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ADVISORY

GLASS GUARDS – DESIGN AND CONSTRUCTION

BUILDING CODE SERVICES

Planning, Real Estate and Economic Development Department



GLASS GUARDS DESIGN AND CONSTRUCTION

PURPOSE

This Advisory applies to the design and construction of guards containing or constructed of glass in buildings. The intent is to provide guidance for determining Ontario Building Code (OBC) compliance.

REFERENCES

Ontario Building Code Division A, 1.4.1.2

Ontario Building Code Division B, 3.1.20.1, 3.3.4.7, 4.3.6.1.(1), 9.8.8, 9.8.8.2, 9.8.8.7

DEFINITIONS

Guard (Div. A 1.4.1.2)-means a protective barrier, with or without openings through it, that is around openings in floors or at the open sides of stairs, landings, balconies, *mezzanines*, galleries, raised *walkways* or other locations to prevent accidental falls from one level to another.

Glass in guard means glass that is supported within structural framework (metal, wood or other material), anchored, and have a continuous protective top rail with the framework supporting the edge of glass. Guard loads are resisted by the top rail and vertical posts. The structural frame can resist the guard loads without the presence of the glass infill panel.

Glass acting as a guard means a guard constructed of glass that is structurally captured/supported (mechanical or sealant) and secured to the structure. Guard loads are resisted by the glass and transferred to the super structure by an anchoring system. Without the glass, the guard is unable to resist guard loads.

DESCRIPTION

Glass forming a guard or used as a component of a guard is required to be designed for the loads and requirements specified in the OBC and its referenced standards. The design of the glass will determine the type, thickness, strength, and other characteristics required for glass to perform its intended function. All guards containing glass components or glass acting as a guard are required to be designed by a Professional Engineer. Nevertheless, experience has shown that designers may not be aware of all OBC and referenced standard requirements.

To demonstrate compliance during the Permit Approvals process, designers are required to provide guard design details identifying:

- Dimensions of the guard,
- Size of all materials (including type and thickness of glass),
- Connections,
- Anchorage,
- Design loads, and
- Applicable design standard(s).

GLASS GUARD CONFIGURATIONS

Glass used in or as a guard can be designed into various configurations. These can be classified into two general categories:

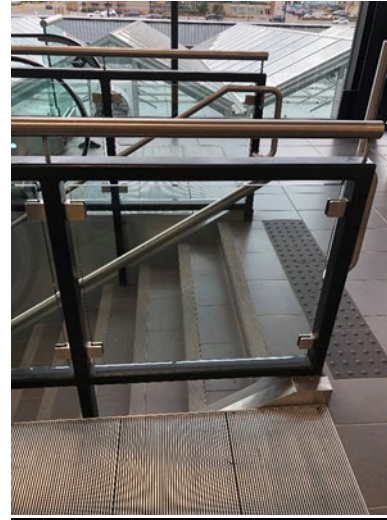
- Glass in guard
- Glass acting as a guard

Below are examples of configurations using glass within or as a guard:

Glass in guard



Example 1-Glass in guard with continuous top and bottom support.



Example 2-Glass in guard with intermittent top and bottom support.

Glass acting as a guard



Example 3-Free-standing cantilevered (intermittent support) glass guard with top rail.



Example 4-Free-standing glass guard (continuous shoe) with top rail.



Example 5-Glass guard with two-sided support. (No top rail)

Special Requirements

Article 7.1 of CAN/CGSB-12.20-M89 requires all free-standing glass guards be capped by a rail which is continuous over two or more panels and for the remaining guard to resist the design loads after the failure of alternate panels. Free-standing glass guards are cantilevered glass panels supported at the bottom only (either by a continuous support or intermittent support), such as those shown in examples 3 and 4 above.

