation of underground system shall be permitted to be terminated at grade, provided that the level at which it is terminated is at least 450 mm above the surrounding ground level/footpath level.

K-3.3 Compartmentation

K-3.3.1 Ancillary areas shall be separated from trainway areas within underwater trainway sections by construction having a minimum 180 min fire resistance rating.

K-3.3.2 Ancillary areas shall be separated from trainway areas within enclosed trainway sections by construction having a minimum 120 min fire resistance rating.

K-3.4 Combustible Components

Where combustible components not specifically mentioned here are installed in a trainway, a fire hazard analysis shall be conducted to determine that the level of occupant fire safety is not adversely affected by the contents.

K-3.5 Walking Surfaces

Walking surfaces designated for evacuation of passengers shall be constructed of non-combustible materials.

K-4 EMERGENCY EGRESS

K-4.1 Location of Egress Routes

K-4.1.1 The system shall incorporate a walking surface or other approved means for passengers to evacuate a train at any point along the trainway so that they can proceed to the nearest station or other point of safety.

K-4.1.2 Walkway continuity shall be maintained at special track sections like cross over or pocket tracks. Walkway continuity shall be provided by cross walks at track level.

K-4.1.3 Within enclosed trainways, the maximum distance between emergency exits/exit stairways shall not exceed 750 m.

K-4.1.4 For trainways in twin bore tunnels or trainways in a tunnel divided by a minimum 120 min fire rated wall separation, cross-passageways shall be permitted to be used *in-lieu* of emergency exit stairways.

K-4.1.5 Where cross passageways are utilized *in-lieu* of emergency exit stairways, the following requirements shall apply:

a) First cross-passageway shall be provided not farther than 500 m from the end of platform of an enclosed station or from the tunnel portal or from a mid-tunnel exit way.

b) Distance between any two cross-passageways shall not be more than 250 m.

c) The crossover in an enclosed trainway shall be considered as cross-passageway. The distance between crossover and subsequent cross-passageway shall not be more than 250 m.

d) Cross-passageways shall be separated from each trainway with separate self-closing fire door assemblies having a fire protection rating of minimum 90 min.

e) A tenable environment shall be maintained in the portion of the trainway that is not involved in an emergency and that is being used for evacuation.

f) A ventilation system for the incident trainway shall be designed to control smoke in the vicinity of the passengers.

g) Provisions shall be made for evacuating passengers *via* the non-incident trainway to a nearby station or other emergency exit.

h) The provisions shall include measures to protect passengers evacuating from non-incident tunnel from oncoming traffic and from other hazards.

j) Where cross-passageways are used *in-lieu* of emergency exit stairways, the interior of the cross-passage shall not be used for any purpose other than as an area of refuge or for access/egress to the opposite tunnel, except for installation of non-combustible equipment inside the cross passageways, provided that such equipment does not infringe the required clear space of the cross-passage.

K-4.1.6 *Level of Cross Passage*

The level of cross-passage inside the tunnel shall be designed in accordance to the following requirements:

a) In trainways where passengers have to walk on the track bed during evacuation, the floor of the cross-passages in such trainways shall be kept close to the level of the track bed. The maximum permitted level difference between the level of track bed and the floor of the cross passage shall be 250 mm. Further, a smooth surface for transition of level difference shall be provided at such cross-passages.

b) In trainways where passengers have to walk on a walkway mounted at the level of the train floor during evacuation, the floor of the cross-passages in such trainways shall be kept in level with the walkway. Further, such walkways shall always be provided on the cross-passageway side of the trainway for unobstructed access to the cross-passageway.

K-4.1.7 For open-cut trainways, an engineering analysis shall be conducted to evaluate the impact of the trainway configuration on safe egress from a train fire to a point of safety.

K-4.1.8 Where the engineering analysis indicates that the configuration will impact tenability beyond the immediate vicinity of the fire, egress routes shall be provided such that the maximum distance from any point within the open-cut section to a point of egress from the trainway shall not be more than 380 m.

K-4.1.9 All the distances mentioned in **K-4.1.3**, **K-4.1.5** and **K-4.1.8** shall be permitted with a maximum variation of $^{+10}_{0}$ percent.

K-4.2 Size of Egress Routes

K-4.2.1 Cross-passageways shall be a minimum of 1 200 mm in clear width and 2 100 mm in height.

K-4.2.2 The width of exit stairs shall not be required to exceed 1 200 mm for enclosed trainways.

K-4.2.3 If double leaf doors wider than 1 200 mm are provided in egress routes serving trainways, then size of active leaf shall not be less than 810 mm.

K-4.3 Egress Components

K-4.3.1 Walking surfaces serving as egress routes within guide ways shall have a uniform, slip-resistant design except as permitted herein.

a) Where the trainway track bed serves as the emergency egress pathway, it shall be nominally level and free of obstructions.

b) Walkways that are more than 750 mm above the floor or grade below shall be provided with a continuous handrail along the side opposite the trainway.

c) Raised walkways that are greater than 1 200 mm wide and located between two trainways shall not be required to have a handrail.

d) Doors in the means of egress, except cross-passageway doors, shall open in the direction of exit travel.

e) Doors in the means of egress shall,

   1) open fully when a force not exceeding 220 N is applied to the latch side of the door, and

   2) be adequate to withstand positive and negative pressures caused by passing trains and the emergency ventilation system.

K-4.3.2 Horizontal sliding doors shall be permitted in cross-passageways.

K-4.4 Signage, Illumination and Emergency Lighting

K-4.4.1 Warning signs posted on entrances to the

trainway and on fences or barriers adjacent to the trainway shall clearly state the hazard (for example, DANGER: HIGH VOLTAGE — 25 000 V) with letter sizes and colours in conformance with requirements of *Metro Railway Rules*.

K-4.4.2 System egress points shall be illuminated.

K-4.4.3 Points of exit from elevated and enclosed trainways shall be marked with internally or externally illuminated signs.

K-4.4.4 *Identification*

Emergency exit facilities shall be identified and maintained to allow for their intended use.

K-4.4.5 Enclosed trainways greater in length than the minimum length of one train shall be provided with directional signs as appropriate for the emergency procedures developed for the metro system.

K-4.4.6 Directional signs indicating station or portal directions shall be installed at maximum 25 m intervals on either side of the enclosed trainways.

K-4.4.7 Directional signs shall be readily visible by passengers for emergency evacuation.

K-5 FIRE PROTECTION AND LIFE SAFETY SYSTEMS

K-5.1 Emergency Access

K-5.1 Except as described herein, points of egress and exits from the guide way shall serve as emergency access routes.

K-5.2 If security fences are used along the trainway, access gates shall be provided in security fences.

K-5.3 Access gates shall be a minimum 1 200 mm wide and shall be of the hinged or sliding type.

K-5.4 Access gates shall be placed as close as practicable to the portals to permit easy access to tunnels.

K-5.5 Information that clearly identifies the route and location of each gate shall be provided on the gates or adjacent thereto.

K-5.6 Access to the elevated trainway shall be from stations or by mobile ladder equipment from roadways adjacent to the track way.

K-5.7 If no adjacent or crossing roadways exist for the elevated trainway, access roads at a maximum of 750 m intervals shall be required.

K-5.8 Where the configuration of an open-cut trainway prevents or impedes access for firefighting, provisions shall be made to permit fire fighter access to that section of trainway at intervals not exceeding 750 m.

K-5.9 All the distances mentioned in **K-5.7** and **K-5.8** above shall be permitted with a maximum variation of $^{+10}_{0}$ percent.

ANNEX M

(*Clause* 6.7.3)

FIRE PROTECTION CONSIDERATIONS FOR VENTING IN INDUSTRIAL BUILDINGS

M-1 APPLICATION

M-1.1 The provisions given below are applicable only to single storey industrial buildings (factories and storage buildings) covering large floor areas without sub-dividing/separating walls which are usually designed to meet modern production methods.

M-1.2 The requirements of fire and explosion venting of industrial buildings, as dealt with in this section, fall under two categories:

a) Smoke and fire venting, and

b) Explosion relief vents.

M-2 SMOKE AND FIRE VENTING

M-2.1 The basic considerations for formulating the design and other requirements for smoke and fire vents are as given in **M-2.1.1** to **M-2.1.20**.

M-2.1.1 The smoke and hot combustion products from a fire, being lighter than the surrounding air, tend to rise, and on reaching the roof or ceiling spread out (mushroom) on all sides and form a layer which floats on top of the cold air beneath. In the absence of vents, this layer becomes progressively deeper until the whole building is filled with hot smoky gases. The time consumed for this to happen may be only a few minutes, depending on variables like, type of materials on fire, process/storage conditions involved, etc.

M-2.1.2 The hot gases at the roof level moved by convection currents contribute to rapid lateral spread of fire.

M-2.1.3 The provision of properly designed and suitably located vents in adequate number helps the speedy removal of smoke and hot gases, thereby preventing spread of fire, besides reducing risks of explosion of unburnt gases and reducing damage to the contents and structure of the building by heat and smoke. In addition, they facilitate firefighting operations, and minimise personal hazards to the firemen.

M-2.1.4 The time taken for accumulation of smoke and hot gases within a building on fire being very short, the venting devices installed shall be designed to operate in the early stage of the fire and must be automatic so as to ensure speed and efficiency in their operation.

M-2.1.5 The smoke and fire venting system shall be designed in such a manner as to keep the temperature of the combustion products from the fire as low as possible, preferably below approximately 150°C.

M-2.1.6 Automatic venting systems are complementary to the fire extinguishing systems, and automatic sprinklers, where provided, should operate before the operation of the vents; otherwise, venting may delay sprinkler operation.

M-2.1.7 It is easier to vent a building of smoke than clear it of smoke once it has been filled.

M-2.1.8 Venting is particularly desirable in large area industrial buildings or warehouses, windowless buildings, underground structures or in areas housing hazardous operations. Automatic fire vents shall be provided for all industrial occupancies (including storage buildings) classified as medium hazard or above having floor areas exceeding 750 m^2, irrespective of whether they are compartmentalized or not.

M-2.1.9 These provisions do not cover other aspects, of ventilation (or lighting) designed for regulation of temperature within a building for personal comfort or meeting process needs.

M-2.1.10 Similarly, fire and smoke venting requirements as given here under are also not applicable to multi-storeyed buildings, as their requirements are different and more complex.

M-2.1.11 It is difficult to determine precise venting requirements on account of the many variables involved. For instance, the rate of combustion varies appreciably according to the nature, shape, size and packaging of the combustible materials as well as the size, height and disposition of the stacks of materials.

M-2.1.12 In industrial buildings of floor area less than 750 m^2 and used as low fire hazard occupancies, conventional ventilators fitted high up near the eaves of the external walls may serve as vents for smoke and hot gases, provided care is taken to ensure that they are kept open at all times or are designed to open automatically in case of fire.

M-2.1.13 Extinction of fires by closing the doors and windows is not likely in the case of industrial buildings because of their large size, where sufficient air to sustain the fire at least in the initial stages can be expected to be present.

M-2.1.14 Of the two types of building ventilation, namely, vertical and horizontal, vertical ventilation is the one commonly adopted in the case of single storey industrial buildings.

M-2.1.15 Since 70 to 80 percent of heat produced in a fire is convective heat, the ventilation system has to be suitably designed to ensure early outflow of the heat and thereby minimise fire spread.

M-2.1.16 Combustible roof linings shall be avoided, as they themselves will contribute to the spread of fire, thereby multiplying the venting problems.

M-2.1.17 A wind blowing across a flat roof or a roof with a pitch under 40° produces a negative pressure, that is, it tends to draw gases out of the building and so aids venting of hot gases. Wind blowing across a roof of pitch greater than 40° will draw gases out on the leeward side, but oppose outward flow on the windward side of the roof.

M-2.1.18 For vents to work at full efficiency, the area of the inlets for cold air entering the compartment must equal at least the total area of the vents. Ideally, the inlets shall be as close to the ground as possible.

M-2.1.19 Where roof vents are installed in a single-storey building any neighbouring buildings, particularly those of more than one storey, will be subject to some degree of exposure hazard either from flying birds or radiation, or both, as a result.

M-2.1.20 If vents are to be installed, the size, design, number and disposition of the vents and the associated roof screens/curtain boards have to be assessed after careful analysis of the various factors stated under **M-2.1.11**, as well as other related factors like type of building construction, nature and height of roof, process hazards, exposure hazard, etc.

M-2.2 Venting Area

M-2.2.1 The estimated requirements for ventilation are largely based on the assumed build-up of the fire from the time of initial outbreak to the time of effective fire fighting action by fire brigade.

M-2.2.2 The vent area required to be provided shall be approximately proportional to the perimeter of the fire area, because the entrained air forms the bulk of the vented gases.

M-2.2.3 The effective area shall be the minimum cross-sectional area through which the hot gases must flow out to the atmosphere.

M-2.2.4 No consideration shall be given to the increased air movement obtained by power operated fans, since it must be assumed that in the event of fire, power will be interrupted, or fans damaged by heat.

M-2.2.5 The total vent areas to be provided shall be as per the following ratios of effective area of vent openings to floor area for various occupancy classifications indicated:

a) Low heat release content (Sub-division G-1) — 1 : 150

b) Moderate heat release content (Sub-division G-2) — 1 : 100

c) High heat release content (Sub-division G-3) — 1 : 30 to 1 : 50

M-2.3 Types of Vents

M-2.3.1 Venting shall be accomplished by any of the types such as monitors continuous gravity vents, until type vents or sawtooth roof skylights.

M-2.3.2 Where monitor type vents are installed, wire glass or metal panels shall be used only if the sash is arranged to open automatically.

M-2.3.3 The use of plain thin glass for venting shall be avoided on account of its unpredictable behaviour during fire. However, if glass or other suitable plastic sheet materials with early disintegration characteristics are used, they should be designed for automatic operation.

M-2.3.4 Where monitors or unit type vents are used, the panels shall be hinged at the bottom and designed to open automatically. Both sides of the vents shall be designed to vent simultaneously to ensure that their effectiveness at the time of fire is not in any way impeded by wind direction.

M-2.3.5 Where movable shutters are provided for continuous gravity vents, these shall open automatically in the event of fire.

M-2.3.6 Unit type vents shall be of relatively small area, ranging between 1 m^2 and 9 m^2, having light weight metal frames and housing with hinged dampers which shall be designed for both manual and automatic operation.

M-2.3.7 Sawtooth roof skylight shall be considered as satisfactory for venting purposes only when designed for automatic operation.

M-2.3.8 Likewise, exterior wall windows shall not be reckoned as satisfactory means for venting of fire gases and smoke in industrial buildings. However, they may be reckoned as additional means of venting when, they are located close to the caves and are provided with ordinary glass or movable sash arranged for both manual and automatic operation.

M-2.3.9 Baffles shall not be installed inside vents, as they greatly reduce the effective area for venting.

M-2.4 Vent Operation

M-2.4.1 The vents shall be automatic in operation, unless where specified in these provisions that they shall be designed for both manual and automatic operation.

M-2.4.2 The release mechanism shall be simple for operation and independent of electrical power, since electrical services may be interrupted by fire.

M-2.4.3 The automatic operation of vents shall be achieved by actuation of fusible links or other types of heat and smoke detectors, or by interlocking with operation of sprinkler system or any other automatic fire extinguishing system covering the area. Following their release, the vents shall be designed to open by a system of counterweights and associated equipment utilizing the force of gravity or spring loaded levers.

M-2.4.4 Automatic fire alarm system, where installed, shall be coupled to the automatic vents to ensure simultaneous operation.

M-2.4.5 Automatic sprinklers, where installed, shall operate before the vents open order to avoid any likely delay in sprinkler operation. However, heat actuated devices used for vent release shall be suitably shielded from sprinkler discharge so that water does not delay their action. Further, provision of operating the vents manually may also be provided.

M-2.4.6 Premises where height of roof apex is 10 m or more or where the materials handled or stored have high smoke producing characteristics, in addition to fusible links, the vent release mechanism shall be interlinked to smoke actuated automatic fire detectors to ensure early operation of vents.

M-2.4.7 Non-corrosive materials shall be used for hinges, hatches and other related parts to ensure long fail-safe operation of the vents.

M-2.4.8 In case of any doubts regarding the types of vents required to be installed for any particular occupancy, authorities having jurisdiction shall be consulted.

M-2.5 Size, Spacing and Disposition of Vents

M-2.5.1 Vents shall be correctly sited to ensure their functional efficiency. Ideally, they shall be sited at the highest point in each area to be covered.

