

Glass Panels in Balcony Guards – Status Update

Date:	May 31, 2012
To:	Planning and Growth Management Committee
From:	Chief Building Official and Executive Director, Toronto Building
Wards:	All
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SUMMARY

The purpose of this report is to provide Planning and Growth Management Committee with a status update on the matter of glass balcony guard safety, potential Ontario Building Code (building code amendments) and the City's present ability to take action with respect to existing glass balcony guards where no failure has occurred.

In response to the failure of a number of glass paneled balconies in the City last summer, Toronto Building conducted a review of the commonalities and possible causes for failure of the glass paneled balconies. The November 3, 2011 report from the Chief Building Official provided a summary of the evolution of the design of glass balconies, potential causes of failure and the standards which govern glass in building construction. That report resulted in a series of recommendations, including that the Province enact an emergency amendment to the building code to address glass balcony guard safety.

In response to the request from the City, and others, for a building code change, the Ministry of Municipal Affairs and Housing established the "Expert Advisory Panel on Glass Panels in Balcony Guards". This report provides an overview of the issues considered by the Panel and recommends that Council ask the Province to expeditiously adopt building code amendments in keeping with the recommendations of the Panel.

This report also considers the question of how to appropriately address glass balcony guard safety on existing buildings. Current regulatory authority does not permit the City to implement a proactive inspections and maintenance program. The report recommends that Council request that the Chief Building Official undertake a communications program to advise certain building owners of actions they may wish to pursue to mitigate the risks from falling broken glass.

RECOMMENDATIONS

The Chief Building Official and Executive Director, Toronto Building, recommends that City Council:

1. Encourage the Province to enact a clear, prescriptive emergency interim amendment to the Ontario Building Code, in keeping with the recommendations of the Expert Advisory Panel on Glass Panels in Balcony Guards to minimize the risk to public safety from falling glass as the result of glass balcony failure.
2. Request the Chief Building Official and Executive Director, Toronto Building to undertake a communications strategy with existing building owners on possible glass balcony guard failures, by:
 - a. identifying all buildings constructed within the last five years sharing characteristics similar to those with failed glass balcony guards, and
 - b. encouraging the owners of those buildings to engage a professional designer to assess the risks associated with the glass balcony guards with the objective of determining whether further testing or replacement of the glass is appropriate.

Implementation Points

Toronto Building will amend its current practices for the review and inspection of building permits in response to any new building code requirements affecting the design and construction of glass balcony panel guards.

Financial Impact

The recommendations will have **no** immediate financial impact beyond what has already been approved in the current year's budget.

DECISION HISTORY

At its November 29, 30 and December 1, 2011 meeting City Council adopted the (November 3, 2011) report from the Chief Building Official and Executive Director, Toronto Building, "Glass Balcony Guards: Review".

That report directed the Chief Building Official to request that the Ministry of Municipal Affairs and Housing consider an emergency amendment to the building code to better address concerns for public safety when glass paneled balconies may break. The report also directed the Chief Building Official to advise associations and agencies with an interest in residential construction of the results of the City's analysis of glass panel safety in balcony guards.

Council also adopted the recommendations of the Planning and Growth Management Committee (November 8, 2011) in consideration of the staff report, requesting a re-evaluation of wind tunnel standards.

ISSUE BACKGROUND

Glass used in panels on balcony guards is typically tempered glass. Design changes that have taken place in the past 40 years have resulted in the use of larger, thicker panels. The total volume of glass now being used for glass panel balconies has increased from earlier designs.

The building code does not specify that glass may not break. The standard referenced in the building code does not require assurance that glass will not break, only that glass will break into small pieces of a maximum size where tempered glass is used.

As outlined in the previous reports, during the summer of 2011 there was a concentration of instances of glass panel failure in Toronto on a number of high-rise residential buildings. Toronto Building responded to remedy unsafe conditions, under the authority of the *Building Code Act, 1992*. Compliance with the Orders issued to remedy the unsafe conditions was achieved by Toronto Building, with cooperation from the development companies involved.

