

# Guidelines on Use of Glass in Buildings to Ensure Human Safety

## Safety, the Main Concern

With the increased activities and growth in the building and housing sector in India, glass has seen a spectacular rise in popularity as building material over last few years and its use has been increased many folds especially in shopping malls, commercial complexes, offices, hotels, hostels, air ports etc. and now even in residential buildings also which would obviously be inviting risk of human injury frequently. The worldwide increase in use of glass has become a matter of concern both from human safety and energy conservation point of view. Energy aspect has been taken care of and covered under the *Energy Conservation Building Code 2007 (ECBC)* brought out by Bureau of Energy Efficiency, Ministry of Power,



Govt. of India. CCPS has also partnered with International Institute of Energy Conservation (IIEC) in developing ECBC by BEE. Therefore, it is very important that use of glass should be safe, appropriate and suitable which does not cause human injury or threat to human life.

Fatal accidents due to glass impact, are reported in media from time to time which could be averted if appropriate glass had been used at those critical locations. (*Cheap Glass Culprit in Boy's Death* – The Ahmedabad Mirror dated 12<sup>th</sup> November, 2008 and *Victim allegedly walked through a glass door at Naaz Saloon, Sector 20-D, Chandigarh succumbed to death* reported in The Tribune dated 27<sup>th</sup> July, 2009).

Worldwide statistics show steep rise in use of glass in buildings resulting increased injuries due to impact breakage and falling glass. In fact, in other countries, the process and action had been initiated long back to reduce glass related injuries and ensure human safety while using glass in buildings. For instance, in 1960s, the first Standard including American National Standard Z97.1 was initiated by the glass industry. In

1972, Consumer Product Safety Commission (CPSC) was established and Consumer Product Safety Act was passed and promulgated. In 1977, CPSC standard 16 CFR part 1201 was enacted by the Federal Government and was made mandatory in all parts of the United States. Australian standard was made compulsory in 1991. In United Kingdom, standard came in existence sometime in early 1990s, in Mexico in 2001 and other countries of Europe. Singapore, China and Hong Kong have also controlled use of glass in buildings.

However, in India, no guidelines, standards/byelaws governing use of glass in buildings existed till 2007. In fact even the *National Building Code 2005*, which serves as a Model Code for adoption by most departments and agencies involved in building construction, is completely silent on this issue. Even major construction departments in the country do not have any documented or specified guidelines to refer to enable them to follow or include in their specifications architectural drawings, tender documents etc. to ensure safe use of glass in buildings. Prevailing Building Bye Laws adopted by the local bodies also do not contain any reference or conditionality in their documents in this regard. In the present scenario, this vital issue can not be overlooked or ignored.

## Status of Guidelines:

Considering the utmost importance of this issue, New Delhi based *Confederation of Construction Products and Services (CCPS)*, a non profit organization, has brought out the *"Guidelines on Use of Glass in Buildings - Human Safety"* through PPP mode adopting consensus method by constituting Steering Committee involving experts from Central & State Govt. departments including M/o Urban Development (GOI), Central PWD, various PWDs, major municipalities, leading architects and engineers, glass manufacturers & processors and other stake holders from across the country and outside. The recommendations of the Guidelines are based on test standards as outlined by Bureau of Indian Standards (BIS) and conform to the IS 2553 (Part 1): 1990 – Safety Glass – Specification, General Purpose and suggest how to regulate glass in relation to human safety by either restricting use of glass or specifying use of Safety Glass at critical locations where chances of injury due to glass breakage are high. Consideration for manifestation, fire fighting and smoke exhaust are also included.

The Guidelines were further reviewed by an Expert Committee, constituted under the Chairmanship of Sh. P. B. Vijay, former Director General, Central PWD, having representations from CPWD, Indian Building Congress (IBC), Consulting Engineers Association of India (CEAI), CCPS, and other stake holders. Director General, CPWD has emphasized in his "Foreword" of the Guidelines that "The purpose of guidelines is not to sell more safety glass but to exhibit the wide choice that exists and allow the use of glass with precautions in order to reduce the risk of accidents."