M-2.5.2 They shall, as far as possible, be located immediately above the risk to be protected so as to allow free and speedy removal of smoke and other combustion products in the event of fire.

M-2.5.3 The minimum dimension for an effective vent opening shall be not less than 1.25 m in any direction.

M-2.5.4 The spacing of the individual vent shall be based on the principle that more number of well distributed smaller vents are more effective than fewer number of badly located larger vents.

M-2.5.5 The maximum spacing between vents for the three occupancy classifications shall be as follows:

a) Low heat release content : 45 m between centres

b) Moderate heat release content : 36 to 37 m between centres

c) High heat release content : 22.5 to 30 m between centres, depending on the severity of fire potential.

M-2.5.6 Vents shall be placed in a sheltered situation where advantage can be taken of the prevailing wind. The design of the vent shall be such as to produce a suction effect. A wind blowing across a flat roof or one with a pitch of 40° produces a negative pressure, that is, it tends to draw gases out of the building and so aids venting of hot gases. Wind blowing across a roof of pitch greater than 40° will draw gases out of the leeward side, but oppose outward flow on the windward side of the roof.

M-2.5.7 Low level inlets, with total area not less than the total area of vents, shall be provided to permit outside air to be drawn in to aid automatic venting. These inlets, which may be in the form of doors, windows or such other openings, shall be designed for manual operation when desired.

M-2.6 Roof Screens or Curtain Boards

M-2.6.1 Industrial buildings with large areas and having no subdivision/separating walls limiting the area of individual compartments to 750 m^2 or less, shall be provided with roof screens or curtain boards.

These screens which extend from the roof downwards at specific intervals not only prevent lateral spread of heat and smoke in the event of fire below, but substantially assist in early operation of automatic sprinklers and vents.

M-2.6.2 They shall be of sheet metal or any other substantially non-combustible material strong enough to withstand damage by heat or impact.

M-2.6.3 They shall be reasonably gas-tight, although small openings for passage of pipes, conduits, etc, shall be permitted.

M-2.6.4 They shall extend down from the roof/ceiling for a minimum depth of 2.2 m. Around specific hazards, the depth shall be 4 m. Where roof/ceiling height exceeds 15 m they shall extend down to within 3 m of the floor. For pitched sawtoothed roofs, they shall extend down to truss level dividing the roof into compartments.

M-2.6.5 In moderate hazard occupancies, the distance between the screens/curtain boards shall not exceed 75 m and the curtained areas shall be limited to a maximum of 4 500 m^2.

M-2.6.6 In high hazard occupancies, the distance between screens shall not exceed 30 m and the curtained area shall be limited to 750 m^2.

M-2.6.7 The curtained roof area shall be so arranged that they effectively aid in the venting of smoke and hot gases through the automatic vents provided in each area.

M-2.6.8 In sprinklered buildings, the screens shall preferably be so located as to coincide with the individual sprinkler system areas.

M-3 EXPLOSION RELIEF VENTS

M-3.1 Industrial premises where combustible dusts can accumulate or where flammable gases, vapours or mists in explosive concentrations may be present are constantly exposed to explosion hazards. Pressures developed by such explosions may be of the order of 7×10^5 Pa and ordinary buildings will not be able to withstand the shock of such pressures. Hence, such buildings require explosion relief vents for preventing structural damage.

M-3.2 Basic Principle/Considerations

M-3.2.1 Most ordinary building walls will not withstand a sustained internal pressure as great as 6.9×10^3 Pa. Hence, explosion relief vents for buildings must be designed to operate at pressures well below those at which the building walls will fail.

M-3.2.2 There is a rise in pressure during an explosion within an enclosure even with open, unobstructed vents, and any delay in opening the venting devices increases that pressure.

M-3.2.3 Structural damage can be minimised by locating hazardous operations or equipment outside buildings and cut-off from other operations by a pressure resisting wall. Such isolated processes or equipment shall be housed in single-storey buildings properly vented and a device provided at the inlet of the collector which will prevent an explosion from blowing back through the duct work and into the building.

M-3.2.4 Where highly hazardous operations cannot be located outside of main buildings they shall be segregated by pressure resisting walls and each such unit shall be ventilated outdoors. External walls may be of heavy construction, if equipped with suitable vents or high weight panels which blow out easily.

M-3.2.5 Operations or equipment involving explosion hazards shall not be permitted in basements or areas partially below grade.

M-3.2.6 Fire can be expected to follow an explosion in most occupancies, so that any fixed fire extinguishing equipment, like sprinklers, if installed, shall be such that only the minimum damage is caused to it.

M-3.2.7 For a given material, the finer the particle size of the dust, the more violent is the explosion. Some materials, such as aluminium powder, hydrogen, and acetylene, are difficult to vent effectively due to the rapid rate of pressure rise. Some slow burning materials, such as coal dust in a confined space, may do much damage because of the longer duration of their presence. Some dusts, such as magnesium, titanium and zirconium and several metal hydrides may react with and ignite in some common inert gases, such as nitrogen and carbon dioxide.

M-3.2.8 The maximum explosion pressure in a vented structure decreases as the size of the vent increases, but is independent of the rupturing pressure of a diaphragm.

M-3.2.9 The most effective vent for the release of explosion pressures is an unobstructed vent opening.

M-3.2.10 Pressure required to rupture diaphragms of the same area and material directly varies with the thickness of the material.

M-3.2.11 The slower the rate of pressure rise, the more easily can the explosion be vented.

M-3.2.12 The degree of venting required is directly proportional to the degree of explosion hazard.

M-3.2.13 Experience has shown that most explosions of dusts, vapours and gases do not involve a large part of the total volume of the enclosure, and frequently occur near the upper or lower limits of the explosive range. Consequently, such explosions are relatively weak compared with the optimum.

M-3.2.14 Rectangular unrestricted vents are as effective as square vents of equal area.

M-3.3 Types of Explosion Relief Vents

M-3.3.1 The explosion relief vents shall be any one or more of the following types, depending on individual requirements as assessed by the Authority. Open or unobstructed vents, louvres, open roof vents, hanger type doors, building doors, windows, roof or wall panels or movable fixed sash.

M-3.3.2 The effect or external wind pressure or suction on these devices shall be taken into consideration while designing and selecting the type of vents, since wind pressures may reach over 2×10^5 Pa in severe wind storms.

M-3.3.3 The type of vent for explosion relief for any occupancy shall be selected with life safety as the primary aim followed by minimum damage to property.

M-3.3.4 Where large hanger type doors of metal curtain doors in side walls are used as vents, care shall be taken to ensure that they are kept wide open during operations.

M-3.3.5 Where weather hoods are used to cover roof vents, they shall be as light as possible and lightly attached so as to enable them to be blown off quickly when an explosion occurs.

M-3.3.6 Doors and windows when used as explosion vents shall be installed to swing outwards. Doors shall have friction, spring or magnetic latches that will function automatically to permit the door to open under slight internal pressure.

M-3.3.7 Movable sash shall be of the top or bottom hinged or protected type. These shall be equipped with a latch or friction device to prevent accidental opening due to wind action or intrusion. Such latches or locks shall be well maintained.

M-3.3.8 Fixed sash shall be set in place with very light wall anchorages, or, if tight, shall be securely fitted and glazed with plastic panes in plastic putty.

M-3.3.9 Where the process is such that the whole of a building or a room may be desirable to arrange for a lightly constructed wall or roof to collapse and thus avert the worst effects of an explosion.

M-3.4 Design, Size and Disposition of Vents

M-3.4.1 The required area of explosion vents shall ordinarily depend on the expected maximum intensity of an explosion in the occupancy, the strength of the structure, the type of vent closure and other factors.

M-3.4.2 Venting shall be planned in such a manner as to prevent injury to personnel and damage to exposure.

In congested locations, substantial ducts or diverters shall be provided to direct the blast.

M-3.4.3 When ductwork is used, the ducts shall be of sufficient strength to withstand the maximum expected explosion pressure.

M-3.4.4 Where explosions are likely within duct and piping systems, they shall be vented by the use of suitable diaphragms designed to blow out at a predetermined pressure. There shall be no physical connection between ductwork system for more than one collector.

M-3.4.5 In large structures, the position of vents shall be relative to the point of origin of explosion, when it can be determined.

M-3.4.6 Where relatively slow explosions involving coal dust, chlorinated solvents, etc, are involved, light, hinged swinging panels may be preferred to diaphragm type of vents.

M-3.4.7 Obstructions of any kind blocking the vents from the risk covered shall be avoided, particularly where risks of rapid violent explosions are present.

M-3.4.8 Counter weights add to the inertia of the vents and so shall be avoided.

M-3.4.9 Various relieving devices, including devices actuated by detonators, shall start to open at as low a pressure as possible. They shall be of light construction, so that full opening can be quickly attained.

M-3.4.10 Vents shall be of such size and design as to prevent rupture of the protected device or apparatus.

M-3.4.11 Skylights or monitors with movable sash that will open outwards, or fixed sash containing panes of glass or plastic that will blow out readily under pressure from within, can be used to supplement wall vents or windows, provided resistance to their displacement or opening is kept as low as consistent with the requirements for structural strength.

M-3.4.12 Flexible plastic sheets when used for vent closures shall be installed in slotted frames in such a way that pressure from within bulges the sheets and releases them from the holding frame.

M-3.4.13 Fragile sheets made of plastic, when used for vent closures, shall be thin sheets that will crack or rupture under less pressure than single strength glass. For this reason use of transparent or translucent plastic sheets is more advantageous than use of glass in window sash.

M-3.4.14 If closed vents are used they shall be larger in area than unenclosed vents to provide equivalent explosion pressure relief.

M-3.4.15 Small enclosures, such as machines, shall be vented more generously than buildings, because if an explosion occurs in a machine, its entire volume may be involved.

M-3.4.16 Vents for the protection of buildings and equipment shall be installed on the following basis:

a) Small enclosures of less than 30 m^3, machines and ovens of light construction: 1 000 cm^2 for each 0.3 m^3 to 0.9 m^3.

b) For small enclosures of more substantial construction having reasonably high bursting strength: 1 000 cm^2 for each 0.9 m^3.

c) Fairly large enclosures of 30 to 700 m^3, such as bins, silos, rooms, storage tanks, etc: 1 000 cm^2 for each 0.9 m^3 to 1.5 m^3. In these cases, attempt shall be made to the extent possible to predict the likely point of origin of the explosion in relation to the vent.

d) Large rooms and buildings over 700 m^3 containing hazardous equipment comprising a small fraction of the entire volume:

   1) For heavy reinforced concrete, walls: 100 cm^2 for each 2.25 m^3.
   2) For light reinforced concrete, brick or wood construction: 1 000 cm^2 for each 1.65 m^3 to 2.25 m^3.
   3) For lightweight construction such as prefabricated panels: 1 000 cm^2 for each 1.5 m^3 to 1.65 m^3.

e) Large rooms or building over 700 m^3 containing hazardous equipment comprising a large part of the entire volume of a room or building shall be vented as generously as possible: 1 000 cm^2 for each 0.3 m^3 to 1.05 m^3.

f) In order to obtain these ratios, the size of the building or room must be limited. For some hazardous materials, such as hydrogen, acetylene, carbon disulphide, etc, these limits are extremely low.

g) Emphasis shall always be placed on segregating hazardous areas by means of firewalls or separating walls to prevent spread of fire.

h) Interior walls of light construction, such as tile, shall be avoided in hazardous locations, since they can cause injuries to personnel in the event of an explosion.

LIST OF STANDARDS

The following list records those standards which are acceptable as 'good practice' and 'accepted standards' in the fulfillment of the requirements of the Code. The latest version of a standard shall be adopted at the time of enforcement of the Code. The standards listed may be used by the Authority for conformance with the requirements of the referred clauses in the Code.

In the following list, the number appearing in the first column within parentheses indicates the number of the reference in this Part.

	IS No.	*Title*
(1)	3808 : 1979	Method of test for non-combustibility of building materials (*first revision*)
(2)	IS/ISO 834-1 : 1999	Fire resistance tests — Elements of building construction Part 1 General requirements
	IS/ISO 834-4 : 2000	Fire resistance tests — Elements of building construction: Part 4 Specific requirements for load bearing vertical separating elements
	IS/ISO 834-5 : 2000	Fire resistance tests — Elements of building construction: Part 5 Specific requirements for load bearing horizontal separating elements
	IS/ISO 834-6 : 2000	Fire resistance tets — Elements of building constructions: Part 6 Specific requirements for beams
	IS/ISO 834-7 : 2000	Fire resistance tests — Elements of building construction: Part 7 Specific requirements for columns
	IS/ISO 834-8 : 2003	Fire resistance tests — Elements of building construction: Part 8 Specific requirements for non-load bearing vertical separating elements
	IS/ISO 834-9 : 2003	Fire resistance tests — Elements of building construction: Part 9 Specific requirements for non-load bearing ceiling elements
(3)	8757 : 1999	Glossary of terms associated with fire safety (*first revision*)
	7673 : 2004	Glossary of terms for fire fighting equipment (*first revision*)
(4)	8758 : 2013	Code of practice for fire precautionary measures in construction of temporary structures and pandals (*second revision*)
(5)	9668 : 1990	Code of practice for provision and maintenance of water supplies and fire fighting
	3844 : 1989	Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises (*first revision*)
(6)	1646 : 2015	Code of practice for fire safety of buildings (general) : Electrical installations (*third revision*)
(7)	9457 : 2005	Code of practice for safety colours and safety signs (*first revision*)
	12349 : 1988	Fire protection — Safety sign
	12407 : 1988	Graphic symbols for fire protection plans
(8)	11360 : 1985	Specification for smoke detectors for use in automatic electrical fire alarm system
(9)	655 : 2006	Specification for air ducts
(10)	1649 : 1962	Code of practice for design and construction of flues and chimneys for domestic heating appliances (*first revision*)
	1642 : 2013	Code of practice for safety of buildings (general): Details of construction (*second revision*)
(11)	12777 : 1989	Method for classification of flame spread of products
(12)	1642 : 2013	Code of practice for safety of buildings (general): Details of construction (*second revision*)
(13)	16246 : 2015	Elastomer insulated cables with limited circuit Integrity when affected by fire — Specification
(14)	6044 (Part 1) : 2013	Liquefied petroleum gas storage installations — Code of Practice : Part 1 Residential commercial and industrial cylinder installations
	6044 (Part 2) : 2001	Code of Practice for liquefied petroleum gas storage Installations: Part 2 Commercial, industrial and domestic bulk storage installations
(15)	2175 : 1988	Specification for heat sensitive fire detectors for use in automatic fire alarm system (*second revision*)
	IS/ISO 7240-5 : 2003	Fire detection and alarm systems: Part 5 Point-type heat detectors
	IS/ISO 7240-7 : 2011	Fire detection and alarm systems: Part 7 Point-type smoke detectors using scattered light, transmitted light or ionization