Report on Failures and Remedial Action

Shortly after the glass panel failures, Toronto Building retained an independent Professional Engineer to peer review the reports and remedial plans received by the City. The Professional Engineer also investigated the cause of the failures to determine what further actions should be undertaken to protect the public. The Chief Building Official's November 3, 2011 report to Planning and Growth Management Committee provided an overview of the Professional Engineer's report, including guard manufacturing and design; evolution of glass balconies; building code requirements and an assessment of failures.

In the assessment of failures, the November report noted that "Nickel sulphide inclusions were identified as the most likely cause of failure in the buildings where the highest frequency of failure occurred, potentially aggravated by other factors, such as loading, or deflection, either causing glass inclusions to rupture at a higher rate, or as a result of glass to metal contact".

The report requested that the Province review the use of glass panels in balcony guards and consider an emergency amendment to the building code to better address concerns for public safety when glass paneled balconies may break.

Remedial actions are proceeding at the following various sites subject to the initial review:

38 Grenville: Permits have been issued and installation is now underway of the replacement of all the tempered glass with laminated glass panes;

One Bedford: Installation is now underway of the replacement of all the tempered glass with laminated glass panes;

326 King Street West (TIFF Building): Installation is now underway of the replacement of all the tempered glass with laminated glass panes and modifications to the railing to include edge protection to the top of the glazing;

620 Dundas Street East (Regent Park): Tempered glass panels were removed from Block 14 to undergo a heat soaking test. During two cycles of heat soaking no glass breakage occurred. Engineering review of balcony installation identified design or installation issues that required remediation. Minor deficiencies and areas of glass to metal contact were remediated and there have been no further failures to date.

Further Incidents of Glass Failure

As a result of the glass balcony panel failures last summer, Toronto Building staff developed a response protocol. Under the protocol, when there is glass balcony panel failure, Toronto Building requires a Professional Engineer to assess the level of risk and determine the appropriate remedy. The City may also require that the building owner undertake further testing, depending on the assessed level of risk. While there have been several panel failures since last summer, none of these recent incidents have required this level of testing.

Incidents of other building envelope failures have been linked to the issues associated with the glass balcony issue. However, none of those identified are related to the failure of glass balconies, as they are different types of glass and use different installation designs and approaches. To date, they all have been linked to some form of external damage.

COMMENTS

Building Code Amendments/Expert Advisory Panel Glass Panels in Balcony Guards

In response to requests from the City of Toronto and RESCON (Residential Construction Council of Central Ontario), the Ministry of Municipal Affairs and Housing established the "Expert Panel on Glass Panels in Balcony Guards". The Panel was given the mandate to provide the Ministry with recommendations on whether and how the building code might be amended to address the issue of balcony glass breakage and public safety.

Recognizing the inherent properties of glass, the panel developed a number of recommendations for building code amendments intended to reduce the probability of glass panel breakage and injury to people within the vicinity of a building where an incident of broken glass has occurred.

Toronto Building staff (along with staff from Mississauga and Markham) participated on the Panel representing the interests of municipalities. Twenty-three additional stakeholders participated in the panel, including: Professional Engineers, building code experts, insurance providers (Tarion Warranty Corporation, ProDemnity); developers (BILD) and codes and standards organizations (National Building Code and the Canadian Standards Association).

The Panel met for four sessions in early 2012 to discuss potential building code amendments and associated matters. Through these discussions the panel developed a series of recommendations to the Ministry on how the building code should be amended to provide additional prescriptive requirements for all glass in both interior and exterior guards in buildings. The Panel recommended that the building code specify the type of glazing that must be used, depending on the design of the balcony guard and the distance of the guard from the edge of the balcony floor. For example, in "outboard" glazing where the glass is beyond the edge of the balcony floor, the panel recommended that heat strengthened laminated glass be used and that it be designed, fabricated and erected to be retained in place at the time of failure.

As the Ontario Building Code is written in an objective based format, it is also expected that any prescriptive requirements would not preclude a designer from using an alternative solution if the intent of the building code requirements are met.

At the time of writing of this report, the Ministry of Municipal Affairs and Housing is still considering the recommendations of the Expert Advisory Panel on Glass Panels in Balcony Guards. The Province has not conveyed how it may proceed with any building code amendments.