GLASS DESIGN LOAD REQUIREMENTS

Prescriptive

All glass guards, for both Part 3 and Part 9 buildings, are required to be designed by a Professional Engineer in accordance with Division B Part 4 or Part 9 (where applicable) of the OBC. The structural design of glass is required to be in accordance with CAN/CGSB-12.20-M89 (OBC 4.3.6). Glass elements in or acting as a guard are to be designed for the same loads as other guard construction materials referenced in OBC 4.1.5.14 or 9.8.8.2, as applicable, based on the building type and guard location.

Article 4.3.6.1 further refers to ASTM E1300 as a prescriptive compliance path for the design of glass. This standard is intended for the design of glazing systems and excludes guards as part of its applicable scope. Glass used for or in a guard is not be designed using this standard.

Performance Standards

There are several alternative standards available to the industry that might be used to design guards. Many of these standards are not referenced within the OBC. Examples of design standards available include:

- CSA A500:16 “Building Guards”, and
- ASTM E 985 “Specification for Permanent Metal Railing Systems and Rails for Buildings”.

Design completed under non-referenced OBC standards are to be assessed through the Alternative Solution process.

TYPES OF GLASS

The OBC regulates types of glass that may be used depending on the occupancy or location of the glass element within the guard. The OBC provides context on the type of glass that may be used in article 9.8.8.7 and SB-13.

For Part 9 buildings and guards within dwelling units (including Part 3 dwelling units) the types of glass that may be used include:

- Tempered or laminated glass conforming to CAN/CGSB-12.1-M “Tempered or Laminated Safety Glass”, or
- Wired glass conforming to CAN/CGSB-12.11-M “Wired Safety Glass”.

For Part 3 buildings, glass used under the scope of SB-13 shall be:

- Heat strengthened laminated glass
- Heat soaked tempered glass
- Tempered glass (not more than 6mm thick)

The type of glass that can be used will vary based on the clearance between the floor and edge of glass. The design of glass elements used in a guard within SB-13 are to be designed using CAN/CGSB 12.20 M89.

Note:

Recent and ongoing efforts have been made to harmonize glass design and testing standards across North America. Labelling of glass using ANSI Z97.1 is to be considered an acceptable equivalent to CAN/CGSB-12.1-M.

GLASS GUARD REGULATION AND REFERENCED STANDARDS

CAN/CGSB-12.1-1990 - Tempered or Laminated Safety Glass

CAN/CGSB-12.1-1990 is a material standard (1990 version) referenced in the 2012 OBC. The 2017/2022 edition of the standard includes changes to load combinations and types of glass permitted.

The 2017 and 2022 edition is not referenced in the 2012 OBC. Communication has been provided to staff confirming sufficiency of compliance of both the 2017 and 2022 edition of the standard as an equivalent to the 1990 edition.

This standard applies to glass that has been tempered or combined with other materials to reduce the likelihood of injury to persons by objects projected from an exterior source or by glass fragments when the glass is cracked or broken. It specifies requirements for safety glass intended primarily for use in doors and adjacent glazed panels and is particularly applicable to glazed exterior/interior passageway doors, storm (combination) doors, patio doors, shower and bathtub doors and their enclosures.

CAN/CGSB-12.11-M90

CAN/CGSB-12.11-M90 applies to flat rolled glass having a layer of meshed wire completely imbedded in the sheet, intended for use in skylights and general glazing in building construction where fire retardation, security and safety are a consideration.

CAN/CGSB-12.20-M89

CAN/CGSB-12.20-M outlines, 'structural requirements intended to minimize the risk of progressive or localized collapse of structural glass panels with possible catastrophic consequences'. The standard describes the procedures recommended for the structural design of soda-lime glass for use in buildings including windows, glass doors, balustrades, partitions and sloped glazing.

All glass used in guards is to be designed to this standard.

OBC SUPPLEMENTARY STANDARD SB-7

The OBC Supplementary Standard SB-7 does not include design of glass in guards.

OBC SUPPLEMENTAL STANDARD SB-13

SB-13 applies to glass being installed in a guard for Part 3 buildings.

The type (tempered, tempered laminated, heat strengthened laminated) of glass is determined by the support of the glass and position relative to the edge of the floor.