Revised National Building Code of India 2016 equipped with a new Section on Glass and Glazing

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National Building Code is a vital document anticipated to assist regulate, the building construction activities and guide to unify the building regulations throughout the country and serve as a model for adoption by municipal corporations, municipalities, development authorities and other local bodies, central & state PWDs and other construction departments and agencies, professionals, consultants, builders and developers. Local authorities are responsible to regulate the building activities in the areas of their jurisdiction by including provisions and conditions in the byelaws for various aspects. The Code contained guidelines on all these aspects and regulations which can be immediately adopted or enacted for use by municipal administrations, local bodies and various departments.

The first version of the Code was published in 1970 by the then Indian Standards Institution. It laid down minimum provisions, which are designed to protect the safety of the public with regard to structural sufficiency, fire hazards and health aspects of buildings. Industrialized system of buildings and architectural control was also covered.

In view of comments and suggestions received, development of new and revised codes, considering special requirements on various aspects, new developments in the field of building construction, lessons learnt in the aftermath of number of natural calamities etc , NBC was subsequently revised in 1983 and 2005.

Further with the developments in the techno-legal and techno financial regime, changing requirements of cityscapes and life style, changes in various standards, the revision of NBC 2005 was initiated in July 2014, under National Building Code Sectional Committee CED 46 of BIS, under the Chairmanship of Padmashree Dr. H. C. Visvesvaraya, former Vice-Chancellor of the University of Roorkee. New sections have been added on glass and glazing; information and communication enabled installations; solid waste management; and asset and facility management. With the concerted efforts of Mr. Sanjay Pant, HOD, Civil Engineering Division, Mr. Arun Kumar, Sr. Scientist and his team, revision of the Code was completed in record time constituting 24 Panels, involving 1000 experts, conducting more than 50 meetings and reviewing large number of comments received during the process of revision.

During last few years there have been significant increase in use of glass in building construction. The sky lines of Indian metros are dotted with high-rise buildings clad in glimmering glass. Popularity gained not because of fashion, competition or fascination of architects, designers, specifiers and consultants but due to inherited properties, unmatched quality and advantages glass has which may be spelled out as freedom from conventional building shapes, adds beauty to the building and aesthetics, does not deteriorate, corrode, stain or fade, transparent to visible light, optimal use of day light, satisfies sense of openness and harmony, helps to keep clean environment because of zero degeneration, can be recycled indefinitely, helps to maintain hygienic environment with easy maintenance, saves the space inside the building, no extra design is required for slab for making glass partition on upper floors being lighter in weight, as cladding fulfill functional requirement of lighting, excellent material for thermal insulation, water proofing and energy conservation, as bad conductor of heat saves energy in air conditioning of building etc.

Inspite of extensive use of glass, the need for regulations for safe use of glass in buildings was felt essential, as there was no guidelines, no Indian Standard, no manual, no byelaws to

ensure safety. Fatal incidences due to glass impact and problems faced by fire fighters while carrying out rescue operations and fire fighting having glass façade are reported in media from time to time. Recognizing the gravity of the problem and uncertainty faced by the departments, authorities, engineers. Architects, planners and users, Architectural Glass Panel of The All India Glass Manufactures' Federation (Formerly Indian Glass Manufactures' Association) shoulder the responsibility to support the formulation of Guidelines on Use of Glass in Buildings – Human Safety and task was assigned to Confederation of Construction Products and Services (CCPS) a not for profit organization. The Guidelines was prepared in record time of eleven months in 2007 adopting consensus method involving CPWD, M/o Urban Development, various PWDs, major municipalities, IBC, CEAI, glass industry and experts and suggest how to regulate glass in relation to human safety. .

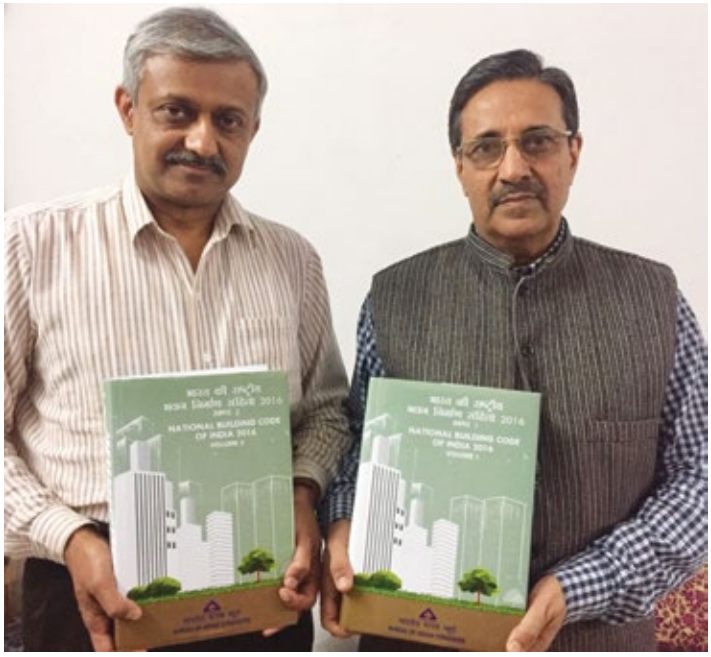
Since the issue was very sensitive and felt need of the hour, the CCPS widely propagated the Guidelines in the country and succeeded in drawing the attention of authorities which resulted in mandating, considering and implementing the Guidelines by 21 States, Central & State Government Departments, PSUs and eminent construction agencies which include Central PWD, Government of Andhra Pradesh, Government of Rajasthan, NBCC, Airport Authority of India, Haryana PWD, Delhi PWD, Greater Hyderabad Municipal Corporation, Mumbai Fire Brigade BMC, etc.