IS No.	Title
IS/ISO 7240-11 : 2011	Fire detection and alarm systems: Part 11 Manual call points
IS/ISO 7240-15 : 2004	Fire detection and alarm systems: Part 15 Point-type fire detectors using scattered light, transmitted light or ionization sensor in combination with a heat sensor
11360 : 1985	Specification for smoke detectors for use in automatic electrical fire alarm system
(16) 2189 : 2008	Code of practice for selection, installation and maintenance of automatic fire detection and alarm system (*second revision*)
(17) 636 : 1988	Specification for non-percolating flexible fire fighting delivery hose (*third revision*)
884 : 1985	Specification for first-aid hose reel for fire fighting(*first revision*)
901 : 1988	Specification for couplings, double male and double female instantaneous pattern for fire fighting (*third revision*)
902 : 1992	Specification for suction hose couplings for fire fighting purposes (*third revision*)
903 : 1993	Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner (*fourth revision*)
904 : 1983	Specification for two-way and three-way suction collecting heads for fire fighting purposes (*second revision*)
905 : 1980	Specification for delivery breechings, dividing and collecting, instantaneous pattern for fire fighting purposes (*second revision*)
906 : 1988	Specification for revolving branch pipe for fire fighting (*third revision*)
907 : 1984	Specification for suction strainers, cylindrical type for fire fighting purpose (*second revision*)
908 : 1975	Specification for fire hydrant, stand post type (*second revision*)
909 : 1992	Specification for underground fire hydrant : Sluice valve type (*third revision*)
910 : 1980	Specification for combined key for hydrant, hydrant cover and lower valve (*second revision*)
926 : 1985	Specification for fireman's axe (*second revision*)
927 : 1981	Specification for fire hooks (*second revision*)
928 : 1984	Specification for fire bells (*second revision*)
937 : 1981	Specification for washers for water fittings for fire fighting purposes (*second revision*)
939 : 1977	Specification for snatch block for use with fibre rope for fire brigade use (*first revision*)
941 : 1985	Specification for blowers and exhauster for fire fighting (*second revision*)
942 : 1982	Functional requirements for 275 l/min portable pump set for fire fighting (*second revision*)
943 : 1979	Functional requirement for 680 l/min trailer pump for fire brigade use (*second revision*)
944 : 1979	Functional requirement for 1800 l/min trailer pump for fire brigade use (*second revision*)
947 : 1985	Functional requirement for towing tender for trailer fire pump for fire brigade use (*first revision*)
948 : 1983	Functional requirement for water tender, Type A, for fire brigade use (*second revision*)
949 : 2012	Functional requirement for emergency (rescue) tender (*third revision*)
950 : 2012	Functional requirements for water tender, Type B for fire brigade use (*third revision*)
952 : 1986	Specification for fog nozzle for fire brigade use (*second revision*)
955 : 1980	Functional requirements for dry power tender for fire-brigade use (150 kg capacity) (*first revision*)
957 : 1967	Specification for control van for fire brigade
1941 (Part 1) : 1976	Functional requirements for electric motor sirens : Part 1 AC, 3-Phase, 50 Hz, 415 volts type (*second revision*)
2097 : 2012	Specification for foam making branch pipe and foam inductor (*second revision*)
2175 : 1988	Specification for heat sensitive fire detectors for use in automatic detectors for use in automatic fire alarm system (*second revision*)
2546 : 1974	Specification for galvanized mild steel fire bucket (*first revision*)

IS No.	*Title*
2696 : 1974	Functional requirements for 1125 l/min light fire engine (*first revision*)
2745 : 1983	Specification for non-metal helmet for firemen and civil defence personnel (*second revision*)
2871 : 2012	Specification for branch pipe, universal for fire fighting purposes (*second revision*)
2878 : 2004	Specification for fire extinguisher, carbon-dioxide type (portable and trolley mounted) (*third revision*)
2930 : 1980	Functional requirements for hose laying tender for fire brigade use (*first revision*)
3582 : 1984	Specification for basket strainers for fire fighting purposes (cylindrical type) (*first revision*)
4308 : 2003	Specification for dry chemical powder for fire fighting B and C class fires (*second revision*)
4571 : 1977	Specification for aluminium extension ladders for fire brigade use (*first revision*)
4643 : 1984	Specification for suction wrenches for fire brigade use (*first revision*)
4861 : 1984	Specification for dry powder for fighting fires in burning metals (*first revision*)
4927 : 1992	Specification for unlined flax canvas hose for fire fighting (*first revision*)
4928 : 1986	Specification for delivery valve for centrifugal pump outlets (*first revision*)
4947 : 2006	Specification for gas cartridges for use in fire extinguishers (*third revision*)
4989 : 2006	Foam concentrate for producing mechanical foam for fire fighting — Specification (*third revision*)
4989 (Part 4) : 2003	Specification for multipurpose aqueous film forming foam liquid concentrate for extinguishing hydrocarbon and polar solvent fires
5131 : 2002	Specification for dividing breeching with control, for fire brigade use (*second revision*)
5290 : 1993	Specification for landing valve (*third revision*)
5486 : 1985	Specification for quick release knife (*first revision*)
5505 : 1985	Specification for multi-edged rescue axe (non-wedging) (*first revision*)
5612	Specification for hose-clamps and hose-bandages for fire brigade use
(Part 1) : 1977	Hose clamps (*first revision*)
(Part 2) : 1977	Hose bandages (*first revision*)
5714 : 1981	Specification for hydrant, stand-pipe for fire fighting (*first revision*)
6026 : 1985	Specification for hand operated sirens (*first revision*)
6067 : 1983	Functional requirements for water tender, Type 'X' for fire brigade use (*first revision*)
IS/ISO 7240-5 : 2003	Fire detection and alarm systems — Part 5: Point-type heat detectors
IS/ISO 7240-7 : 2011	Fire detection and alarm systems — Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization
IS/ISO 7240-11 : 2011	Fire detection and alarm systems — Part 11 Manual call points
8090 : 1992	Specification for couplings, branch pipe, nozzle, used in hose reel tubing for fire fighting (*first revision*)
8096 : 1992	Specification for fire beaters (*first revision*)
8149 : 1994	Functional requirements for twin CO_2 fire extinguishers (trolley mounted) (*first revision*)
8423 : 1994	Specification for controlled percolating hose for fire fighting (*first revision*)
8442 : 2008	Specification for stand post type water and foam monitor for fire fighting (*first revision*)
9972 : 2002	Specification for automatic sprinkler heads (*first revision*)
10460 : 1983	Functional requirements for small foam tender for fire brigade use
10658 : 1999	Specification for higher capacity dry powder fire extinguisher (trolley mounted) (*first revision*)
10993 : 1984	Functional requirements for 2 000 kg dry powder tender for fire brigade use
11101 : 1984	Specification for extended branch pipe for fire brigade use

IS No.	*Title*
11108 : 1984	Specification for portable fire extinguisher halon-1211 type
11833 : 1986	Specification for dry powder fire extinguisher for metal fires
12717 : 1989	Functional requirements of fire fighting equipment — High capacity portable pumpset (1 100-1 600 l/min)
12796 : 1989	Specification for fire rake
13039 : 1991	Code of practice for provision and maintenance of external hydrant system
13385 : 1992	Specification for fire extinguisher 50 capacity wheel mounted water type (Gas cartridge)
13386 : 1992	Specification for 50 litre capacity fire extinguisher, mechanical foam type
14609 : 1999	Specification for ABC dry powder for fire fighting
14933 : 2001	Specification for high pressure fire fighting hose
14951 : 2001	Specification for fire extinguisher, 135 litre capacity mechanical foam type
15051 : 2002	Specification for high pressure fire hose delivery couplings
IS 15105 : 2002/ ISO 6182-1	Design and installation of fixed automatic sprinkler fire extinguishing system
IS 15220 : 2002/ ISO 7201-1	Specification for halon 1211 and halon 1301 — fire extinguishing media for fire protection
IS 15683 : 2006/ ISO 7165 : 2009	Portable fire extinguishers — Performance and construction — Specification
11360 : 1985	Specification for smoke detectors for use in automatic electrical fire alarm system
IS 15493 : 2004/ ISO 14520-1	Gaseous fire extinguishing systems : General requirements
IS 15505 : 2004/ ISO 14520-6	Gaseous fire extinguishing systems: HCFC Blend A extinguishing systems
IS 15506 : 2004/ ISO 14520-14	Gaseous fire extinguishing systems — IG 55 extinguishing systems
IS 15525 : 2004/ ISO 14520-13	Gaseous fire extinguishing systems — IG 100 extinguishing systems
IS 15501 : 2004/ ISO 14520-15	Gaseous fire extinguishing systems — IG 541 extinguishing systems
IS 15497 : 2004/ ISO 14520-12	Gaseous fire extinguishing systems — IG 01 extinguishing systems
15519 : 2004	Code of practice for water mist fire protection systems — System design, installation and commissioning
IS 15517 : 2004/ ISO 14520-9	Gaseous fire extinguishing systems — Carbon dioxide, total flooding and local application including in cabinet subfloors systems
IS 15517 : 2004/ ISO 14520-9	Gaseous fire extinguishing systems — HFC 227ea (Hepta Fluoro Propane) extinguishing system
(18) 2190 : 2010	Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers (*fourth revision*)
(19) 884 : 1985	Specification for first aid hose reel for fire fighting (*first revision*)
(20) 15105 : 2002	Design and installation of fixed automatic sprinkler fire extinguishing system
(21) 15325 : 2003	Design and installation of fixed automatic high and medium velocity water spray system — Code of practice
(22) 12835 (Part 1) : 1989	Design and installation of fixed foam fire extinguishing system — Code of practice: Part 1 Low expansion foam
(23) 15528 : 2004	Gaseous fire extinguishing systems — Carbon dioxide, total flooding and local application (sub-floor and in-cabinet), high and low floor pressure (refrigerated) systems
(24) 15519 : 2004	Water mist fire protection systems — System design, installation and commission ing — Code of Practice
(25) 15493 : 2004	Gaseous fire extinguishing Systems — General requirements
15497 : 2004	Gaseous fire extinguishing systems — IG 01 extinguishing systems
15501 : 2004	Gaseous fire extinguishing systems — IG 541 extinguishing systems
15505 : 2004	Gaseous fire extinguishing systems — HCFC Blend A

IS No.	*Title*
15506 : 2004	Gaseous fire extinguishing systems — IG 55 extinguishing systems
15517 : 2004	Gaseous fire extinguishing systems — HFC 227 ea (Hepta fluoro propane) extinguishing systems
15525 : 2004	Gaseous fire extinguishing systems — IG 100 extinguishing systems
(26) 2189 : 2008	Code of practice for selection, installation and maintenance of automatic fire detection and alarm system (*fourth revision*)
2190 : 2010	Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers (*fourth revision*)
3844 : 1989	Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises (*first revision*)
9668 : 1990	Code of practice for provision and maintenance of water supplies for fire fighting
13039 : 1991	Code of practice for provision and maintenance of external hydrant system
13039 : 2014	External hydrant systems — Provision and maintenance — Code of practice
(27) 4878 : 1986	Byelaws for construction of cinema buildings (*first revision*)
(28) 2726 : 1988	Code of practice for fire safety of industrial buildings : Cotton ginning and pressing (including cotton seed delintering) factories (*first revision*)
3034 : 1993	Code of practice for fire safety of industrial buildings : Electrical generating and distributing stations (*second revision*)
3058 : 1990	Code of practice for fire safety of industrial buildings : Viscose rayon yarn and/or staple fibre plants (*first revision*)
3079 : 1990	Code of practice for fire safety of industrial buildings : Cotton textile mills (*first revision*)
3594 : 1991	Code of practice for fire safety of industrial buildings : General storage and warehousing including cold storage (*first revision*)
3595 : 1984	Code of practice for fire safety of industrial buildings : Coal pulverizers and associated equipment (*first revision*)
3836 : 2000	Code of practice for fire safety of industrial buildings : Jute mills (*second revision*)
4209 : 2013	Code of safety for chemical laboratories (*second revision*)
4226 : 1988	Code of practice for fire safety of industrial buildings : Aluminium/ Magnesium powder factories (*first revision*)
4886 : 1991	Code of practice for fire safety of industrial buildings : Tea factories (*first revision*)
6329 : 2000	Code of practice for fire safety of industrial buildings : Saw mills and wood works (*first revision*)
9109 : 2000	Code of practice for fire safety of industrial buildings : Paint and Varnish factories
11457 (Part 1) : 1985	Code of practice for fire safety of chemical industries: Part 1 Rubber and plastic
(29) 13039 : 2014	External hydrant systems — Provision and maintenance — Code of practice

NATIONAL BUILDING CODE OF INDIA

PART 5 BUILDING MATERIALS

BUREAU OF INDIAN STANDARDS

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FOREWORD

This Code (Part 5) lists Indian Standard specifications for materials used in building construction. The Indian Standards for methods of tests, to ensure the requirements demanded of the materials in the various situations, are also included. This is with a view to ensuring the quality and effectiveness of building materials used in the construction and of their storage, which are as important as other aspects of building activity like planning, designing and constructing the building itself.

Historically, choice of building materials was determined by what was locally available, appropriateness to geo-climatic conditions and affordability of users. In the recent past, different initiatives have been taken in the areas of research and development, standardization, and development and promotion of innovative materials. A review of the recent trends indicates that the growth in the area of building materials covers emerging trends and latest developments in the use of wastes, mineral admixtures in cement and concrete, substitutes to conventional timber, composite materials and recycling of wastes, at the same time ensuring desired response of materials in relation to fire safety, long term performance and durability. In addition to these, nowadays, development of specific materials is being researched which may be structured and designed to meet needs to specially developed construction technologies in time to come, such as, for disaster prone areas or aggressive climatic and industrial situations.

To encourage use of appropriate materials, it may be desirable to have to the largest extent possible, performance oriented approach for specifications rather than prescriptive approach. The approach has been already adopted in some cases in development of standards, wherever found possible.

Indian Standards cover the requirements for most of the materials in use. However, there may be a gap between development of new materials and techniques of application and formulation of standards. It, therefore, becomes necessary for a Building Code to be flexible to recognize building materials other than those for which Indian Standards are available. This Part of the Code, therefore, since its first version, duly takes care of this aspect and explicitly provides for use of new or alternate building materials, provided it is proved by authentic tests that the new or alternative material is effective and suitable for the purpose intended. However, it is worthwhile that more and more emphasis is given to the satisfaction of performance requirements expected of a building material, so that a wide range of such new or alternate materials can be evaluated and used, if found appropriate.

As already emphasized, quality of material is quite important for their appropriate usage, whether it is a material for which an Indian Standard is available or a new or alternative material as defined in **4** of this Part of the Code. While continuing to emphasize on conformity of building materials to available Indian Standards, this Part recommends that the building regulating authority may also recognize the use of building materials conforming to other specifications and test methods (*see* **4.2**), in case Indian Standards are not available for particular materials. Third party certification schemes available in the country for quality assurance of above materials can be used with advantage to ensure the appropriateness of these materials.

It is well recognized that buildings during their construction and subsequently in their operation consume lot of resources. The holistic approach for ensuring proper and sustainable developments is to take care of the concerned aspects affecting sustainability during the conceptualization, planning, design, construction, and operation and maintenance stages. The building material production, transportation and utilization assume a substantial component of the embodied energy that goes into a building. It is therefore important that sustainability of building materials is well understood and ensured in a building project. This Part of the Code recognizes this aspect and covers appropriate provision therefore.

This Part of the Code was first published in 1970 and subsequently revised in 1983 and 2005 as Part 5 of NBC 2005. The first and second revision of this Part incorporated an updated version of the list of Indian Standards given at the end of this Part of the Code. Also the list of building materials was completely revised to make it more user-friendly. This second revision of this Part, while basically retaining the structure of 2005 version of the Code, incorporates the following modifications:

a) The clause on new/alternative materials has been extended to give examples of some potential new/ alternative materials;
b) Recognizing the importance of sustainability in building construction and built environment, a new clause giving broad aspects relating to sustainable materials, has been added;
c) The list at the end of this Part has been updated to reflect the latest available Indian Standard specifications and methods of test.
d) In the above list, existing categories have been re-organized and some new categories have been added either under the existing principal categories or as separate principal categories. In the process, the categories such as, bricks, blocks and other masonry units; mortar (including sand for mortar); supplementary cementitious materials; mesh/net for mosquito/vector prevention; concrete door and window frame; other composite material doors and windows; fire check doors; stone flooring, etc, have been added.
e) The headings of some of the categories have been rechristened to more appropriately reflect the materials/ products actually covered thereunder.

A reference to SP 21 : 2005 'Summaries of Indian Standards for Building Materials' may be useful. This publication gives the summaries of Indian Standards covering various building materials, fittings and components except standards relating to paints.

All standards cross-referred in the main text of this Part, are subject to revision. The parties to agreement based on this Part are encouraged to investigate the possibility of applying the most recent editions of the standards.

For the purpose of deciding whether a particular requirement of this Part is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this Part.

NATIONAL BUILDING CODE OF INDIA

PART 5 BUILDING MATERIALS

1 SCOPE

This Code (Part 5) covers the requirements of building materials and components, and criteria for accepting new or alternative building materials and components.

2 MATERIALS

Every material used in fulfillment of the requirements of this Part, unless otherwise specified in the Code or approved, shall conform to the relevant Indian Standards. A list of Indian Standard specifications as the 'accepted standards' is given at the end of this Part of the Code. At the time of publication of the Code, the editions indicated were valid. All standards are subject to amendments and revisions. The Authority shall take cognizance of such amendments and revisions. The latest version of the specification shall, as far as possible, be adopted at the time of enforcement of this Part of the Code.