This report recommends that Council encourage the Province to enact clear, prescriptive emergency interim amendments to the building code, in keeping with the recommendations of the Expert Advisory Panel on Glass Panels in Balcony Guards to minimize the risk to public safety from falling glass as the result of glass balcony failure.

Wind Load

In 2006, the building code included amendments to the prescribed requirements for loads on balcony guards. These changes applied additional requirements for the structural design of buildings. Loads specified under Part 4 require that load combinations be considered so that both the factored live load and the factored wind load must be considered to act together. The live load is provided in Ontario Building Code 4.1.5.15.

The wind load is site specific and is based on building size conditions and location in Ontario. Table 4.1.3.2. contains the five load combinations used by designers for their calculations.

Wind load design emerged as a parallel matter during the City's analysis of the glass panel balcony failures.

Some lack of clarity in the applicability of the load factors relevant to balcony guard design emerged in the review of the balcony failures in Toronto. Some confusion and inconsistency in design practices were identified.

Part of the difference in designers' approaches may be the result of the further reference in the building code to the load factors of the CAN/CGSB-12.20-M(89) standard "Structural Design of Glass for Buildings" and the Code requirements of 4.1.3.2. The load factors in the CAN/CGSB 12.20 standard were derived from the 1986 Ontario Building Code/1985 National Building Code and are not the same as those specified in the 2006 Code and if used would result in lesser design loads.

If designers conducted their analysis to CAN/CGSB 12.20 rather than to the 2006 Ontario Building Code 4.17 and 4.1.3.2., the design of guards may meet the CAN/CGSB requirements but not the wind load requirements of the building code, although both procedures are referenced in Part 4 of the building code.

It was the opinion of the City's consulting Professional Engineer that the building code requirements have not been interpreted the same way by all users, including whether guards are "structural components" as referenced by Ontario Building Code 4.1.3.2.(1) and how the design coefficients and factors are to be incorporated into the guard loads.

The Professional Engineer's report also noted that in addition to the calculation of the design load, there can be additional variance from the building code requirements in the determination of the distribution of wind loads on the building using the boundary layer wind tunnel for pressure wind modelling. This is an alternative design method permitted by the building code.

Isolated areas such as building extremities and unusual geometries may result in site-specific wind load that exceeds loads calculated in accordance with Table 4.1.3.2. Using this methodology a site-specific wind study would be completed. This is becoming more common for larger buildings in the downtown core. On the other hand, such studies may find that building code calculated loads can be reduced for substantial areas of the wall.

In an urban setting such as Toronto, when a building is completed, the surrounding area may be developed in such a way as to make the initial wind study obsolete within a short time-frame.

In considering the November 3, 2012 report from the Chief Building Official, Planning and Growth Management Committee requested that she re-evaluate wind tunnel

standards and criteria and report on changes to improve modelling and application standards. This is a matter in which the City does not have authority to set standards.

Notwithstanding some disagreement on interpretation, none of the Professional Engineers' reports submitted to the City (and reviewed by the City's independent Professional Engineer) determined that wind load design was a direct cause of glass breakage in any of the buildings. Nevertheless, there is some agreement that clarification is required in the building code for determining the structural design of guards is necessary to remove confusion on the matter among designers.

This issue was discussed at length during the Expert Panel's discussions. At the request of the Panel, the National Research Council's Technical Advisor, Standing Committee on Structural Design provided a memorandum clarifying the intent of the building code and whether or not the live load should be considered in combination with the wind load. The memorandum clarified that the live load needs to be considered in combination with the wind load and confirmed that "structural components" in Ontario Building Code 4.1.3.2.(1) were intended to include guard elements.

The Expert Panel determined that a building code amendment to clarify the appropriate procedures for the structural design of guards currently prescribed in the building code is necessary. The Panel provided this request to the Ministry of Municipal Affairs and Housing.

Review of Options: Inspection and Maintenance of Glass Balcony Guards on Existing Buildings

Toronto Building, in consultation with Legal Services, has reviewed regulatory approaches to address public safety concerns with glass balcony guards on existing buildings. In the United States, a number of cities have building façade maintenance programs. These programs are not specific to balcony guards, but require routine inspection and maintenance of exterior walls, cornices and other projections from buildings five or six storeys and higher. There is no clear authority in the *Building Code Act, 1992* in Ontario for the City to establish a pro-active building envelope inspection and maintenance program. The options set out below were also considered by staff.

