

NEW HOUSES vs. OLD DESIGN PROVISIONS

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THOUSANDS OF SMALL HOUSES are being built in our municipal areas every year. Obviously, the safety and stability of these small buildings are of paramount concern.

Part 9 of the National Building Code of Canada (NBCC) (www.nationalcodes.nrc.gc.ca/eng/nbc/), provides a prescriptive design solution for small wood-frame buildings within its limitation. Part 9 is derived from a combination of calculated designs and solutions based on performance history. It is developed as a simple reference, which allows a designer to practise building design within the limitations without the assistance of an architect or engineer.

LATERAL RESISTANCE

The lateral resistance of wood-frame buildings is an important issue in their safety and stability. Part 9 does not adequately address the lateral resistance of these buildings, however. The Ontario Building Code (OBC) (www.e-laws.gov.on.ca/html/regs/english/elaws_regs_060350_e.htm), in its proposed 2010 revision A-9.4.1.1(3), pointed out that “the only explicit treatment of structural loads in section 9.4 is for gravity loads; wind and earthquake loads are dealt with implicitly in the body of part 9 and are not used as inputs to any of the span tables,” and it also confirms that “Part 9 buildings are not exempt from having to comply with the wind and earthquake loading requirements of Part 4.” This important amendment was not included in the final version of the new 2012 OBC.

The Canadian Wood Council’s (CWC) *Engineering Guide for Wood Frame Construction* (<http://webstore.cwc.ca/technical-books/egwf09e-engineering-guide-for-wood-frame-construction-2009>) also states that “many wood frame buildings based only on the part 9 prescriptive requirements would appear to be inadequate for resisting lateral loads; however, performance history indicates that this is not the case.” It appears that the lateral resistance of a building relies on shear resistance of a minimum length of exterior walls and the contribution of non-structural elements, such as interior finishes, exterior cladding and non-load-bearing partitions.

The CWC guide also addresses the structural requirements for buildings designed under part 9. Even though the guide is used as a complement to part 9, in most cases, it can’t help non-engineer designers to go further than the prescriptive method, which completely relies on the historical performance of “prototype” field-tested buildings in terms of lateral resistance and stability of traditional wood-frame buildings.

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CWC Engineering Guide for Wood Frame Construction

MODERN DESIGNS

New developments in building materials, such as engineered woods, have reduced the restriction and limitation of designs in matters of span, supporting area, building height and area of openings. These lessened restrictions have also changed the demands of designers and house owners significantly. Modern houses in Canada do not resemble traditional wood-frame houses. The CWC guide’s 2009 edition states that “some wood frame buildings covered by part 9 differ sufficiently from norm that they cannot be counted on to demonstrate

similar performance if their design is based only on the prescriptive provisions of part 9.” Modern houses have fewer interior partitions and are taller than traditional houses. They are often built on narrower lots with more critical height over width ratio than before. The historical performance of wood-frame houses can’t adequately ensure the stability and safety of these houses. This is an important clarification that has been recognized in many other provinces and in the National Building Code of Canada (NBCC) for many years.

The *Professional Engineers Act* gives PEO the authority to regulate the practice of professional engineering and govern its members in order “that the public interest may be served and protected.” PEO is generally expected to determine the standard of practice for Ontario engineers, especially when it is directly related to the health and safety of the public.

Every year, thousands of design proposals are submitted to the province’s building departments to obtain building permits for new buildings. Many of the new house designs have open plans with very few or no interior walls. Many of these buildings could be inadequate to resist lateral loads and may not comply with part 4 of the OBC or the CWC guide. They do not fit in the category of traditional wood-frame houses, although they have performed well during the past few decades despite the fact that their stability analysis does not correspond to part 4 of the building code.

SAFEGUARDS LACKING

There are insufficiencies in part 9 of OBC that have been recognized by different professional associations, such as the Professional Engineers and Geoscientists of BC, the NBCC and the CWC guide. In the past few years, several proposals have been submitted for next editions of the OBC. Surprisingly, they were not included in the 2012 OBC despite the formal recognition of the arguments and despite having any experimental results that apply to new house designs.

The *Guidelines for Professional Structural Engineering Services for Part 9 Buildings in British Columbia* Version 2.0 (https://www.apeg.bc.ca/getmedia/f0fca87d-c089-4c22-a45d-908f187b5076/APEGBC-Guidelines_for_Structural_Engineering_Services_for_Part_9_Buildings.pdf.aspx) requires APEGBC members to evaluate and mitigate the vulnerability of the primary structural system to lateral loads. The guidelines state: “in fact, if only the prescriptive provisions are followed, a modern-style Part 9 building in a high-hazard region (wind or seismic) will likely have compromised sway resistance due to open layouts with few if any interior walls and/or exterior walls very significantly interrupted by many large windows or doors.”

Despite all the evidence, part 9 of the OBC is still lacking in provisions to safeguard many of the modern open-plan-design buildings against lateral forces. More importantly, the mechanism for detecting dangerous designs is not in place. House designers are very often non-engineers. In Ontario, the designers who have obtained Building Code Identification

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Number (BCIN) certification can design a house within the limitations of part 9. They are clearly not engineers and not able to consider the possible need for lateral resistance provisions beyond part 9. The same situation exists in the building departments where non-engineers examine the engineering requirements of modern house design.

CONVERSATION NEEDED

We propose a dialog within the engineering community to discuss and suggest necessary changes to the OBC relating to the areas discussed. We also feel strongly in identifying the engineering elements of building design in part 9 of the OBC, which should be designed and controlled by engineers.

We feel that PEO is taking the appropriate measures in the case of the Elliot Lake building collapse. PEO has suggested that the OBC be amended to reference “structural adequacy reports.” It is obvious that PEO will make its best effort to make sure our buildings and their occupants are safe, regardless of the size of the buildings. Σ

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