3 SUSTAINABLE MATERIALS

Choice of building materials is important in sustainable design because of the extensive network of activities such as extraction, processing and transportation steps required for making a material, and activities involved thereafter till building construction and even thereafter. These activities may pollute the air, soil and water, as well as destroy natural habitats and deplete natural resources. One of the most effective strategies for minimizing the environmental impacts of material usage is to reuse existing buildings. Rehabilitation of existing building, and their shell and non-shell components, not only reduces the volume of solid waste generated and its subsequent diversion to landfills but also the environmental impacts associated with the production, delivery and use or installation of new building materials. However, the use of sustainable building materials is one of the best strategies in the pursuit of sustainable buildings.

An ideal sustainable building material is not only environment friendly but also causes no adverse impact on health of occupants, is readily available, can be reclaimed and recycled, and is not only made from renewable raw material, but also uses predominantly renewable energy in its extraction, production, transportation, fixing and ultimate disposal. Practically, this kind of ideal material may not be available and hence, when selecting sustainable materials, it may be best to choose materials which fulfill most of these criteria. Sustainable building materials also offer specific benefits to the building owner and building occupants, such as, reduced maintenance/replacement costs over the life of the building; energy conservation; improved occupant health and productivity; lower costs associated with changing space configurations; and greater design flexibility.

The selection of sustainable building materials shall be made in accordance with Part 11 'Approach to Sustainability' of the Code.

4 NEW OR ALTERNATIVE MATERIALS

4.1 The provisions of this Part are not intended to prevent the use of any material not specifically prescribed under **2**. Any such material may be approved by the Authority or an agency appointed by them for the purpose, provided it is established that the material is satisfactory for the purpose intended and the equivalent of that required in this Part or any other specification issued or approved by the Authority. The Authority or an agency appointed by them shall take into account the following parameters, as applicable to the concerned new or alternative building material:

a) Requirements of the material specified/ expected in terms of the provisions given in the standards on its usage, including its applicability in geo-climatic condition;
b) General appearance;
c) Dimension and dimensional stability;
d) Structural stability including strength properties;
e) Fire safety;
f) Durability;
g) Thermal properties;
h) Mechanical properties;
j) Acoustical properties;
k) Optical properties;
m) Biological effect;
n) Environmental aspects;
p) Working characteristics;
q) Ease of handling;
r) Consistency and workability;
s) UV resistance; and
t) Toxicity.

Some of such new/alternative materials may be ferrocement, decorative concrete, polymer concrete, micro-concrete repair materials, dry-mix mortar, non-shrink grout, optical fibres, special materials for bunkers/blast resistant structures, artificial stones used in restoration of heritage structures, nanotechnology based advanced materials, aluminium composite panels, vermiculite based boards, exfoliated perlite, geopolymeric cement, pervious concrete, UPVC doors and windows, stainless steel insulated water tanks, etc.

For establishing the performance of the material/ component, laboratory/field tests, and field trials, as required, and study of historical data are recommended. For sampling and frequency of tests for new or alternate materials, similar product standards shall be referred to.

The above materials would no longer be treated as new/ alternative materials as soon as Indian Standards for the same are established.

4.2 Approval in writing of the Authority or an agent appointed by them for the purpose of approval of material, shall be obtained by the owner or his agent before any new, alternative or equivalent material is used. The Authority or their agent shall base such approval on the principle set forth in **4.1** and shall require that tests be made (*see* **8.1**) or sufficient evidence or proof be submitted, at the expense of the owner or his agent, to substantiate any claim for the proposed material.

NOTE — For interpretation of the term 'Authority' (*see also* **8.1**), the definition of 'Authority having jurisdiction' given in Part 2 'Administration' of the Code shall apply.

5 THIRD PARTY CERTIFICATION

For ensuring the conformity of materials for which Indian Standards exist and for new or alternative building materials, to requisite quality parameters the services under the third party certification schemes of the Government, may be utilized with advantage.

6 USED MATERIALS

Utilization of used materials may not be precluded provided these meet the requirements of this Part for new materials (*see* Part 2 'Administration' of the Code).

7 STORAGE OF MATERIALS

All building materials shall be stored on the building site in such a way as to prevent deterioration or the loss or impairment of their structural and other essential properties (*see* Part 7 'Construction Management, Practices and Safety' of the Code).

8 METHODS OF TEST

8.1 Every test of material as required in this Part or by the Authority shall be carried out in accordance with the methods of test prescribed in relevant Indian Standards. In cases of methods of tests for which Indian Standards are not available, the same shall conform to the methods of tests issued by the Authority or their agent. A list of Indian Standard methods of test is given at the end of this Part of the Code as the 'accepted standards'. Laboratory tests shall be conducted by recognized laboratories acceptable to the Authority.

8.1.1 The manufacturer/supplier shall satisfy himself that materials conform to the requirements of the specifications and if requested shall supply a certificate to this effect to the purchaser or his representative. When such test certificates are not available, the specimen of the material shall be tested.

LIST OF STANDARDS

Following are the Indian Standards for various building materials and components, to be complied with in fulfillment of the requirements of the Code.

In the following list, while enlisting the Indian Standards, the materials have been categorized in such a way as to make the list user friendly. In the process, if so required, some of the standards have been included even in more than one category of products, such as in the category based on composition as well as on end application of the materials. The list has been arranged in alphabetical order of their principal category as given below:

1) Aluminium and other light metals and their alloys
2) Bitumen and tar products
3) Bricks, blocks and other masonry building units
4) Builder's hardware
5) Building chemicals
6) Building lime and products
7) Clay and stabilized soil products
8) Cement and concrete (including steel reinforcement for concrete)
9) Composite matrix products (including cement and resin matrix products)
10) Conductors and cables
11) Doors, windows and ventilators
12) Electrical wiring, fittings and accessories
13) Fillers, stoppers and putties
14) Floor covering, roofing and other finishes
15) Glass
16) Gypsum based materials

17) Mortar (including sand for mortar)
18) Paints and allied products
19) Polymers, plastics and geosynthetics/ geotextiles
20) Sanitary appliances and water fittings
21) Steel and its alloys
22) Stones
23) Structural sections
24) Thermal insulation materials
25) Threaded fasteners, rivets and nails
26) Timber, bamboo and other lignocellulosic building materials
27) Unit weights of building materials
28) Waterproofing and damp-proofing materials
29) Welding electrodes and wires
30) Wire ropes and wire products (including wire for fencing)

1. ALUMINIUM AND OTHER LIGHT METALS AND THEIR ALLOYS

IS No.	*Title*
733 : 1983	Specification for wrought aluminium and aluminium alloys bars, rods and sections for general engineering purposes (*third revision*)
734 : 1975	Wrought aluminium and aluminium alloys forging stock and forgings (for general engineering purposes) (*second revision*)
736 : 1986	Specification for wrought aluminium and aluminium alloys plate for general engineering purposes (*third revision*)
737 : 2008	Specification for wrought aluminium and aluminium alloys sheet and strip for general engineering purposes (*fourth revision*)
738 : 1994	Specification for wrought aluminium and aluminium alloys drawn tube for general engineering purposes (*third revision*)
739 : 1992	Specification for wrought aluminium and aluminium alloys — Wire for general engineering purposes (*third revision*)
740 : 1977	Specification for wrought aluminium and aluminium alloys rivet stock for general engineering purposes (*second revision*)
1254 : 2007	Corrugated aluminium sheet (*fourth revision*)
1284 : 1975	Wrought aluminium alloys bolt and screw stock for general engineering purposes (*second revision*)
1285 : 2002	Specification for wrought aluminium and aluminium alloys — Extruded round tube and hollow sections for general engineering purposes (*third revision*)
2479 : 1981	Colour code for the identification of aluminium and aluminium alloys for general engineering purposes (*second revision*)
2676 : 1981	Dimensions for wrought aluminium and aluminium alloy sheet and strip
2677 : 1979	Dimensions for wrought aluminium and aluminium alloys, plates and hot rolled sheets
3577 : 1992	Wrought aluminium and its alloys — Rivet, bolt and screw stock — Dimensions and tolerances (*first revision*)
3965 : 1981	Dimensions for wrought aluminium and aluminium alloys bar, rod and section (*first revision*)
6477 : 1983	Dimensions for wrought aluminium and aluminium alloys extruded hollow sections
14712 : 1999	Specification for wrought aluminium and its alloys — Chequered/tread sheets for general engineering purposes
15965 : 2012	Pre-painted aluminium zinc alloy metallic coated steel strip and sheet (Plain)

2. BITUMEN AND TAR PRODUCTS

IS No.	*Title*
73 : 2013	Specification for paving bitumen (*fourth revision*)
212 : 1983	Specification for crude coal tar for general use (*second revision*)
215 : 1995	Specification for road tar (*third revision*)
216 : 2006	Specification for coal tar pitch (*second revision*)
217 : 1988	Specification for cutback bitumen (*second revision*)
218 : 1983	Specification for creosote oil for use as wood preservatives (*second revision*)
454 : 1994	Specification for cutback bitumen from waxy crude (*second revision*)

IS No.	Title
702 : 1988	Specification for industrial bitumen (*second revision*)
1201 to 1220	Methods for testing tar and bituminous materials (*first revision*)
1201 : 1978	Sampling (*first revision*)
1202 : 1978	Determination of specific gravity (*first revision*)
1203 : 1978	Determination of penetration (*first revision*)
1204 : 1978	Determination of residue of specified penetration (*first revision*)
1205 : 1978	Determination of softening point (*first revision*)
1206	Determination of viscosity
(Part 1) : 1978	Industrial viscosity (*first revision*)
(Part 2) : 1978	Absolute viscosity (*first revision*)
(Part 3) : 1978	Kinematic viscosity (*first revision*)
1207 : 1978	Determination of equiviscous temperature (EVT) (*first revision*)
1208 : 1978	Determination of ductility (*first revision*)
1209 : 1978	Determination of flash point and fire point (*first revision*)
1210 : 1978	Float test (*first revision*)
1211 : 1978	Determination of water content (Dean and Stark method) (*first revision*)
1212 : 1978	Determination of loss on heating (*first revision*)
1213 : 1978	Distillation test (*first revision*)
1215 : 1978	Determination of matter insoluble in toluene (*first revision*)
1216 : 1978	Determination of solubility in carbon disulphide or trichloroethylene (*first revision*)
1217 : 1978	Determination of mineral matter (ASH) (*first revision*)
1218 : 1978	Determination of phenols (*first revision*)
1219 : 1978	Determination of naphthalene (*first revision*)
1220 : 1978	Determination of volatile matter content (*first revision*)
3117 : 2004	Specification for bitumen emulsion for roads and allied applications (anionic type) (*first revision*)
8887 : 2004	Specification for bitumen emulsion for roads (cationic type) (*second revision*)
9381 : 1979	Methods for testing tar and bituminous materials: Determination of FRAASS breaking point of bitumen
9382 : 1979	Methods for testing tar and bituminous materials: Determination of effect of heat and air by thin film oven test
10511 : 1983	Method for determination of asphaltenes in bitumen by precipitation with normal haptane
10512 : 2003	Method for determination of wax content in bitumen (*first revision*)
13758	Coal tar pitch — Methods of test
(Part 1) : 1993	Determination of matter insoluble in quinoline
(Part 2) : 1993	Determination of coking value
15172 : 2002	Methods for testing tar and bituminous materials — Determination of curing index for cutback bitumens
15173 : 2002	Methods for testing tar and bituminous materials — Determination of breaking point for cationic bitumen emulsion
15174 : 2002	Methods for testing tar and bituminous material — Determination of breaking point for anionic bitumen emulsion
15462 : 2004	Specification for polymer and rubber modified
15799 : 2008	Methods for testing tar and bituminous materials — Determination of durability of bitumen
15808 : 2008	Specification for multigrade bitumen for use in pavement construction

3. BRICKS, BLOCKS AND OTHER MASONRY BUILDING UNITS

IS No.	Title
1077 : 1992	Specification for common burnt clay building bricks (*fifth revision*)
1725 : 2013	Specification for stabilized soil blocks used in general building construction (*second revision*)
2180 : 1988	Specification for heavy duty burnt clay building bricks (*third revision*)
2185	Specification for concrete masonry units

IS No.	*Title*
(Part 1) : 2005	Hollow and solid concrete blocks (*third revision*)
(Part 2) : 1983	Hollow and solid lightweight concrete blocks (*first revision*)
(Part 3) : 1984	Autoclaved cellular (aerated) concrete blocks (*first revision*)
(Part 4) : 2008	Cellular concrete blocks using preformed foam
2222 : 1991	Specification for burnt clay perforated building bricks (*third revision*)
2691 : 1988	Specification for burnt clay facing bricks (*second revision*)
2849 : 1983	Specification for non-load bearing gypsum partition blocks (solid and hollow types)
3115 : 1992	Specification for lime based blocks (*second revision*)
3316 : 1974	Specification for structural granite (*first revision*)
3495 (Parts 1 to to 4) : 1992	Methods of test of burnt clay building bricks (*third revision*) Determination of compressive strength Determination of water absorption Determination of efflorescence Determination of warpage
3583 : 1988	Specification for burnt clay paving bricks (*second revision*)
3620 : 1979	Specification for laterite stone block for masonry (*first revision*)
3952 : 2013	Specification for burnt clay hollow bricks and blocks for walls and partitions (*third revision*)
4139 : 1989	Specification for calcium silicate bricks (*second revision*)
4860 : 1968	Specification for acid resistant bricks
4885 : 1988	Specification for sewer bricks (*first revision*)
5454 : 1978	Methods for sampling of clay building bricks (*first revision*)
5751 : 1984	Specification for precast concrete coping blocks (*first revision*)
5779 : 1986	Specification for burnt clay soling bricks (*first revision*)
6165 : 1992	Dimensions for special shapes of clay bricks (*first revision*)
9893 : 1981	Specification for precast concrete blocks for lintels and sills
10360 : 1982	Specification for lime pozzolana concrete blocks for paving
12440 : 1988	Specification for precast concrete stone masonry blocks
12894 : 2002	Specification for pulverized fuel ash lime bricks (*first revision*)
13757 : 1993	Specification for burnt clay fly ash building bricks
15658 : 2006	Specification for precast concrete blocks for paving

4. BUILDER'S HARDWARE

IS No.	*Title*
204	Specification for tower bolts
(Part 1) : 1991	Ferrous metals (*fifth revision*)
(Part 2) : 1992	Non-ferrous metals (*fifth revision*)
205 : 1992	Specification for non-ferrous metal butt hinges (*fourth revision*)
206 : 2010	Specification for tee and strap hinges (*fifth revision*)
208 : 1996	Specification for door handles (*fifth revision*)
281 : 2009	Specification for mild steel sliding door bolts for use with padlocks (*fourth revision*)
362 : 1991	Specification for parliament hinges (*fifth revision*)
363 : 1993	Specification for hasps and staples (*fourth revision*)
364 : 1993	Specification for fanlight catch (*third revision*)
452 : 1973	Specification for door springs, rat-tail type (*second revision*)
453 : 1993	Specification for double-acting spring hinges (*third revision*)
729 : 1979	Specification for drawer locks, cupboard locks and box locks (*third revision*)
1019 : 1974	Specification for rim latches (*second revision*)
1341 : 1992	Specification for steel butt hinges (*sixth revision*)
1823 : 1980	Specification for floor door stoppers (*third revision*)
1837 : 1966	Specification for fanlight pivots (*first revision*)
2209 : 1976	Specification for mortice locks (vertical type) (*third revision*)
2681 : 1993	Specification for nonferrous metal