Property Standards

The Property Standards By-law requires that buildings and structures be maintained or improved on an ongoing basis, to standards set out in the By-law. Property standards provide that property not complying with the standards be repaired and maintained. Property standards legislation contained in the *Building Code Act, 1992*, however, does not provide authority to require pro-active investigations to determine if a public safety risk exists with glass balcony guards. The inspection of a glass balcony guard to determine if further testing is required is more appropriately undertaken by a Professional Engineer, within the context of building code design requirements.

Building Code Act: Unsafe Orders

Legal staff have also advised that there is no clear authority to rely on the power to issue unsafe orders under the *Building Code Act, 1992* on existing buildings, where no apparent unsafe condition is present in order to require that property owners engage a Professional Engineer for assessing the risks posed by individual balcony designs, conducting testing where appropriate and (possibly) recommending replacement of balcony guard systems.

Building Code Act/Building Code Amendments: Mandatory and Discretionary Programs

Under the *Building Code Act, 1992* the building code regulates the construction, operation and maintenance of most small capacity on-site sewage treatment systems (septic systems), as the only building type for which the Province has established the authority for both mandatory and discretionary maintenance and inspection programs. Mandatory programs have been established in certain areas of the Province (e.g., within 100 metres of the Lake Simcoe shoreline and in parts of "vulnerable areas" within source protection areas).

If the Province wished to enact a mandatory maintenance and inspection program for glass balcony guards, an amendment to the *Building Code Act, 1992* would be required, similar to the statutory authority requiring septic system re-inspections. A provincially mandated program could require building owners to have an inspection undertaken on their buildings in order to determine whether or not an unsafe condition exists. Upon receiving information from the building owners, the City could then determine whether an immediate "order to comply" is required. A program of this nature would place the obligation on the owner to undertake the investigation and actions that they should be undertaking as part of building envelope maintenance. This could be specifically targeted to balcony guards or more broadly focused.

The Province could also choose to amend the building code to provide the City with discretionary authority to develop and administer a re-inspection program should Council decide to do so. Responsibility for the establishment, administration and enforcement would rest with the City.

Should either a mandatory requirement or discretionary authority be available, a glass balcony guard re-inspection and program would require considerable staff effort to require rather than encourage investigations. Careful consideration should be given to whether Council wishes to pursue statutory authorities in this area, as there may be broad implications as this authority with respect to existing buildings apply only to septic systems today. To determine whether one of these approaches is appropriate for glass balcony guards, further discussions with the Province and affected stakeholders are necessary.

Targeted Communications Program to Building Owners

In the absence of statutory authority to establish a pro-active inspection and maintenance program of glass balcony guards, Toronto Building is preparing to proceed with a targeted communication program aimed at certain building owners. Staff are developing a database of all buildings constructed in Toronto since 2007 with glass panel balcony guards that share certain similarities to those that recently failed. The purpose of the program will be to advise these building owners that while glass balcony guard panels are acceptable under the building code and that building and occupancy permits were properly issued, recent experience has shown that these building elements may present potential risks. In light of these potential issues, Toronto Building (in consultation with Legal Services) will be advising building owners of some actions they may want to undertake, such as engaging a professional engineer to conduct a risk assessment to determine whether further testing is necessary, potentially leading to replacement of balcony systems in some cases.

Next Steps

Toronto Building will continue and is required to issue building permits where the application complies with the *Building Code Act, 1992*, the building code and all applicable law, as prescribed by the *Building Code Act, 1992*. Toronto Building continues to assess applications based on the current building code requirements. Non-compliance with building code requirements was not identified as a causal factor in the failure of balcony guards to date.

There is significant interest from the City and other stakeholders on if and how the Province may proceed with any building code amendments. This report recommends that Council request that the Province move expeditiously with an emergency building code amendment to improve public safety in the event of glass balcony panel failure. In the meantime, Toronto Building will develop a database of existing buildings with glass paneled balcony guards and develop a targeted communications strategy to advise owners of options for inspection and maintenance of the guards.

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