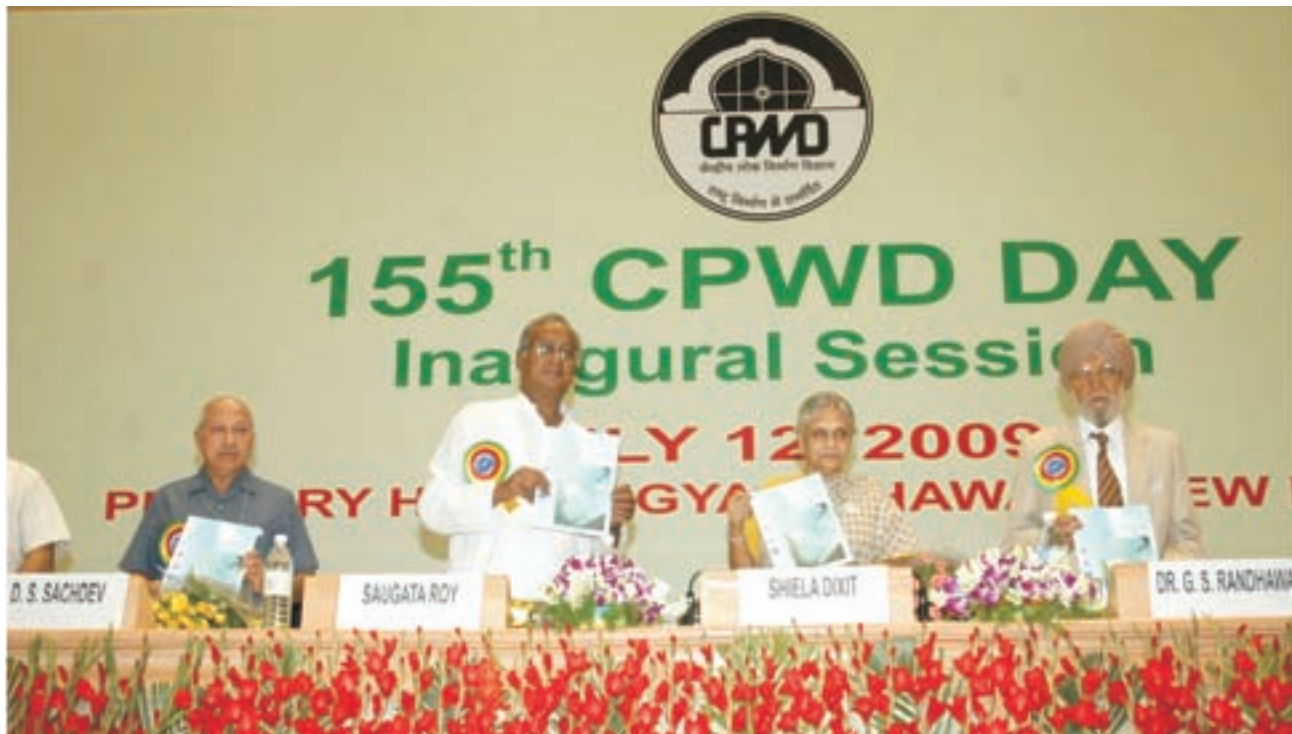
### Propagation and Implementation

CCPS has made all efforts for implementation and propagation of the guidelines amongst the practicing engineers, architects, builders, developers, processors, fabricators, State and Central Government departments and the policy makers in the country. CCPS has also organized 8 Training Workshops for the officers of CPWD, Delhi Development Authority, Airport Authority of India, PWD Delhi, Greater Hyderabad Municipal Corporation, Punjab Urban Development Authority, Municipal Corporation Delhi and PWD (Commonwealth Games Zone-I) to acquaint them with the Guidelines and pursue for early implementation. These workshops were attended by 276 officers.

The Planning Commission has also taken note of increased use of glass in buildings that too without following safety norms or guidelines. A meeting was called by Shri Anwarul Hoda, the then Hon'ble Member (HUD), Planning Commission on 12<sup>th</sup> December, 2008 in Yojana Bhawan,, where CCPS gave a presentation on the Guidelines. Hon'ble Member expressed his concern at the absence of standard and guidelines on safety part while using glass in buildings in the country. He observed that Municipal Bodies are concerned about sanctioning of building plans but safety aspect while using glass in buildings is totally missing. He stressed the need for inclusion of conditionality in Building Byelaws to ensure human safety while using glass in buildings and State Governments should come forward for implementation of the Byelaws.