IS No.	Title
	sliding door bolts for use with padlocks (*third revision*)
3564 : 1995	Specification for door closers (hydraulically regulated) (*second revision*)
3818 : 1992	Specification for continuous (piano) hinges (*third revision*)
3828 : 1966	Specification for ventilator chains
3843 : 1995	Specification for steel backflap hinges (*first revision*)
3847 : 1992	Specification for mortice night latches (*second revision*)
4621 : 1975	Specification for indicating bolts for use in public baths and lavatories (*first revision*)
4948 : 2002	Specification for welded steel wire fabric for general use (*second revision*)
4992 : 1975	Specification for door handles for mortice locks (vertical type) (*first revision*)
5187 : 1972	Specification for flush bolts (*first revision*)
5899 : 1970	Specification for bathroom latches
5930 : 1970	Specification for mortice latch (vertical type)
6315 : 1992	Specification for floor springs (hydraulically regulated) for heavy doors (*second revision*)
6318 : 1971	Specification for plastic window stays and fasteners
6343 : 1982	Specification for door closers (pneumatically regulated) for light door weighing up to 40 kg (*first revision*)
6607 : 1972	Specification for rebated mortice locks (vertical type)
7196 : 1974	Specification for hold fast
7197 : 1974	Specification for double action floor springs (without oil check) for heavy doors
7534 : 1985	Specification for sliding locking bolts for use with padlocks (*first revision*)
8756 : 1978	Specification for ball catches for use in wooden almirah
9106 : 1979	Specification for rising butt hinges
9131 : 1979	Specification for rim locks
9460 : 1980	Specification for flush drop handle for drawer
9899 : 1981	Specification for hat coat and wardrobe hooks
10019 : 1981	Specification for mild steel stays and fasteners
10090 : 1982	Specification for numericals
10342 : 1982	Specification for curtain rail system
12817 : 2013	Specification for stainless steel butt hinges (*second revision*)
12867 : 1989	Specification for PVC hand rails covers
14912 : 2001	Specification for door closers concealed type (hydraulically regulated)
15833 : 2009	Specification for stainless steel tower bolts
15834 : 2008	Specification for stainless steel sliding door bolts for use with padlocks
16015 : 2013	Specification for mortice locks with lever mechanism (vertical type, sliding door locks and dead locks)
16016 : 2013	Specification for cylindrical locks with pin tumbler mechanism

5. BUILDING CHEMICALS

a) Anti-termite Chemicals

IS No.	Title
8944 : 2005	Specification for chlorpyrifos emulsifiable concentrates (*first revision*)
16131 : 2015	Specification for imidacloprid suspension concentrate (sc)

b) Chemical Admixture/Water Proofing Compounds

IS No.	Title
2645 : 2003	Specification for integral water-proofing compounds for cement mortar and concrete (*second revision*)
6925 : 1973	Methods of test for determination of water soluble chlorides in concrete admixtures
9103 : 1999	Specification for concrete admixtures (*first revision*)

c) Sealants/Fillers

IS No.	Title
1834 : 1984	Specification for hot applied sealing compound for joint in concrete (*first revision*)

IS No.	Title
1838	Specification for preformed fillers for expansion joint in concrete pavements and structures (non-extruding and resilient type)
(Part 1) : 1983	Bitumen impregnated fibre (*first revision*)
(Part 2) : 1984	CNSL aldehyde resin and coconut pith
(Part 3) : 2011	Polymer based
10566 : 1983	Methods of tests for preformed fillers for expansion joint in concrete paving and structural construction
11433	Specification for one grade polysulphide based joint sealant
(Part 1) : 1985	General requirements
(Part 2) : 1986	Methods of test
12118	Specification for two parts polysulphide based sealants
(Part 1) : 1987	General requirements
(Part 2) : 1987	Methods of test

d) Adhesives

IS No.	Title
848 : 2006	Specification for synthetic resin adhesives for plywood (phenolic and aminoplastic) (*second revision*)
849 : 1994	Specification for cold setting case in glue for wood (*first revision*)
851 : 1978	Specification for synthetic resin adhesives for construction work (non-structural) in wood (*first revision*)
852 : 1994	Specification for animal glue for general wood-working purposes (*second revision*)
1508 : 1972	Specification for extenders for use in synthetic resin adhesives (urea-formaldehyde) for plywood (*first revision*)
4835 : 1979	Specification for polyvinyl acetate dispersion-based adhesives for wood (*first revision*)
9188 : 1979	Performance requirements for adhesive for structural laminated wood products for use under exterior exposure condition
12830 : 1989	Rubber based adhesives for fixing PVC tiles to cement
12994 : 1990	Epoxy adhesives, room temperature curing general purpose
15477 : 2004	Specification for adhesives for use with ceramic tiles and mosaics

6. BUILDING LIME AND PRODUCTS

IS No.	Title
712 : 1984	Specification for building limes (*third revision*)
1624 : 1986	Method of field testing of building lime (*second revision*)
2686 : 1977	Specification for cinder as fine aggregates for use in lime concrete (*first revision*)
3068 : 1986	Specification for broken brick (burnt-clay) coarse aggregates for use in lime concrete (*second revision*)
3115 : 1992	Specification for lime based blocks (*second revision*)
3182 : 1986	Specification for broken bricks (burnt clay) fine aggregates for use in lime mortar (*second revision*)
4098 : 1983	Specification for lime-pozzolana mixture (*first revision*)
4139 : 1989	Specification for calcium silicate bricks (*second revision*)
6932	Method of tests for building limes
(Part 1) : 1973	Determination of insoluble residue, loss on ignition, insoluble matter, silicon dioxide, ferric and aluminium oxide, calcium oxide and magnesium oxide
(Part 2) : 1973	Determination of carbon dioxide content
(Part 3) : 1973	Determination of residue on slaking of quicklime
(Part 4) : 1973	Determination of fineness of hydrated lime
(Part 5) : 1973	Determination of unhydrated oxide
(Part 6) : 1973	Determination of volume yield of quicklime
(Part 7) : 1973	Determination of compressive and transverse strength
(Part 8) : 1973	Determination of workability
(Part 9) : 1973	Determination of soundness
(Part 10) : 1973	Determination of popping and pitting of hydrated lime
(Part 11) : 1984	Determination of setting time of hydrated lime
10360 : 1982	Specification for lime pozzolana concrete blocks for paving

IS No.	*Title*
10772 : 1983	Specification for quick setting lime pozzolana mixture
12894 : 2002	Specification for pulverized fuel ash lime bricks (*first revision*)
15648 : 2006	Specification for pulverized fuel ash for lime-pozzolana mixture applications

7. CLAY AND STABILIZED SOIL PRODUCTS

a) Blocks

IS No.	*Title*
3952 : 2013	Specification for burnt clay hollow bricks and blocks for walls and partitions (*third revision*)

b) Stabilized Soil Products

IS No.	*Title*
1725 : 2013	Specification for stabilized soil blocks used in general building construction (*second revision*)

c) Bricks

IS No.	*Title*
1077 : 1992	Specification for common burnt clay building bricks (*fifth revision*)
2180 : 1988	Specification for heavy duty burnt clay building bricks (*third revision*)
2222 : 1991	Specification for burnt clay perforated building bricks (*third revision*)
2691 : 1988	Specification for burnt clay facing bricks (*second revision*)
3495 (Parts 1 to 4) : 1992	Methods of test of burnt clay building bricks (*third revision*)
	Determination of compressive strength
	Determination of water absorption
	Determination of efflorescence
	Determination of warpage
3583 : 1988	Specification for burnt clay paving bricks (*second revision*)
3952 : 2013	Specification for burnt clay hollow bricks and blocks for walls and partitions (*third revision*)
4885 : 1988	Specification for sewer bricks (*first revision*)
5454 : 1978	Methods for sampling of clay building bricks (*first revision*)
5779 : 1986	Specification for burnt clay soling bricks (*first revision*)
6165 : 1992	Dimensions for special shapes of clay bricks (*first revision*)
13757 : 1993	Specification for burnt clay fly ash building bricks

d) Jallies

IS No.	*Title*
7556 : 1988	Specification for burnt clay jallies (*first revision*)

e) Tiles

IS No.	*Title*
654 : 1992	Specification for clay roofing tiles, Mangalore pattern (*third revision*)
1464 : 1992	Specification for clay ridge and ceiling tiles (*second revision*)
1478 : 1992	Specification for clay flooring tiles (*second revision*)
2690	Specification for burnt clay flat terracing tiles
(Part 1) : 1993	Machine made (*second revision*)
(Part 2) : 1992	Hand made (*second revision*)
3367 : 1993	Specification for burnt clay tiles for use in lining irrigation and drainage works (*second revision*)
3951	Specification for hollow clay tiles for floor and roofs
(Part 1) : 2009	Filler type (*second revision*)
(Part 2) : 2009	Structural type (*second revision*)
8920 : 1978	Methods for sampling of burnt clay tiles
13317 : 1992	Specification for clay roofing county tiles, half round and flat tiles

8. CEMENT AND CONCRETE (INCLUDING STEEL REINFORCEMENT FOR CONCRETE)

a) Aggregates

IS No.	*Title*
383 : 2016	Specification for coarse and fine aggregates for concrete (*third revision*)
650 : 1991	Specification for standard sand for testing of cement (*second revision*)
1542 : 1992	Specification for sand for plaster (*second revision*)
2116 : 1980	Specification for sand for masonry mortars (*first revision*)

IS No.	*Title*
2386	Methods of test for aggregates for concrete
(Part 1) : 1963	Particle size and shape
(Part 2) : 1963	Estimation of deleterious materials and organic impurities
(Part 3) : 1963	Specific gravity, density, voids, absorption and bulking
(Part 4) : 1963	Mechanical properties
(Part 5) : 1963	Soundness
(Part 6) : 1963	Measuring mortar making properties of fine aggregates
(Part 7) : 1963	Alkali aggregate reactivity
(Part 8) : 1963	Petrographic examination
2430 : 1986	Methods of sampling of aggregates of concrete (*first revision*)
6579 : 1981	Specification for coarse aggregate for water bound macadam (*first revision*)
9142 : 1979	Specification for artificial light-weight aggregates for concrete masonry units

b) Cement

IS No.	*Title*
269 : 2015	Specification for ordinary Portland cement (*sixth revision*)
455 : 2015	Specification for Portland slag cement (*fifth revision*)
1489	Specification for Portland pozzolana cement
(Part 1) : 2015	Flyash based (*fourth revision*)
(Part 2) : 2015	Calcined clay based (*fourth revision*)
3466 : 1988	Specification for masonry cement (*second revision*)
6452 : 1989	Specification for high alumina cement for structural use (*first revision*)
6909 : 1990	Specification for supersulphated cement (*first revision*)
8041 : 1990	Specification for rapid hardening Portland cement (*second revision*)
8042 : 2015	Specification for white Portland cement (*third revision*)
8043 : 1991	Specification for hydrophobic Portland cement (*second revision*)
12330 : 1988	Specification for sulphate resisting Portland cement
12600 : 1989	Specification for low heat Portland cement
16415 : 2015	Specification for composite cement

c) Supplementary Cementitious Materials (Mineral Admixtures including Pozzolanas)

IS No.	*Title*
1344 : 1981	Specification for calcined clay pozzolana (*second revision*)
1727 : 1967	Methods of test for pozzolanic materials (*first revision*)
3812 (Part 1) : 2013	Specification for pulverized fuel ash For use as pozzolana in cement, cement mortar and concrete (*third revision*)
(Part 2) : 2013	For use as admixture in cement mortar and concrete (*third revision*)
6491 : 1972	Method of sampling of flyash
12089 : 1987	Specification for granulated slag for manufacture of Portland slag cement
12870 : 1989	Methods of sampling calcined clay pozzolana
15388 : 2003	Specification for silica fume
16354 : 2015	Specification for metakaolin for use in cement, cement mortar and concrete

d) Chemical Admixtures

IS No.	*Title*
6925 : 1973	Methods of test for determination of water soluble chlorides in concrete admixtures
9103 : 1999	Specification for admixtures for concrete (*first revision*)

e) Concrete

IS No.	*Title*
456 : 2000	Code of Practice for plain and reinforced concrete (*fourth revision*)
1343 : 2012	Code of Practice for prestressed concrete (*second revision*)
4926 : 2003	Code of Practice for ready-mixed concrete (*second revision*)

f) Cement and Concrete Sampling and Methods of Test

IS No.	*Title*
516 : 1959	Methods of test for strength of concrete
1199 : 1959	Methods of sampling and analysis of concrete
2770 (Part 1) : 1967	Methods of testing bond in reinforced concrete: Pullout test

IS No.	*Title*
3085 : 1965	Methods of test for permeability of cement mortar and concrete
3535 : 1986	Methods of sampling hydraulic cement (*first revision*)
4031	Methods of physical tests for hydraulic cement
(Part 1) : 1996	Determination of fineness by dry sieving (*second revision*)
(Part 2) : 1999	Determination of fineness by specific surface by Blaine air permeability method (*second revision*)
(Part 3) : 1988	Determination of soundness (*first revision*)
(Part 4) : 1988	Determination of consistency of standard cement paste (*first revision*)
(Part 5) : 1988	Determination of initial and final setting times (*first revision*)
(Part 6) : 1988	Determination of compressive strength of hydraulic cement (other than masonry cement)(*first revision*)
(Part 7) : 1988	Determination of compressive strength of masonry cement (*first revision*)
(Part 8) : 1988	Determination of transverse and compressive strength of plastic mortar using prism (*first revision*)
(Part 9) : 1988	Determination of heat of hydration (*first revision*)
(Part 10) : 1988	Determination of drying shrinkage (*first revision*)
(Part 11) : 1988	Determination of density (*first revision*)
(Part 12) : 1988	Determination of air content of hydraulic cement mortar (*first revision*)
(Part 13) : 1988	Measurement of water retentivity of masonry cement (*first revision*)
(Part 14) : 1989	Determination of false set
(Part 15) : 1991	Determination of fineness by wet sieving
4032 : 1985	Methods of chemical analysis for hydraulic cement (*first revision*)
5816 : 1999	Method of test for splitting tensile strength of concrete (*first revision*)
8142 : 1976	Methods of test for determining setting time of concrete by penetration resistance
9013 : 1978	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens
9284 : 1979	Method of test for abrasion resistance of concrete
12423 : 1988	Methods for colorimetric analysis of hydraulic cement
12803 : 1989	Methods of analysis of hydraulic cement by X-ray fluorescence spectrometer
12813 : 1989	Method of analysis of hydraulic cement by atomic absorption spectrophotometer
13311	Methods of non-destructive testing of concrete
(Part 1) : 1992	Ultrasonic pulse velocity
(Part 2) : 1992	Rebound hammer
14959	Method of test for determination of water soluble and acid soluble chlorides in mortar and concrete
(Part 1) : 2001	Fresh mortar
(Part 2) : 2001	Hardened mortar and concrete

g) Treatment of Concrete Joints

IS No.	*Title*
1834 : 1984	Specification for hot applied sealing compound for joint in concrete (*first revision*)
1838	Specification for preformed fillers for expansion joint in concrete pavements and structures (non extruding and resilient type)
(Part 1) : 1983	Bitumen impregnated fibre (*first revision*)
(Part 2) : 1984	CNSL aldehyde resin and coconut pith
(Part 3) : 2011	Polymer based
10566 : 1983	Methods of test for preformed fillers for expansion joints in concrete paving and structural construction
11433	Specification for one grade polysulphide based joint sealant
(Part 1) : 1985	General requirements
(Part 2) : 1986	Methods of test
12118	Specification for two parts polysulphide based sealants
(Part 1) : 1987	General requirements
(Part 2) : 1987	Methods of test

h) Steel Reinforcement and Prestressing Steel for Concrete

IS No.	*Title*
432	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
(Part 1) : 1982	Mild steel and medium tensile steel bars (*third revision*)
(Part 2) : 1982	Hard drawn steel wire (*third revision*)
1566 : 1982	Specification for hard drawn steel wire fabric for concrete reinforcement (*second revision*)
1608 : 2005	Metallic materials — Tensile testing at ambient temperature (*third revision*)
1785	Specification for plain hard drawn steel wire for pre-stressed concrete
(Part 1) : 1983	Cold drawn stress-relieved wire (*second revision*)
(Part 2) : 1983	As drawn wire (*first revision*)
1786 : 2008	Specification for high strength deformed steel bars and wires for concrete reinforcement (*fourth revision*)
2090 : 1983	Specification for high tensile steel bars used in prestressed concrete (*first revision*)
6003 : 2010	Specification for indented wire for prestressed concrete (*second revision*)
6006 : 2014	Specification for uncoated stress-relieved strand for prestressed concrete (*second revision*)
10790	Methods of sampling of steel for prestressed and reinforced concrete
(Part 1) : 1984	Prestressing steel
(Part 2) : 1984	Reinforcing steel
13620 : 1993	Specification for fusion bonded epoxy coated reinforcing bars
14268 : 1995	Specification for uncoated stress relieved low relaxation seven ply strand for prestressed concrete
16172 : 2014	Specification for reinforcement couplers for mechanical splices of bars in concrete