CCPS has also approached Bureau of Indian Standards (BIS) to formulate a New Indian Standard on Safe Use of Glass in Buildings. BIS in Sectional Committee CED 13 meeting held on 5th November 2008 under the Chairmanship of Mr. D.S. Sachdev, Director General, CPWD exceeded to the request of CCPS and decided to deal with the subject comprehensively as per the extract of the Minutes - "**6.1.1 The Committee considered the request along with the document received from Confederation of Construction Products and Services (CCPS), New Delhi for formulation of a new Indian Standard on safe use of glass in buildings. The Committee considered the publication entitled, 'Guidelines on Use of Glass in Buildings, Part A: Human Safety', brought out by CCPS which were circulated to the members vide BIS e-mail dated 20 October 2008 and a hard copy of which was also tabled during the meeting.** ……. **The Committee finally observed that there is a need to deal with subject comprehensively".** IS 16231 (Part 4) 2014 Code of Practice – Use of Glass in Buildings Part 4 Safety Related to Human Impact was first brought out by BIS in 2014, which was derived from CCPS Guidelines on Use of Glass in Buildings – Human Safety. Parts 1 to 3 on General methodology for selection, Energy and light, and Fire and loading of IS 16231 were published in 2016.

While revising NBC 2005, BIS has also considered Glass and Glazing an important subject and a new section No. 8 on 'Glass and Glazing' has been added in Part 6 of Structural Design and Clause 3.4.10 Glazing in Part 4 of Fire and Life Safety of NBC 2016. This section provides guidance on the selection of appropriate glazing for various types for buildings, the energy and light aspects, determining the appropriate thickness of glass used in glazing, specialised operation for fixing and with respect to rescue and fire fighting operations, human safety aspect while using glass in buildings.

Based on the recommendations of National Building Code 2016, IS: 16231 (Part 4) 2014 'Code of Practice on Use of Glass in Buildings – Safety Related to Human Impact' and CCPS Guidelines on Use of Glass in Buildings - Human Safety, Advisory clauses for safety against Impact for various critical locations/cases and precautions to be observed are given below:

1.1 CASE 1: At locations where Glass is used as vertical walls and having sill height Hs ≥ 0.75 m or provided with residual protection like sill structure, transom, balustrade, railing, or grill inside i.e. location is not likely to be subjected to human



impact, therefore any type of Glass is permitted and Safety Glass is not mandatory. (Hs = Sill height, Hf = Falling height in case of change in level between the two sides of glass)

1.2 CASE 2: At locations where Glass is used as vertical walls and having sill height Hs < 0.75m and falling height Hf ≤1.5 m i.e. at this location there are chances of human impact but no risk of fall, therefore safety glass (Laminated or Toughened) shall required to be used.

1.3 CASE 3: At locations where Glass is used as vertical walls and having sill height Hs < 0.75m and falling height Hf > 1.5m i.e. at this location there are chances of human impact as well as risk of fall, therefore safety glass shall required to be used, however laminated is preferred.

1.4 CASE 4: At locations where Glass is used in roof (skylights), ceilings, bus shelters, floors, stairs, or sloped façade i.e. locations where there are chances of risk of fall, laminated safety glass shall required to be used.

1.5 CASE 5: At locations where Glass is used as a balustrades, balcony, or railings i.e. locations where there are chances of human impact as well as risk of fall both, laminated safety glass shall required to be used.

1.6 Toughened (tempered) or Laminated glass should meet respective test requirements as given in respective Indian Standard specifications.

1.7 If smaller dimension of the pane is 250 mm or less and its area is 0.5 sqm or less, glass other than safety glass may be used, provided that the nominal thickness is not less than 6 mm (applicable to vertical glazing)

2.0 Enhance person's awareness of presence of glass by making visible manifestation. Clear glass panels capable of being mistaken for an unimpeded path of travel should be marked to make them visible by incorporating manifestation. Manifestation employed shall be in form of opaque band of size not less than 20 mm in height and located at vertical distance from floor level to not less than 700 mm from upper edge of band and not more than 1200 mm to lower edge of the band. The manifestation shall preferably be permanent, e.g. etching of the glazing, but alternatively, if applied materials are used they shall be durable and not easily removable.

