
BULLETIN 2001-011-BU

APRIL 19, 2007

SEISMIC DESIGN OF ONE & TWO FAMILY DWELLINGS

With the adoption of the 2007 Vancouver Building By-law, engineered seismic design to Part 4 of the By-law was extended to be applied to all wood frame buildings other than one and two family dwellings. One and two family dwellings have been exempt from the engineered design provisions of Part 4 where they are constructed of relatively close spaced timber framing elements with moderate spans (<12.2 m) and light loadings (<2.4 kPa) in accordance with the prescriptive design provisions of Part 9. This exemption under Part 9 is based largely on the past performance of wood frame housing in earthquakes (Alaska 1964, San Fernando 1971, Edgcombe 1987, Loma Prieta 1989, Northridge 1994). It also recognizes the significant contribution to lateral resistance of load sharing, non-structural elements, and the continuity and redundancy of load paths in wood frame housing.

With current trends in modern house construction away from the more traditional design forms, many of the assumptions on which Part 9 of Division B is based may no longer be valid. The Building By-law is based on the National Building Code (NBC) which is a national document covering a wide geographic area. Much of this area is of low seismicity, unlike southwestern British Columbia which is at a high risk of earthquakes. There is also a clear trend to larger homes in the City. Currently many new single family dwellings are large homes, incorporating a variety of long span structural systems such as wood joists, laminated veneer lumber, parallel strand lumber, and other proprietary products.

In requiring structural drawings for wood frame housing to be sealed by a registered professional engineer, the City expects engineering judgement and professionalism to be applied to the design. It is the stated intent of the current By-law that Part 9 of Division B buildings be capable of resisting wind and earthquake loadings. This may not be the case for Part 9 houses which contain large span framing systems, weak first storeys, large areas of glazing with few interior partitions, unbraced pony walls, etc. To quote from the Appendix to the By-law:

A-9.4 “... Thus Part 9 buildings are not exempt from having to comply with the wind and earthquake loading requirements of Part 4. In many cases these considerations can safely be ignored, but in certain configurations, the building’s resistance to wind and earthquake loadings must be carefully considered.”

While at first glance this note may appear inconsistent with the By-law, it states a clear objective of the By-law that small wood frame buildings be capable of resisting wind and earthquake loading. The By-law does not relax the seismic design for wood frame housing. It leaves the evaluation of the seismic performance of the structure to the designer, and clearly requires that the ability of the building to resist earthquake forces be given an initial assessment to determine whether further analysis is required.

Until relatively recently, there has been no Canadian design guide which deals with this issue, and neither the By-law nor the related appendix note makes it clear where lateral load resistance analysis may or may not be required. In the past, some designers have looked to US standards, such as the BOCA One and Two Family Dwelling Code or the Uniform Building Code for guidance. However, the Canadian Wood Council has recently prepared a revised wood Frame Construction Guide which contains practical design guidelines for the seismic design of wood frame buildings.

The objective of the Canadian Wood Council Guide is:

“... to provide acceptable design solutions for wood elements and connections in small buildings that are 3 storeys or less in building height, 600 m² or less in building area, and are constructed using repetitive wood framing.”

Designers are recommended to follow this relatively simple prescriptive guide which sets out a clear methodology for evaluating wood frame buildings for earthquake resistance. It includes simple prescriptive recommendations for designing a wood frame structure where design to Part 4 is not warranted. It also accounts for the different seismic zones in Canada.

Accordingly, the City will look to Professional Engineers executing a Schedule B-1 Letter of Assurance for structural adequacy to confirm that the design has been reviewed and found to be adequate to resist wind and earthquake loading in accordance with the intent of Section 9.4 of the By-law, as further clarified under Appendix note A-9.4. In addition, removal of the reference to seismic design on the Schedule B-2 will not be permitted.

Commencing October 1, 2001, Professional Engineers will be requested to explicitly acknowledge that they have reviewed the seismic aspects of one and two family dwellings by placing the following statement on the design drawings, which has been endorsed by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC):

The undersigned hereby gives assurance that the design of this structure has been reviewed for resistance to wind and earthquake loadings and has been found to substantially comply with Section 9.4 of the VBBL as described under the referenced note A-9.4 and City of Vancouver Bulletin 2001-011-BU.

Signed: _____ Date _____

Conformance to the Canadian Wood Council Frame Construction Guide or other acceptable methodology will be considered as meeting the objectives of the By-law. Designers are also reminded that the By-law requires that the structural framing of all Part 9 building other than one and two family dwellings be designed to Part 4.

Signed by
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