9. COMPOSITE MATRIX PRODUCTS

a) Cement Matrix Products

i) *Precast Concrete Products*

IS No.	*Title*
2174 : 1962	Specification for reinforced concrete dust bins
2185	Specification for concrete masonry units
(Part 1) : 2005	Hollow and solid concrete blocks (*third revision*)
(Part 2) : 1983	Hollow and solid lightweight concrete blocks (*first revision*)
(Part 3) : 1984	Autoclaved cellular (aerated) concrete blocks (*first revision*)
(Part 4) : 2008	Cellular concrete blocks using preformed foam
4996 : 1984	Specification for reinforced concrete fence posts (*first revision*)
5751 : 1984	Specification for precast concrete coping blocks (*first revision*)
5758 : 1984	Specification for precast concrete kerbs (*first revision*)
5820 : 1970	Specification for precast concrete cable covers
6072 : 1971	Specification for autoclaved reinforced cellular concrete wall slabs
6073 : 2006	Specification for autoclaved reinforced cellular concrete floor and roof slabs (*first revision*)
6441	Methods of test for autoclaved cellular concrete products
(Part 1) : 1972	Determination of unit weight or bulk density and moisture content
(Part 2) : 1972	Determination of drying shrinkage
(Part 4) : 1972	Corrosion protection of steel reinforcement in autoclaved cellular concrete
(Part 5) : 1972	Determination of compressive strength
(Part 6) : 1973	Strength, deformation and cracking of flexural members subject to bending — Short duration loading test
(Part 7) : 1973	Strength, deformation and cracking of flexural members subject to bending — Sustained loading test
(Part 8) : 1973	Loading tests for flexural members in diagonal tension
(Part 9) : 1973	Jointing of autoclaved cellular concrete elements
6523 : 1983	Specification for precast reinforced concrete door and window frames (*first revision*)

IS No.	*Title*
9375 : 1979	Specification for precast reinforced concrete plant guards
9872 : 1981	Specification for precast concrete septic tanks
9893 : 1981	Specification for precast concrete blocks for lintels and sills
12440 : 1988	Specification for precast concrete stone masonry blocks
12592 : 2002	Specification for precast concrete manhole covers and frames (*first revision*)
13356 : 1992	Specification for precast ferrocement water tanks (250 to 10 000 litres capacity)
13990 : 1994	Specification for precast reinforced concrete planks and joists for flooring and roofing
14143 : 1994	Specification for prefabricated brick panel and partially precast concrete joist for flooring and roofing
14201 : 1994	Specification for precast reinforced concrete channel unit for construction of floors and roofs
14241 : 1995	Specification for precast L-Panel units for roofing

ii) *Asbestos Fibre Cement Products*

IS No.	*Title*
459 : 1992	Specification for corrugated and semi-corrugated asbestos cement sheets (*third revision*)
1592 : 2003	Specification for asbestos cement pressure pipes and joints (*fourth revision*)
1626	Specification for asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings
(Part 1) : 1994	Pipes and pipe fittings (*second revision*)
(Part 2) : 1994	Gutters and gutter fittings (*second revision*)
(Part 3) : 1994	Roofing fittings (*second revision*)
2096 : 1992	Specification for asbestos cement flat sheets (*first revision*)
2098 : 1997	Specification for asbestos cement building boards (*first revision*)
5913 : 2003	Methods of test for asbestos cement products (*second revision*)
6908 : 1991	Specification for asbestos cement pipes and fittings for sewerage and drainage (*first revision*)
7639 : 1975	Method of sampling asbestos cement products
9627 : 1980	Specification for asbestos cement pressure pipes (light duty)
13000 : 1990	Specification for silica-asbestos-cement flat sheets
13008 : 1990	Specification for shallow corrugated asbestos cement sheets

iii) *Other Fibre Cement Products*

IS No.	*Title*
14862 : 2000	Specification for fibre cement flat sheets
14871 : 2000	Specification for products in fibre reinforced cement long corrugated or asymmetrical section sheets and fittings for roofing and cladding

iv) *Concrete Pipes and Pipes Lined/Coated with Concrete or Mortar*

IS No.	*Title*
458 : 2003	Specification for precast concrete pipes (with and without reinforcement) (*fourth revision*)
784 : 2001	Specification for prestressed concrete pipes (including specials) (*second revision*)
1916 : 1989	Specification for steel cylinder pipe with concrete lining and coating (*first revision*)
3597 : 1998	Methods of test for concrete pipes (*second revision*)
4350 : 1967	Specification for concrete porous pipes for under drainage
7319 : 1974	Specification for perforated concrete pipes
7322 : 1985	Specification for specials for steel cylinder reinforced concrete pipes (*first revision*)
15155 : 2002	Specification for bar/wire wrapped steel cylinder pipe with mortar lining and coating

b) Resin Matrix Products

IS No.	*Title*
1998 : 1962	Methods of test for thermosetting synthetic resin bonded laminated sheets
2036 : 1995	Specification for phenolic laminated sheets (*second revision*)

IS No.	*Title*
2046 : 1995	Specification for decorative thermosetting synthetic resin bonded laminated sheets (*second revision*)

10. CONDUCTORS AND CABLES

IS No.	*Title*
694 : 2010	Polyvinyl chloride insulated unsheathed and sheathed cables/ cords with rigid and flexible conductor for rated voltages up to and including 450/750 V (*fourth revision*)
1554	Specification for PVC insulated (heavy duty) electric cables
(Part 1) : 1988	For working voltages up to and including 1 100 volts (*third revision*)
(Part 2) : 1988	For working voltages from 3.3 kV up to and including 11 kV (*second revision*)
3961	Recommended current rating for cables
(Part 1) : 1967	Paper-insulated lead-sheathed cables
(Part 2) : 1967	PVC-insulated and PVC-sheathed heavy duty cables
(Part 3) : 1968	Rubber insulated cables
(Part 5) : 1968	PVC insulated light duty cables
4289	Specification for flexible cables for lifts and other flexible connections
(Part 1) : 1984	Elastomer insulated cables (*first revision*)
(Part 2) : 2000	PVC insulated circular cables
7098	Specification for cross-linked polyethylene insulated sheathed cables
(Part 1) : 1988	For working voltage up to and including 1 100 V (*first revision*)
(Part 2) : 2011	For working voltages form 3.3 kV up to and including 33 kV (*second revision*)
(Part 3) : 1993	For working voltages from 66 kV upto and including 220 kV
8130 : 2013	Specification for conductors for insulated electric cables and flexible cords (*second revision*)
9968	Specification for elastomer-insulated cables
(Part 1) : 1988	For working voltages up to and including 1 100 V (*first revision*)
(Part 2) : 2002	For working voltages from 3.3 kV up to and including 33 kV (*first revision*)
10810	Methods of test for cables
(Part 0) : 1984	General
(Part 1) : 1984	Annealing test for wires used in conductors
(Part 2) : 1984	Tensile test for aluminium wires
(Part 3) : 1984	Wrapping test for aluminium wires
(Part 4) : 1984	Persulphate test of conductor
(Part 5) : 1984	Conductor resistance test
(Part 6) : 1984	Thickness of thermoplastic and elastomeric insulation and sheath
(Part 7) : 1984	Tensile strength and elongation at break of thermoplastic and elastomeric insulation and sheath
(Part 8) : 1984	Breaking strength and elongation at break for impregnated paper insulation
(Part 9) : 1984	Tear resistance for paper insulation
(Part 10) : 1984	Loss of mass test
(Part 11) : 1984	Thermal ageing in air
(Part 12) : 1984	Shrinkage test
(Part 13) : 1984	Ozone resistance test
(Part 14) : 1984	Heat shock test
(Part 15) : 1984	Hot deformation test
(Part 16) : 1986	Accelerated ageing test by oxygen pressure method
(Part 17) : 1986	Tear resistance test for heavy duty sheath
(Part 19) : 1984	Bleeding and blooming test
(Part 20) : 1984	Cold bend test
(Part 21) : 1984	Cold impact test
(Part 22) : 1984	Vicat softening point
(Part 23) : 1984	Melt-flow index
(Part 24) : 1984	Water soluble impurities test of insulating paper
(Part 25) : 1984	Conductivity of water extract test of insulating paper
(Part 26) : 1984	*p*H value of water extract test of insulating paper
(Part 27) : 1984	Ash content test of insulating paper
(Part 28) : 1984	Water absorption test (Electrical)
(Part 29) : 1984	Environmental stress cracking test
(Part 30) : 1984	Hot set test

IS No.	Title
(Part 31) : 1984	Oil resistance test
(Part 32) : 1984	Carbon content test for polyethylene
(Part 33) : 1984	Water absorption test (Gravimetric)
(Part 34) : 1984	Measurement of thickness of metallic sheath
(Part 35) : 1984	Determination of tin in lead alloy for sheathing
(Part 36) : 1984	Dimensions of armouring material
(Part 37) : 1984	Tensile strength and elongation at break of armouring materials
(Part 38) : 1984	Torsion test on galvanized steel wires for armouring
(Part 39) : 1984	Winding test on galvanized steel strips for armouring
(Part 40) : 1984	Uniformity of zinc coating on steel armour
(Part 41) : 1984	Mass of zinc coating on steel armour
(Part 42) : 1984	Resistivity test of armour wires and strips and conductance test of armour (wires/strips)
(Part 43) : 1984	Insulation resistance
(Part 44) : 1984	Spark test
(Part 45) : 1984	High voltage test
(Part 46) : 1984	Partial discharge test
(Part 47) : 1984	Impulse test
(Part 48) : 1984	Dielectric power factor test
(Part 49) : 1984	Heating cycle test
(Part 50) : 1984	Bending test
(Part 51) : 1984	Dripping test
(Part 52) : 1984	Drainage test
(Part 53) : 1984	Flammability test
(Part 54) : 1984	Static flexibility test
(Part 55) : 1986	Abrasion test
(Part 56) : 1987	Accelerated ageing by the air-pressure method
(Part 57) : 1987	Flexing test
(Part 58) : 1998	Oxygen index test
(Part 59) : 1988	Determination of the amount of halogen acid gas evolved during combustion of polymeric materials taken from cables
(Part 60) : 1988	Thermal stability of PVC insulation and sheath
(Part 61) : 1988	Flame retardant test
(Part 62) : 1993	Fire resistance test for bunched cables
(Part 63) : 1993	Smoke density of electric cables under fire conditions
(Part 64) : 2003	Measurement of temperature index
12943 : 1990	Brass glands for PVC cables

11. DOORS, WINDOWS AND VENTILATORS

a) Wooden Doors, Windows and Ventilators

IS No.	Title
1003	Specification for timber panelled and glazed shutters
(Part 1) : 2003	Door shutters (*fourth revision*)
(Part 2) : 1994	Window and ventilator shutters (*third revision*)
2191	Specification for wooden flush door shutters (cellular and hollow core type)
(Part 1) : 1983	Plywood face panels (*fourth revision*)
(Part 2) : 1983	Particle board face panels and hardboard face panels (*third revision*)
2202	Specification for wooden flush door shutters (solid core type)
(Part 1) : 1999	Plywood face panels (*sixth revision*)
(Part 2) : 1983	Particle board face panels and hardboard face panels (*third revision*)
4020	Method of tests for door shutters
(Part 1) : 1998	General (*third revision*)
(Part 2) : 1998	Measurement of dimensions and squareness (*third revision*)
(Part 3) : 1998	Measurement of general flatness (*third revision*)
(Part 4) : 1998	Local planeness test (*third revision*)
(Part 5) : 1998	Impact indentation test (*third revision*)
(Part 6) : 1998	Flexure test (*third revision*)
(Part 7) : 1998	Edge loading test (*third revision*)
(Part 8) : 1998	Shock resistance test (*third revision*)
(Part 9) : 1998	Buckling resistance test (*third revision*)
(Part 10) : 1998	Slamming test (*third revision*)
(Part 11) : 1998	Misuse test (*third revision*)
(Part 12) : 1998	Varying humidity test (*third revision*)
(Part 13) : 1998	End immersion test (*third revision*)
(Part 14) : 1998	Knife test (*third revision*)
(Part 15) : 1998	Glue adhesion test (*third revision*)
(Part 16) : 1998	Screw withdrawal resistance test (*third revision*)
4021 : 1995	Specification for timber door, window and ventilator frames

IS No.	*Title*
6198 : 1992	Specification for ledged, braced and battened timber shutters (*second revision*)

b) Metal Doors, Windows and Ventilators

IS No.	*Title*
1038 : 1983	Specification for steel doors, windows and ventilators (*third revision*)
1361 : 1978	Specification for steel windows for industrial buildings (*first revision*)
1948 : 1961	Specification for aluminium doors, windows and ventilators
1949 : 1961	Specification for aluminium windows for industrial buildings
4351 : 2003	Specification for steel door frames (*second revision*)
6248 : 1979	Specification for metal rolling shutters and rolling grills (*first revision*)
7452 : 1990	Specification for hot rolled steel sections for doors, windows and ventilators (*second revision*)
10451 : 1983	Specification for steel sliding shutters (top hung type)
10521 : 1983	Specification for collapsible gates

c) Plastic Doors and Windows

IS No.	*Title*
14856 : 2000	Specification for glass fibre reinforced (GRP) panel type door shutters for internal use
15380 : 2003	Specification for moulded raised high density fibre (HDF) panel doors
15931 : 2012	Specification for solid panel foam UPVC door shutters

d) Concrete Door and Window Frames

IS No.	*Title*
6523 : 1983	Specification for precast reinforced concrete door and window frames (*first revision*)

e) Other Composite Material Doors and Windows

IS No.	*Title*
16073 : 2013	Specification for bamboo-jute composite panel door shutter
16074 : 2014	Specification for steel flush door shutters
16096 : 2013	Specification for phenol bonded bamboo-jute composite hollow door shutter

f) Fire Check Doors

IS No.	*Title*
3614	Specification for fire-check doors
(Part 1) : 1966	Plate, metal covered and rolling type
(Part 2) : 1992	Metallic and non-metallic fire check doors — Resistance test and performance criteria

g) Mesh/Net for Mosquito/Vector Prevention

IS No.	*Title*
1568 : 1970	Specification for wire cloth for general purposes (*first revision*)
3150 : 1982	Specification for hexagonal wire netting for general purposes (*second revision*)
11199 : 1985	Specification for HDPE mono-filament twine door nets

12. ELECTRICAL WIRING, FITTINGS AND ACCESSORIES

IS No.	*Title*
371 : 1999	Specification for ceiling roses (*third revision*)
374 : 1979	Specification for electric ceiling type fans and regulators (*third revision*)
418 : 2004	Specification for tungsten filament lamp for domestic and similar general lighting purposes (*fourth revision*)
1258 : 2005	Specification for bayonet lamp holders (*fourth revision*)
1293 : 2005	Specification for plugs and socket-outlets of rated voltage up to and including 250 volts and rated current up to and including 16 amperes (*third revision*)
1554	PVC insulated (heavy duty) electric cables
(Part 1) : 1988	For working voltages upto and including 1 100 V (*third revision*)
(Part 2) : 1988	For working voltages from 3.3 kV upto and including 11 kV (*second revision*)
2086 : 1993	Specification for carriers and bases used in re-wirable type electric fuses up to 650 volts (*third revision*)
2206 (Part 1) : 1984	Specification for flameproof electric lighting fittings: Well glass and bulkhead types (*first revision*)