The Adviser (HUD), Planning Commission has addressed a letter No. PC/H/4/3/2006-HUD-Vol. IV dated 4th Feb, 2009 and 26<sup>th</sup> November 2009 to Principal Secretaries/Secretaries of HUD Deptt. of all States/UTs requesting to initiate action for ensuring safe use of glass in buildings by insisting on certain conditions.

On the occasion of 155<sup>th</sup> CPWD DAY, these Guidelines were released at Vigyan Bhawan, New Delhi on 12<sup>th</sup> July 2009 in the presence of Mrs. Shiela Dixit, Hon'ble Chief Minister, Govt. of Delhi, Chief Guest, Mr. Saugata Roy, Hon'ble Minister of State for Urban Development, Mr. D.S. Sachdev,



**Sh. D.S. Sachdev**, Director General (W), CPWD, **Sh. Saugata Roy**, Hon'ble Minister of State for Urban Development, **Smt. Shiela Dixit**, Hon'ble Chief Minister, Govt. of Delhi and **Dr. G.S. Randhawa**, releasing the guidelines in New Delhi

DG (W), Mr. B.K. Chugh, ADG (TD) Central PWD, Mr. R.C. Mishra, Addl. Secretary, M/o UD, Padma Bhushan Dr. G.S. Randhawa and more than thousand dignitaries and participants.

Central PWD has mandated these Guidelines and issued an O M No. 129/SE(TAS)/2007/212 dated 04.08.2009 directing its follow up with immediate effect, in the department and in PWD, Govt. of National Capital Territory of Delhi to ensure safe use of glass while planning, designing and executing the buildings.

Town & Country Planning Department., Govt. of Andhra Pradesh and Greater Hyderabad Municipal Corporation had recommended for insisting conditions, based on the CCPS guidelines vide their letters dated 20.08.2008 and 31.12.2008 respectively to the Prl. Secretary, MA & UD Department, Govt. of Andhra Pradesh.

Govt of Andhra Pradesh has also issued G.O.Ms. No. 205 dated 27.02.2009 addressing to all Municipal Commissioners /Vice Chairmen of Urban Development Authorities/Commissioners of Municipal Corporations in the State, Hyderabad Metropolitan Development Authority, Hyderabad, Greater Hyderabad Municipal Corporation, Director of Municipal Administration and Director of Town & Country Planning, to follow and ensure the guidelines and conditions whenever permissions are accorded for usage of glass in buildings.

Greater Hyderabad Municipal Corporation has issued a Circular No. Glass/TPS/HO/GHMC/2009 dated 10.11.2009 to indicate as one of the conditions on usage of glass in the plans while releasing the building permission.

Metropolitan Commissioner, Mumbai Metropolitan Region Development Authority (MMRDA) has recommended to Govt. of Maharashtra vide letter dated 14th May 2010 to put certain conditions mentioned in the Guidelines in DCRs on use of glass in buildings to ensure human safety.

Rajasthan Housing Board has issued office orders No. PS/CE-I/2008-09/133 and 135, dated 2.7.2008 and 4.7.2008 respectively for promoting the Guidelines amongst the department.

Chief Engineer, PWD, Govt. of Manipur has issued necessary instructions in this regard vide letter No.12/10/2007-CE/819 dated 5.8.2008

Bureau of Indian Standards (BIS) has undertaken to develop "Indian Standard Code of Practice for Use of Glass in Buildings" covering comprehensive components in the Sectional Committee CED 13 meeting held under the Chairmanship of Mr. D.S. Sachdev, the then ADG, CPWD on 05.11.2008. A specialized working group, under the Chairmanship of Chief Engineer (CDO), CPWD comprising of 8 members including CCPS, was also constituted by BIS for preparing the draft on various parts/sections of the proposed glass standard. Draft has been prepared and reviewed by the Working Group members and is under circulation for comments before putting up to Sectional Committee CED 13.

### Task Ahead

It is very important that the Central/State Governments/ UT Adms., builders, developers etc should come forward to ensure safe use of glass in buildings by insisting conditionality through GO/OM/circulars or inclusion of recommendations of Guidelines in building byelaws and specifications/manual as is initiated by Govt. of Andhra Pradesh, Central PWD etc. *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 lost their lives, or sacrificed their limbs, before we attempt to prevent those accidents.* Now with the availability of these Guidelines, which were approved and adopted by the CPWD and some State Govts., the officials, architects, engineers, designers, builders, developers and even users in the country have no excuse to show ignorance for insisting or selecting right type of glass and even examining the already fitted glasses in the buildings for its appropriateness or introducing safety measures as suggested in the Guidelines to ensure human safety.

