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D R A F T REGULATIONS/NORMS

Human Safety requirements for Glass Wall and Façade in buildings as per NBC 2016. IS: 16231 (Part 4) and “CCPS Guidelines on Use of Glass in Buildings - Human Safety”

S No	Suggested Regulations/Norms	Justifications/ Remarks
	<p>The use of glass in buildings especially in multiplexes, malls, hotels, offices and even in residential etc have increased many folds which may jeopardize human/fire safety. It is therefore, essential and felt necessary to regulate glass in relation to human and fire safety by either restricting use of glass or specifying use of safety glass at critical locations where chances of injury are high and facilitate fire fighters to combat the blaze.</p> <p>Fatal incidences due to glass impact and difficulty faced by fire brigade while carrying out fire fighting and rescue operations in the buildings having glass façade, has raised alarm and required to make provisions in the regulations to ensure safety while using glass in buildings.</p> <p>Recognizing the gravity of the problem and uncertainty faced by the departments, authorities, engineers, Architects, planners, users etc, Guidelines on Use of Glass in Buildings – Human Safety was brought out by Confederation of Construction Products and Services (CCPS) and subsequently, IS: 16231 (Part 4) 2014 ‘Code of Practice on Use of Glass in Buildings – Safety Related to Human Impact’ was formulated by Bureau of Indian Standard (BIS) and now it is included in the revised National Building Code 2016.</p> <p>As per Clause 7 - Safety Related to Human Impact of Section no. 8 on “Glass and Glazing” in Part 6 of STRUCTURAL DESIGN and Clause 3.4.10 ‘Glazing’ in Part 4 of FIRE AND LIFE SAVING of revised NBC 2016, following conditions are enforced with immediate effect :</p>	<p>Availability of ‘Guidelines on Use of Glass in Buildings – Human Safety’ brought out by Confederation of Construction Products and Services (CCPS) which has been implemented by 19 States, Central & State Govt. Departments, PSUs etc</p> <p>IS: 16231 (Part 4) 2014 ‘Code of Practice on Use of Glass in Buildings – Safety Related to Human Impact’ which is derived from CCPS Guidelines.</p> <p>National Building Code 2016, Part 6 Structural Design, Section 8 Glass and Glazing,</p>
	Advisory clauses for safety against Impact	
1.0	The glazing used at different locations/cases in buildings and for façade shall be as per 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 as follows:	As per National Building Code 2016, Part 6: Structural Design, Section 8: Glass and Glazing, Clause 7: Safety related to Human Impact, page 52
1.1	At locations where Glass is used as vertical walls and having sill height $H_s \geq 0.75$ 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. (Case 1)	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”
1.2	At locations where Glass is used as vertical walls and having sill height $H_s < 0.75$ m and falling height $H_f \leq 1.5$ 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. (Case 2)	NBC 2016 Part 6, Section 8: Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
1.3	At locations where Glass is used as vertical walls and having sill height $H_s < 0.75$ m and falling height $H_f > 1.5$ m 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. (Case 3)	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
1.4	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. (Case 4)	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7. IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”

1.5	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. (Case 5)	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
1.6	Toughened (tempered) or Laminated glass should meet respective test requirements as given in respective Indian Standard specifications.	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
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)	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
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.	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
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.).	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
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.	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
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.	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
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.	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings-Human Safety”
7.0	If insulating Glass Unit (IGU) is used in critical locations, then one of the following shall apply: <ul style="list-style-type: none"> ▪ 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 	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings - Human Safety”
8.0	In case of mirror glazing, it should conform to the requirements of other safety glasses unless is fully backed by solid material	NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7 IS: 16231 (Part 4) 2014 and “ CCPS Guidelines on Use of Glass in Buildings - Human Safety”

9.0	<p>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.</p> <p>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 X 1 000 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 fire personnel for smoke exhaust in times of distress.</p>	<p>National Building Code 2016, Part 4, FIRE and LIFE SAFETY, Clause: 3.4.10.2 (c) page 25</p>
10.0	<p>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.</p>	<p>NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7. IS: 16231 (Part 4) 2014 and "CCPS Guidelines on Use of Glass in Buildings - Human Safety"</p>
11.0	<p>Any broken glass in any glazing should be removed immediately on breakage</p>	<p>NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7. IS: 16231 (Part 4) 2014 and "CCPS Guidelines on Use of Glass in Buildings-Human Safety"</p>
12.0	<p>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.</p>	<p>NBC 2016 Part 6, Section 8 Glass and Glazing, Clause 7. IS: 16231 (Part 4) 2014 and "CCPS Guidelines on Use of Glass in Buildings - Human Safety"</p>
13.0	<p>For specific provisions relating to smoke evacuation, Fire Doors, Part 4 'Fire and life Safety' of the NBC may be referred.</p>	<p>NBC 2016</p>
14.0	<p>Test requirements: Safety glass should conform to all the requirements when tested as per the test methods mentioned in the relevant Indian Standards,</p>	<p>NBC 2016 IS: 16231 (Part 4) 2014 and "CCPS Guidelines</p>
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