IS No.	*Title*
2215 : 2006	Specification for starters for fluorescent lamps (*third revision*)
2412 : 1975	Specification for link clips for electrical wiring (*first revision*)
2418	Specification for tubular fluorescent lamps for general lighting services
(Part 1) : 1977	Requirements and tests (*first revision*)
(Part 2) : 1977	Standard lamp data sheets (*first revision*)
(Part 3) : 1977	Dimensions of G-5 and G-13 bi-pin caps (*first revision*)
(Part 4) : 1977	Go and no-go gauges for G-5 and G-13 bi-pin caps (*first revision*)
2675 : 1983	Specification for enclosed distribution fuseboards and cutouts for voltages not exceeding 1 000 V (*second revision*)
3323 : 1980	Specification for bi-pin lamp holders for tubular fluorescent lamps (*first revision*)
3324 : 1982	Specification for holders for starters for tubular fluorescent lamps (*first revision*)
3419 : 1988	Specification for fittings for rigid non-metallic conduits (*second revision*)
3480 : 1966	Specification for flexible steel conduits for electrical wiring
3528 : 1966	Specification for waterproof electric lighting fittings
3553 : 1966	Specification for watertight electric lighting fittings
3837 : 1976	Specification for accessories for rigid steel conduits for electrical wiring (*first revision*)
3854 : 1997	Specification for switches for domestic and similar purposes (*second revision*)
4160 : 2005	Specification for interlocking switch socket outlets (*first revision*)
4649 : 1968	Specification for adaptors for flexible steel conduits
5077 : 1969	Specification for decorative lighting outfits
8030 : 1976	Specification for luminaires for hospitals
9537	Specification for conduits for electrical installations
(Part 1) : 1980	General requirements
(Part 2) : 1981	Rigid steel conduits
(Part 3) : 1983	Rigid plain conduits for insulating materials
(Part 4) : 1983	Pliable self-recovering conduits for insulating materials
(Part 5) : 2000	Pliable conduits of insulating materials
(Part 6) : 2000	Pliable conduits of metal or composite materials
(Part 8) : 2003	Rigid non threadable conduits of aluminium alloy
9926 : 1981	Specification for fuse wires used in rewirable type electric fuses up to 650 volts
10322	Specification for luminaires
(Part 1) : 2014	General requirements and tests (*first revision*)
(Part 2) : 1982	Constructional requirements
(Part 3) : 1984	Screw and screwless terminations
(Part 4) : 1984	Methods of tests
(Part 5/Sec 1) : 2012	Particular requirements, Section 1 General purpose luminaires (*first revision*)
(Part 5/Sec 2) : 2012	Particular requirements, Section 2 Recessed luminaires (*first revision*)
(Part 5/Sec 3) : 2012	Particular requirements, Section 3 Luminaires for road and street lighting (*first revision*)
(Part 5/Sec 4) : 1987	Particular requirements, Section 4 Portable general purpose luminaires
(Part 5/Sec 5) : 2013	Particular requirements, Section 5 Flood light (*first revision*)
(Part 5/Sec 6) : 2013	Particular requirements, Section 6 Hand lamps
(Part 5/Sec 7) : 2013	Particular requirements, Section 7 Lighting chains
(Part 5/Sec 8) : 2013	Particular requirements, Section 8 Emergency lighting
11037 : 1984	Electronic type fan regulators
12449	Starting devices (other than glow starters)
(Part 1) : 1988	General and safety requirements
(Part 2) : 1988	Performance requirements
12776 : 2002	Specification for galvanized strand for earthing (*first revision*)

IS No.	*Title*
13010 : 2002	AC watt-hour meters, Class 0.5, 1 and 2 (*first revision*)
13779 : 1999	AC static watthour meters (Class 1 and 2) (*first revision*)
13947 (Part 5/ Sec 2) : 2004	Specification for low-voltage switchgear and controlgear: Part 5 Control circuit devices and switching elements, Section 2 Proximity switches
14763 : 2000	Conduit for electrical purposes, outside diameters of conduits for electrical installations and threads for conduits and fittings
14768	Conduit fittings for electrical installations
(Part 1) : 2000	General requirements
(Part 2) : 2003	Metal conduit fittings
14772 : 2000	Enclosures for accessories for household and similar fixed electrical installations
14927	Cable trunking and ducting systems for electrical installations
(Part 1) : 2001	General requirements
(Part 2) : 2001	Cable trunking and ducting systems intended for mounting on walls or ceilings
14930	Conduit systems for electrical installations
(Part 1) : 2001	General requirements
(Part 2) : 2001	Particular requirements for conduit system buried underground
15111	Self ballasted lamps for general lighting services:
(Part 1) : 2002	Safety requirements
(Part 2) : 2002	Performance requirements
15368 : 2003	Cable reels for household and similar purposes
15518 (Part 1) : 2004	Safety requirements for incandescent lamps: Part 1 Tungsten filament lamps for domestic and similar general lighting purposes
15787 : 2008	Switch-socket-outlets (non-interlock type)
15968 : 2013	Ballasts for tubular fluorescent lamps — Performance requirements
15974 : 2013	Auxiliaries for lamps — Starting devices (other than glow starters) — Performance requirements
16102	Self ballasted LED-lamps for general lighting services
(Part 1) : 2012	Safety requirements
(Part 2) : 2012	Performance requirements
16103	LED modules for general lighting
(Part 1) : 2012	Safety specification
(Part 2) : 2012	Performance requirements
16148 : 2014	Performance specification for metal halide lamps
16246: 2015	Specification for elastomer insulated cables with limited circuit integrity when affected by fire
IS/IEC 60079-1: 2007	Explosive atmospheres — Part 1 : Equipment protection by flameproof enclosures "d"
IS/IEC 60898-1: 2002	Electrical accessories — Circuit breakers for overcurrent protection for household and similar installations — Part 1: Circuit-breakers for ac operation
IS/IEC 60947-1 : 2007	Low voltage switchgear and controlgear — Part 1: General rules (*first revision*)
IS/IEC 60947-2 : 2003	Low voltage switchgear and controlgear — Part 2: Circuit breakers
IS/IEC 60947-3 : 1999	Low voltage switchgear and controlgear — Part 3: Switches, disconnectors, switch-disconnectors and fuse combination units
IS/IEC 60794-1-1: 2001	Optical fibre cables — Part 1: Generic specification, Section 1 General
IS/IEC 60794-1-2 : 2003	Optical fibre cables — Part 1: Generic specification, Section 2 Basic optical cable test procedures
IS/IEC 60794-2: 2002	Optical fibre cables — Part 2 Sectional specification for indoor cables

13. FILLERS, STOPPERS AND PUTTIES

IS No.	*Title*
110 : 1983	Specification for ready mixed paint, brushing, grey filler, for enamels, for use over primers (*second revision*)
419 : 1967	Specification for putty for use on window frames (*first revision*)
423 : 1961	Specification for plastic wood, for joiner's filler (*revised*)
3709 : 1966	Specification for mastic cement for bedding of metal windows

IS No.	*Title*
7164 : 1973	Specification for stopper
13184 : 1991	Specification for mastic filler, epoxy based (two pack)

14. FLOOR COVERING, ROOFING AND OTHER FINISHES

a) Concrete Flooring

IS No.	*Title*
1237 : 2012	Specification for cement concrete flooring tiles (*second revision*)
6073 : 2006	Specification for autoclaved reinforced cellular concrete floor and roof slabs (*first revision*)
13801 : 2013	Specification for chequered cement concrete tiles (*first revision*)
13990 : 1994	Specification for precast reinforced concrete planks and joists for flooring and roofing
14201 : 1994	Specification for precast reinforced concrete channel units for construction of floors and roofs
15658 : 2006	Specification for precast concrete blocks for paving

b) Flooring Compositions

IS No.	*Title*
657 : 1982	Specification for materials for use in the manufacture of magnesium oxychloride flooring compositions (*second revision*)
9162 : 1979	Methods of tests for epoxy resin, hardeners and epoxy resin composition for floor topping
9197 : 1979	Specification for epoxy resin, hardness and epoxy resin compositions for floor topping
10132 : 1982	Method of test for materials for use in the preparation of magnesium oxychloride flooring composition

c) Linoleum Flooring

IS No.	*Title*
653 : 1992	Specification for linoleum sheets and tiles (*third revision*)
9704 : 1980	Methods of tests for linoleum sheets and tiles

d) Rubber Flooring

IS No.	*Title*
809 : 1992	Specification for rubber flooring materials for general purposes (*first revision*)

e) Stone Flooring

IS No.	*Title*
1128 : 1974	Specification for limestone (slab and tiles) (*first revision*)
1130 : 1969	Specification for marble (blocks, slabs and tiles)
3316 : 1974	Specification for structural granite (*first revision*)
3622 : 1977	Specification for sand stone (slabs and tiles) (*first revision*)
14223 (Part 1) : 1994	Specification for polished building stones: Part 1 Granite

f) Bituminous Flooring

IS No.	*Title*
1195 : 2002	Specification for bitumen mastic for flooring (*third revision*)
5317 : 2002	Specification for pitch-mastic for bridge decking and roads (*second revision*)
8374 : 1977	Specification for bitumen mastic, anti-static and electrically conducting grade
9510 : 1980	Specification for bitumen mastic acid resisting grade
13026 : 1991	Specification for bitumen mastic for flooring for industries handling LPG and other light hydrocarbon products
15194 : 2002	Specification for pitch-mastic flooring for industries handling heavy hydrocarbon products like kerosene, diesel and furnace oil

g) Plastic Flooring

IS No.	*Title*
3461 : 1980	Specification for PVC asbestos floor tiles (*first revision*)
3462 : 1986	Specification for unbacked flexible PVC flooring (*second revision*)
3464 : 1986	Methods of test for plastic flooring and wall tiles (*second revision*)

h) Ceramic/Vitreous Flooring and Wall Finishing

IS No.	*Title*
2333 : 1992	Specification for plaster of Paris for ceramic industry (*second revision*)
4457 : 2007	Specification for ceramic unglazed vitreous acid resisting tile (*second revision*)
13630	Ceramic tiles — Methods of test, sampling and basis for acceptance
(Part 1) : 2006	Determination of dimensions and surface quality (*first revision*)

IS No.	*Title*
(Part 2) : 2006	Determination of water absorption and bulk density (*first revision*)
(Part 3) : 2006	Determination of moisture expansion using boiling water — Unglazed tiles (*first revision*)
(Part 4) : 2006	Determination of linear thermal expansion (*first revision*)
(Part 5) : 2006	Determination of resistance to thermal shock (*first revision*)
(Part 6) : 2006	Determination of modulus of rupture and breaking strength (*first revision*)
(Part 7) : 2006	Determination of chemical resistance — Unglazed tiles (*first revision*)
(Part 8) : 2006	Determination of chemical resistance — Glazed tiles (*first revision*)
(Part 9) : 2006	Determination of crazing resistance — Glazed tiles (*first revision*)
(Part 10) : 2006	Determination of frost resistance (*first revision*)
(Part 11) : 2006	Determination of resistance to surface abrasion — Glazed tiles (*first revision*)
(Part 12) : 2006	Determination of resistance to deep abrasion — Unglazed tiles (*first revision*)
(Part 13) : 2006	Determination of scratch hardness of surface according to Mohs'(*first revision*)
(Part 14) : 2006	Determination of impact resistance by measurement of coefficient of restitution
(Part 15) : 2006	Ceramic tiles — Sampling and basis for acceptance
13712 : 2006	Ceramic tiles — Definitions, classifications, characteristics and marking (*first revision*)
15622 : 2006	Specification for pressed ceramic tiles

j) Clay Flooring

IS No.	*Title*
1478 : 1992	Specification for clay flooring tiles (*second revision*)
3951	Specification for hollow clay tiles for floor and roofs
(Part 1) : 2009	Filler type (*second revision*)
(Part 2) : 2009	Structural type (*second revision*)

k) Roofing

IS No.	*Title*
277 : 2003	Galvanized steel sheets (plain and corrugated) —Specification (*sixth revision*)
459 : 1992	Specification for corrugated and semi-corrugated asbestos cement sheets (*third revision*)
654 : 1992	Specification for clay roofing tiles, Mangalore pattern (*third revision*)
1464 : 1992	Specification for clay ridge and ceiling tiles (*second revision*)
2690	Specification for burnt clay flat terracing tiles
(Part 1) : 1993	Machine made (*second revision*)
(Part 2) : 1992	Handmade (*second revision*)
3951	Specification for hollow clay tiles for floor and roofs
(Part 1) : 2009	Filler type (*second revision*)
(Part 2) : 2009	Structural type (*second revision*)
6073 : 2006	Specification for autoclaved reinforced cellular concrete floor and roof slabs (*first revision*)
6250 : 1981	Specification for roofing slate tiles (*first revision*)
10388 : 1982	Specification for corrugated coir wood wool cement roofing sheets
12583 : 1988	Specification for corrugated bitumen roofing sheets
12866 : 1989	Specification for plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced)
13317 : 1992	Specification for clay roofing country tiles, half round and flat tiles
13990 : 1994	Specification for precast reinforced concrete planks and joists for flooring and roofing
14201 : 1994	Specification for precast reinforced concrete channel units for construction of floors and roofs
14241 : 1995	Specification for precast L-Panel units for roofing

m) Other Floorings and Roofings

IS No.	*Title*
4456	Methods of test for chemical resistant mortars
(Part 1) : 1967	Silicate type and resin type
(Part 2) : 1967	Sulphur type

IS No.	Title
4457 : 2007	Specification for ceramic unglazed vitreous acid resisting tile (*second revision*)
4832	Specification for chemical resistant mortars
(Part 1) : 1969	Silicate type
(Part 2) : 1969	Resin type
(Part 3) : 1968	Sulphur type
4860 : 1968	Specification for acid resistant bricks
14862 : 2000	Specification for fibre cement flat sheets
14143 : 1994	Specification for prefabricated brick panel and partially precast concrete joist for flooring and roofing
14871 : 2000	Specification for products in fibre reinforced cement — Long corrugated or asymmetrical section sheets and fittings for roofing and cladding

n) Wall Coverings/Finishing

IS No.	Title
1542 : 1992	Specification for sand for plaster (*second revision*)
3952 : 2013	Specification for burnt clay hollow bricks and blocks for walls and partitions (*third revision*)
4456	Methods of test for chemical resistant mortars
(Part 1) : 1967	Silicate type and resin type
(Part 2) : 1967	Sulphur type
4832	Specification for chemical resistant mortars
(Part 1) : 1969	Silicate type
(Part 2) : 1969	Resin type
(Part 3) : 1968	Sulphur type
15418 : 2003	Specification for finished wall papers, wall vinyls and plastic wall coverings in roll form

15. GLASS

IS No.	Title
2553 (Part 1) : 1990	Specification for safety glass: Part 1 General purpose (*third revision*)
2835 : 1987	Specification for flat transparent sheet glass (*third revision*)
3438 : 1994	Specification for silvered glass mirrors for general purposes (*second revision*)
5437 : 1994	Specification for figured rolled and wired glass (*first revision*)
14900 : 2000	Specification for transparent float glass

16. GYPSUM BASED MATERIALS

IS No.	Title
2095	Specification for gypsum plaster boards
(Part 1) : 2011	Plain gypsum plaster boards (*third revision*)
(Part 2) : 2001	Coated/laminated gypsum plaster boards (*second revision*)
(Part 3) : 1996	Reinforced gypsum plaster boards (*second revision*)
2542	Methods of test for gypsum plaster, concrete and products
(Part 1/Sec 1) : 1978	Plaster and concrete, Section 1 Normal consistency of gypsum plaster (*first revision*)
(Part 1/Sec 2) : 1978	Plaster and concrete, Section 2 Normal consistency of gypsum concrete (*first revision*)
(Part 1/Sec 3) : 1978	Plaster and concrete, Section 3 Setting time of plaster and concrete (*first revision*)
(Part 1/Sec 4) : 1978	Plaster and concrete, Section 4 Transverse strength of gypsum plaster (*first revision*)
(Part 1/Sec 5) : 1978	Plaster and concrete, Section 5 Compressive strength and dry set density of gypsum plaster (*first revision*)
(Part 1/Sec 6) : 1978	Plaster and concrete, Section 6 Soundness of gypsum plaster (*first revision*)
(Part 1/Sec 7) : 1978	Plaster and concrete, Section 7 Mechanical resistance of gypsum plaster by dropping ball test (*first revision*)
(Part 1/Sec 8) : 1978	Plaster and concrete, Section 8 Freedom from coarse particles (*first revision*)
(Part 1/Sec 9) : 1978	Plaster and concrete, Section 9 Expansion of plaster (*first revision*)
(Part 1/Sec 10) : 1978	Plaster and concrete, Section 10 Sand in set plaster (*first revision*)
(Part 1/Sec 11) : 1978	Plaster and concrete, Section 11 Wood fibre content in gypsum plaster (*first revision*)

IS No.	Title
(Part 1/Sec 12) : 1978	Plaster and concrete, Section 12 Dry bulk density (*first revision*)
(Part 2/Sec 1) : 1981	Gypsum products, Section 1 Measurement of dimensions (*first revision*)
(Part 2/Sec 2) : 1981	Gypsum products, Section 2 Determination of mass (*first revision*)
(Part 2/Sec 3) : 1981	Gypsum products, Section 3 Determination of mass and thickness of paper surfacing (*first revision*)
(Part 2/Sec 4) : 1981	Gypsum products, Section 4 Transverse strength (*first revision*)
(Part 2/Sec 5) : 1981	Gypsum products, Section 5 Compressive strength (*first revision*)
(Part 2/Sec 6) : 1981	Gypsum products, Section 6 Water absorption (*first revision*)
(Part 2/Sec 7) : 1981	Gypsum products, Section 7 Moisture content (*first revision*)
(Part 2/Sec 8) : 1981	Gypsum products, Section 8 Nail retention of precast reinforced gypsum slabs (*first revision*)
2547	Specification for gypsum building plaster
(Part 1) : 1976	Excluding premixed lightweight plaster (*first revision*)
(Part 2) : 1976	Premixed lightweight plaster (*first revision*)
2849 : 1983	Specification for non-load bearing gypsum partition blocks (solid and hollow types) (*first revision*)
8272 : 1984	Specification for gypsum plaster for use in the manufacture of fibrous plasterboards (*first revision*)
9498 : 1980	Specification for inorganic aggregates for use in gypsum plaster
12679 : 1989	Specification for by-product gypsum for use in plaster, blocks and boards