### Commitment & Assurance by CCPS

CCPS is committed to propagate safe use of glass in buildings to ensure human safety in public interest and would be very glad to provide any further information or assistance in this venture and offer to organize one/half day workshops for the interested people, groups, departments or organizations on the subject at pre decided terms, venue and date and assure of all cooperation and assistance.

# Summary of Guidelines

**1.0 Scope** – The scope of these guidelines covers minimum safety requirements subjected to various kinds of human impact, precautions against risk of fall and falling glass.

**2.0 Safety Glass** – Safety glass shall be of four types as follows:

- a) Toughened Safety (Tempered) Glass (TS)
  - b) Toughened Float Safety Glass (TF)
  - c) Laminated Safety Glass (LS)
  - d) Laminated Float Safety Glass (LF)
- Glass at 'b' and 'd' shall be preferred.

**3.0 Critical Locations** – Critical locations are parts of a building most likely to be subjected to accidental human impact. Where any glazing is within 1.5 metre above the floor level of building, it is considered likely to be subjected to human impact and hence, shall comply with the human impact safety requirements as laid down below. Safety glazing material should also be used:

- a) Where there is danger of falling infill glass materials from overhead glazin
- b) Where there is danger of falling due to a change in floor level.
- c) In case of balustrades, stairs and floors. However, if the smaller dimension of pane is 250 mm or less and its area is 0.50 sq.m. or less, glass not conforming to safety requirements can also be used.

**3.1 Classification of Critical Locations** – The critical locations with appropriate types of glass allowed for use, is listed in the following five cases:

Case 1: Glass used as Vertical Walls (not likely to be subjected to Human Impact)

Hs = 0.75 m or with Residual Protection

Type of Glass to be used: Any glass (**Safety Glass not mandatory**)

Case 2: Glass used as Vertical Walls (Human Impact but no risk of fall)

Hs < 0.75m and Hf = 1.5 m

Type of Glass to be used: **Safety glass** (TF or LF)

Case 3: Glass used as Vertical Walls (Human Impact and risk of fall both)

Hs < 0.75m and Hf = 1.5m

Type of glass to be used: **Safety glass** (LF preferred)

Case 4: Glass used in Horizontal or sloped glazing (Risk of fall)

Type of glass to be used: **Laminated safety glass** (LF)

Case 5: Glass acting as a balustrade, parapet or a railing (Human Impact and risk of fall

both) Type of glass to be used: **Laminated safety glass** (LF)

Residual protection is the protection, provided to avoid the impact of human beings to glass. e.g. sill structure or transom, balustrade or railing, or grill inside.

(Hs = Sill height, Hf = Falling height in case of change in level between the two sides of glass.)

**4.0 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 removed.

**5.0 Identification of Safety Glass** – All Safety Glass shall be indelibly and distinctly marked with type of glass, name or logo to identify the manufacturer, thickness of glass and BIS certification mark. Stickers are not permitted for these markings.

**6.0 Safety Glass Test requirements** – Glasses shall satisfy the relevant resistance to shock test, fragmentation test, warp test for TS and TF glass and LS and LF glass shall comply with light stability test, boil test and fracture and adhesion test in accordance with IS 2553 (Part 1).

**7.0 Precautions** – The following precautions should be taken to reduce the injuries that can result from glass breakage by:

- a) Selecting glass of a suitable type, thickness and size,
- b) Enhancing the person's awareness of the presence of glass by making glass visible (Manifestation)
- c) Minimizing manual handling of large pieces of glass during installation.
- d) In case of external laminated glass facades, open able portions have to be left at regular distances as required for fire fighting and smoke exhaust.
- e) Laminated glass with both glass panes toughened will not be classified as safety glass.

(The Guidelines can be down loaded from the website of CCPS [www.ccpsindia.com](http://www.ccpsindia.com) For more details you may write to [ccps@ccpsindia.com](mailto:ccps@ccpsindia.com))

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