3.0 The effective Toughened safety glass thickness and/or laminated safety glass configuration shall be determined case by case with regard to (a) other solicitations (wind load, snow load, dead load, and human load) (b) overall dimension (length / width, or surface) (c) aspect ratio of the glass (length / width) (d) glazing fixing type (framing, bolted system, structural system etc.).

4.0 Strength of the Glazing System should be such that it has the ability to hold glass in place and prevent it from falling out as a whole.

5.0 Laminated safety glass shall generally not fall out of fixing. However, where laminated glass with both glasses toughened, used for horizontal or sloped glazing, in case of failure of both toughened glasses; it may crumble as a blanket and fall out of fixing. This factor needs to be considered while designing horizontal and sloped glazing. Further, when the slope is acute, in a pane facing the floor should be laminated; and when the slope is obtuse, the outer pane facing the ground/floor should be laminated and all obtuse angle sloped glazing shall be continuously capped for safety reasons.

6.0 Toughened (tempered) safety glass has a safe breakage pattern, as it breaks and disintegrates into small and relatively harmless particles. However thick toughened glass particles may stay interlocked and fall as lumps of these multiple particles and can cause a minor or medium injury mainly due to the weight of the cluster.

7.0 If insulating Glass Unit (IGU) is used in critical locations, then one of the following shall apply:

- If IGU is installed in areas subjected to human impact on either side, then both the panes of the unit shall meet the requirements of this standard
- In situations where access is restricted to one side of the unit, then only the accessible side should meet the requirements of this standard

8.0 In case of mirror glazing, it should conform to the requirements of other safety glasses unless is fully backed by solid material

9.0 In case of external Laminated glass facades openable portions have to be left at regular distances for fire fighting and smoke exhaust. The portion should be of toughened glass and clearly indicated by suitable visible marking.

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 1000 mm X 1000 mm opening outwards. The wordings, 'FIRE OPENABLE – 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 for personnel for smoke exhaust in times of distress. (NBC 2016 Part 4 Fire and Life Safety, Clause 3.4.10 Glazing)

10.0 Broken annealed glass falling on people can cause grievous or even fatal injuries; hence it is recommended to use safety glass in locations where the risk of people getting hurt by falling glass is high.

11.0 Any broken glass in any glazing should be removed immediately on breakage.

12.0 All Safety Glass shall be procured from certified manufacturers and the product shall conform to relevant Indian Standards and shall carry all relevant information through the approved level/ permanent (indelible) markings on the glass surface.

13.0 For specific provisions related to smoke evacuation, Part 4 'Fire and Life Safety' of the NBC may be referred.

14.0 Test requirements: Safety glass should conform to all the requirements when tested as per the test methods mentioned in the relevant Indian Standards.

CCPS is committed to propagate safe use of glass in buildings to ensure human safety and offer to provide all sorts of information in this regard. So far, CCPS has organized 61 Training programmes and capacity building workshops to highlight and acquaint engineers; architects; consultants; builders; planners; fire fighters; central, state and local bodies government officials etc., about the salient features of CCPS guidelines and appropriate glass use. When we know and anticipate that something will create an injury and that it seems conceptually evident that injury may occur, it would be primitive and unfair to wait until a number of people have sacrificed their limbs or lost their lives, before we attempt to prevent those accidents. As the latest provisions on Glass and Glazing have already been standardized as part of IS 16231 series of standards as well as in the revised NBC 2016, which have since been notified and are available in public domain, therefore, there should be no hitch or delay in adopting and including as regulation in Building Byelaws by municipal and local bodied to ensure safe use of glass in buildings ■

GLASS FRATERNITY CONCLAVE

At the initiative of Federation of Safety Glass (FOSG), Glass Fraternity Conclave was held on June 19, 2017 at PHD Chambers, New Delhi. The conclave was mainly organised to discuss and plan a strategy and way forward to get the National Building Codes implemented, which was now in place for the benefit of all the stakeholders of the Glass Industry.

Participants included delegates from float glass manufacturers (i.e. AIS, Gujarat Guardian, HNG Float, Gold Plus and Saint Gobain) PVB, Silicone, Hardware manufacturers and representatives from associations i.e. Glazing Society of India (GSI), The Confederation of Construction Products and Services (CCPS), Glass Academy, uPVC Window and Door Manufacturers Association (UWDMA), International Fenestration Forum (IFF), The All India Glass Manufacturers' Federation (AIGMF) some special invitees and Federation of Safety Glass (FOSG).