17. MORTAR (INCLUDING SAND FOR MORTAR)

IS No.	Title
2116 : 1980	Specification for sand for masonry mortars (*first revision*)
2250 : 1981	Code of Practice for preparation and use of masonry mortars (*first revision*)
3085 : 1965	Method of test for permeability of cement mortar and concrete
4098 : 1983	Specification for lime-pozzolana mixture (*first revision*)
4456	Methods of test for chemical resistant mortars
(Part 1) : 1967	Silicate type and resin type
(Part 2) : 1967	Sulphur type
4832	Chemical resistant mortars
(Part 1) : 1969	Silicate type
(Part 2) : 1969	Resin type
(Part 3) : 1968	Sulphur type
13077 : 1991	Guide for preparation and use of mud mortar in masonry
14959	Method of test determination of water soluble and acid soluble chlorides in mortar and concrete
(Part 1) : 2001	Fresh mortar and concrete
(Part 2) : 2001	Hardened mortar and concrete

18. PAINTS AND ALLIED PRODUCTS

a) Water Based Paints and Pigments

IS No.	Title
427 : 2013	Specification for distemper, dry, colour as required (*third revision*)
428 : 2013	Specification for washable distemper (*third revision*)
5410 : 2013	Specification for cement paint (*second revision*)
15489 : 2013	Specification for paint, plastic emulsion (*first revision*)

b) Ready Mixed Paints, Enamels and Powder Coatings

IS No.	Title
101	Methods of sampling and test for paints, varnishes and related products
(Part 1/Sec 1) : 1986	Test on liquid paints (general and (general and physical), Section 1 Sampling (*third revision*)
(Part 1/Sec 2) : 1987	Test on liquid paints (general and physical), Section 2 Preliminary examination and preparation of samples for testing (*third revision*)
(Part 1/Sec 3) : 1986	Test on liquid paints (general and physical), Section 3 Preparation of panels (*third revision*)
(Part 1/Sec 4) : 1987	Test on liquid paints (general and physical), Section 4 Brushing test (*third revision*)

IS No.	Title
(Part 1/Sec 5) : 1989	Test on liquid paints (general and physical), Section 5 Consistency (*third revision*)
(Part 1/Sec 6) : 1987	Test on liquid paints (general and physical), Section 6 Flash point (*third revision*)
(Part 1/Sec 7) : 1987	Test on liquid paints (general and physical), Section 7 Mass per 10 litres (*third revision*)
(Part 2/Sec 1) : 1988	Test on liquid paints (Chemical examination), Section 1 Water content (*third revision*)
(Part 2/Sec 2) : 1986	Test on liquid paints (Chemical examination), Section 2 Volatile matter (*third revision*)
(Part 3/Sec 1) : 1986	Tests on paint film formation, Section 1 Drying time (*third revision*)
(Part 3/Sec 2) : 1989	Tests on paint film formation, Section 2 Film thickness (*third revision*)
(Part 3/Sec 4) : 1987	Tests on paint film formation, Section 4 Finish (*third revision*)
(Part 3/Sec 5) : 1987	Tests on paint film formation, Section 5 Fineness of grind (*third revision*)
(Part 4/Sec 1) : 1988	Optical test, Section 1 Opacity (*third revision*)
(Part 4/Sec 2) : 1989	Optical test, Section 2 Colour (*third revision*)
(Part 4/Sec 3) : 1988	Optical test, Section 3 Light fastness test (*third revision*)
(Part 4/Sec 4) : 1988	Optical test, Section 4 Gloss (*third revision*)
(Part 5/Sec 1) : 1988	Mechanical test on paint films, Section 1 Hardness tests (*third revision*)
(Part 5/Sec 2) : 1988	Mechanical test on paint films, Section 2 Flexibility and adhesion (*third revision*)
(Part 5/Sec 3) : 1999	Mechanical test on paint films, Section 3 Impact resistance (*fourth revision*)
(Part 5/Sec 4) : 1988	Mechanical test on paint films, Section 4 Print free test (*third revision*)
(Part 6/Sec 1) : 1988	Durability tests, Section 1 Resistance to humidity under conditions of condensation (*third revision*)
(Part 6/Sec 2) : 1989	Durability tests, Section 2 Keeping properties (*third revision*)
(Part 6/Sec 3) : 1990	Durability tests, Section 3 Moisture vapour permeability (*third revision*)
(Part 6/Sec 4) : 1991	Durability tests, Section 4 Degradation of coatings (pictorial aids for evaluation) (*third revision*)
(Part 6/Sec 5) : 1997	Durability tests, Section 5 Accelerated weathering test
(Part 7/Sec 1) : 1989	Environmental tests on paint films, Section 1 Resistance to water (*third revision*)
(Part 7/Sec 2) : 1989	Environmental tests on paint films, Section 2 Resistance to liquids (*third revision*)
(Part 7/Sec 3) : 1990	Environmental tests on paint films, Section 3 Resistance to heat (*third revision*)
(Part 7/Sec 4) : 1990	Environmental tests on paint films, Section 4 Resistance to bleeding of pigments (*third revision*)
(Part 8/Sec 1) : 1989	Tests for pigments and other solids, Section 1 Residue on sieve (*third revision*)
(Part 8/Sec 2) : 1990	Tests for pigments and other solids, Section 2 Pigments and non –volatile matter (*third revision*)
(Part 8/Sec 3) : 1993	Tests for pigments and other solids, Section 3 Ash content (*third revision*)
(Part 8/Sec 4) : 2015	Tests for pigments and other solids, Section 4 Phthalic anhydride (*fourth revision*)
(Part 8/Sec 5) : 1993	Tests for pigments and other solids, Section 5 Lead restriction test (*third revision*)
(Part 8/Sec 6) : 1993	Tests for pigments and other solids, Section 6 Volume solids
(Part 9/Sec 1) : 1993	Tests for lacquers and varnish, Section 1 Acid value (*third revision*)
(Part 9/Sec 2) : 1993	Tests for lacquers and varnish, Section 2 Rosin test (*third revision*)
104 : 1979	Specification for ready mixed paint, brushing, zinc chrome, priming (*second revision*)

IS No.	*Title*
109 : 1968	Specification for ready mixed paint, brushing, priming, plaster to Indian Standard colours No. 361 and 631 (*first revision*)
133 : 2004	Specification for enamel, interior (a) undercoating, (b) finishing (*fourth revision*)
133 (Part 1) : 2013	Specification for enamel, interior (a) undercoating, (b) finishing : Part 1 For household and decorative purposes (*fifth revision*)
137 : 1965	Specification for ready mixed paint, brushing, matt or egg-shell flat, finishing, interior, to Indian Standard colour, as required (*revised*)
158 : 2015	Specification for ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, and heat resisting (*fourth revision*)
164 : 1981	Specification for ready mixed paint for road marking (*second revision*)
168 : 1993	Specification for ready mixed paint, air-drying semi-glossy/matt, for general purposes (*third revision*)
341 : 1973	Specification for black Japan, Types A, B and C (*first revision*)
2074 : 1992	Specification for ready mixed paint, air drying red oxide-zinc chrome, priming (*second revision*)
2075 : 2000	Specification for ready mixed paint, stoving, red oxide-zinc chrome, priming (*second revision*)
2339 : 2013	Specification for aluminium paint for general purposes (*first revision*)
2932 (Part 1) : 2013	Specification for enamel, synthetic, exterior (a) undercoating, (b) finishing: Part 1 For household and decorative applications (*fourth revision*)
2933 (Part 1) : 2013	Specification for enamel, exterior: (a) undercoating (b) finishing: Part 1 for domesic and decorative applications
3536 : 1999	Specification for ready mixed paint, brushing, wood primer (*first revision*)
3537 : 1966	Specification for ready mixed paint, finishing, interior for general purposes, to Indian Standard colours No. 101, 216, 217, 219, 275, 281, 352, 353, 358 to 361, 363, 364, 388, 410, 442, 444, 628, 631, 632, 634, 693, 697, white and black
3539 : 1966	Specification for ready mixed paint, undercoating, for use under oil finishes, to Indian Standard colours, as required
3585 : 1966	Specification for ready mixed paint, aluminium, brushing, priming, water resistant, for wood work
3678 : 1966	Specification for ready mixed paint, thick white, for lettering
9862 : 1981	Specification for ready mixed paint, brushing, bituminous black lead free, acid, alkali, water and chlorine resisting
11883 : 1986	Specification for ready mixed paint, brushing, red oxide, priming for metals
12744 (Part 1) : 2013	Specification for ready mixed paint, air drying, red oxide, zinc phosphate, priming: Part 1 for domestic and decorative applications (*fourth revision*)
13183 : 1991	Specification for aluminium paints, heat resistant
13213 : 1991	Specification for polyurethane full gloss enamel (two pack)
13607 : 1992	Specification for ready mixed paint, finishing, general purposes, synthetic
13871 : 1993	Specification for powder coatings
14506 : 1998	Specification for epoxy redoxide zinc phosphate weldable primer, two component
14589 : 1999	Specification for zinc priming paint, epoxy based, two pack

c) Thinners and Solvents

IS No.	*Title*
82 : 1973	Methods of sampling and test for thinners and solvents for paints (*first revision*)
430 : 1972	Paint remover, solvent type, non-flammable (*second revision*)
431 : 1972	Paint remover, solvent type, flammable (second revision)
533 : 2007	Specification for gum spirit of turpentine (oil of turpentine) (*third revision*)

IS No.	Title
5667 : 1970	Specification for thinner for cellulose nitrate based paints and lacquers
14314 : 1995	Specification for thinner general purposes for synthetic paints and varnishes

d) Varnishes and Lacquers

IS No.	Title
337 : 1975	Specification for varnish, finishing, interior (*first revision*)
344 : 1976	Specification for varnish, stoving (*first revision*)
347 : 1975	Specification for varnish, shellac, for general purposes (*first revision*)
348 : 1968	Specification for French polish (*first revision*)
524 : 1983	Specification for varnish, finishing, exterior, synthetic (*second revision*)
525 : 1968	Specification for varnish, finishing, exterior and general purposes (*first revision*)
642 : 1963	Specification for varnish medium for aluminium paint (*revised*)
10018 : 1981	Specification for lacquer, cellulose, nitrate clear, finishing, glossy for wood

19. POLYMERS, PLASTICS AND GEOSYNTHETICS/GEOTEXTILES

IS No.	Title
1998 : 1962	Methods of test for thermosetting synthetic resin bonded laminated sheets
2036 : 1995	Specification for phenolic laminated sheets (*second revision*)
2046 : 1995	Specification for decorative thermosetting synthetics resin bonded laminated sheets (*second revision*)
2076 : 1981	Specification for unsupported polyvinyl chloride sheeting (*first revision*)
2508 : 1984	Specification for low density polyethylene films (*second revision*)
6307 : 1985	Specification for rigid PVC sheets (*first revision*)
10889 : 2004	Specification for high density polyethylene films (*first revision*)
12830 : 1989	Specification for rubber based adhesives for fixing PVC tiles to cement
13162	Methods of test for geotextiles
(Part 2) : 1991	Determination of resistance to exposure of ultra-violet light and water (Xenon arc type apparatus)
(Part 3) : 1992	Determination of thickness at specified pressure
(Part 4) : 1992	Determination of puncture resistance by falling cone method
(Part 5) : 1992	Determination of tensile properties using a wide width strip
13262 : 1992	Specification for pressure sensitive adhesive tapes with plastic base
13325 : 1992	Method of test for the determination to tensile properties of extruded polymer geogrids using the wide strip
13326 (Part 1) : 1992	Method of test for the evaluation of interface friction between geosynthetics and soil: Part 1 Modified direct shear technique
14182 : 1994	Specification for solvent cement for use with unplasticized polyvinyl-chloride plastic pipe and fittings
14293 : 1995	Method of test for trapezoid tearing – Geotextiles
14294 : 1995	Method of determination of apparent opening size by dry sieving technique – Geotextiles
14324 : 1995	Method of test for determination of water permeability-permittivity — Geotextiles
14443 : 1997	Specification for polycarbonate sheets
14500 : 1998	Specification for linear low-density polyethylene (LLDPE) films
14643 : 1999	Specification for unsintered polytetrafluoroethylene (PTFE) tape for thread sealing applications
14706 : 1999	Sampling and preparation of test specimen of geotextiles
14714 : 1999	Determination of abrasion resistance of geotextiles
14715 : 2000	Specification for woven jute geotextiles
14716 : 1999	Determination of mass per unit area of geotextiles
14739 : 1999	Methods for determination of creep of geotextiles
14753 : 1999	Specification for poly(methyl) methacrylate (PMMA) (Acrylic) sheets

IS No.	*Title*
14986 : 2001	Jute geo-grid for rain water erosion control in road and railway embankments and hill slopes
15060 : 2001	Tensile test for joints/seams by wide width method of geotextiles
15351 : 2015	Specification for textiles — Laminated high density polyethylene (HDPE) woven fabric (geo-membrane) for waterproof lining (*second revision*)

20. SANITARY APPLIANCES AND WATER FITTINGS

a) General

IS No.	*Title*
782 : 1978	Specification for caulking lead (*third revision*)
804 : 1967	Specification for rectangular pressed steel tanks (*first revision*)
1726 : 1991	Specification for cast iron manhole covers and frames (*third revision*)
2963 : 2013	Specification for copper alloy waste fittings and waste plug for wash-basins and sinks (*second revision*)
5219 : 2013	Specification for cast copper alloy traps (*first revision*)
5455 : 1969	Specification for cast-iron steps for manholes
5961 : 1970	Specification for cast iron gratings for drainage purposes
9140 : 1996	Method of sampling of vitreous and fire clay sanitary appliances (*second revision*)
9872 : 1981	Specification for precast concrete septic tanks
12592 : 2002	Specification for precast concrete manhole covers and frames (*first revision*)
12701 : 1996	Specification for rotational moulded polyethylene water storage tanks (*first revision*)
13356 : 1992	Specification for precast ferrocement water tanks (250 to 10 000 litres capacity)
14399	Hot press moulded thermosetting glass fibre reinforced (GRP) sectional water storage tanks
(Part 1) : 1996	Specification for panels
(Part 2) : 1996	Guidelines for assembly, installation and testing

b) Pipes and Fittings excluding valves

i) Brass and Copper Pipes and Fittings

IS No.	*Title*
407 : 1981	Specification for brass tubes for general purposes (*third revision*)
2501 : 1995	Specification for solid drawn copper tubes for general engineering purposes (*third revision*)

ii) *Cast Iron Pipes and Fittings*

IS No.	*Title*
1536 : 2001	Specification for centrifugally cast (spun) iron pressure pipes for water, gas and sewage (*fourth revision*)
1537 : 1976	Specification for vertically cast iron pressure pipes for water, gas and sewage (*first revision*)
1538 : 1993	Specification for cast iron fittings for pressure pipes for water, gas and sewage (*third revision*)
1729 : 2002	Cast iron/ductile iron drainage pipes and pipe fittings for over ground non-pressure pipeline socket and spigot series (*second revision*)
1879 : 2010	Specification for malleable cast iron pipe fittings (*third revision*)
3989: 2009	Specification for centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories (*third revision*)
5531: 2014	Specification for cast iron specials for asbestos-cement pressure pipes for water, gas and sewage (*third revision*)
6418 : 1971	Specification for cast iron and malleable cast iron flanges for general engineering purposes
7181 : 1986	Specification for horizontally cast iron double flanged pipes for water, gas and sewage (*first revision*)
8329 : 2000	Specification for centrifugally cast (spun) ductile iron pressure pipes for water, gas and sewage (*third revision*)
8794 : 1988	Specification for cast iron detachable joints for use with asbestos cement pressure pipes (*first revision*)
9523 : 2000	Specification for ductile iron fittings for pressure pipes for water, gas and sewage (*first revision*)