BULLETIN 2003-001-AD/BU **APRIL 19, 2007**
(Revised)

GUIDELINES FOR SEISMIC EVALUATION OF ONE & TWO FAMILY DWELLINGS

This bulletin should be read in conjunction with Bulletin 2001-011-BU, "Seismic Design of One & Two Family Dwellings", dated April 19, 2007 and the "Engineering Guide for Wood Frame Construction," published by the Canadian Wood Council.

INTRODUCTION

The Vancouver Building By-law (VBBL) exempts one and two family dwellings from the engineering design provisions of Part 4 of Division B where they are constructed in accordance with the prescriptive design limits of Part 9 of Division B. This exemption recognizes the significant contribution to lateral resistance of load sharing non-structural elements and the redundancy of load paths in traditional wood frame housing.

With current trends in modern house construction moving away from more traditional design forms (e.g., use of large span framing systems, larger areas of glazing, and open floor areas with fewer interior partitions), many of the assumptions on which Part 9 is based, may no longer be valid. However, it is the stated intent of the By-law that Part 9 buildings be capable of resisting wind and earthquake loading. (For further information, please refer to Bulletin 2001-011-BU)

GUIDELINES

The intent of these guidelines is to provide a step by step decision making tool, which will assist designers to identify which of the following three categories are applicable and to determine the appropriate lateral design methodology for a particular building:

a) Projects which are deemed to satisfy lateral load requirements under Part 9 and which do not require further review (See Step 1),
b) Projects which include additional design factors which may require structural solutions beyond Part 9, but still fall within the Part 9 classification (See Step 2), and
c) Projects which, because of their design characteristics and/or structural complexity, must be designed entirely under Part 4. (See Step 3).

The City's guidelines are based on the Canadian Wood Council (CWC) publication,"Engineering Guide for Wood Frame Construction", 2004. This guide uses the idea of "Braced Wall Panels" and "Braced Wall Lines" to assess the structural redundancy of a building. Although not referenced in the National Building Code of Canada, the CWC Guide is now considered as a national standard for small wood frame buildings, particularly with regard to determining when additional lateral design is required.

Braced Wall Panels - are sections of walls constructed such that they provide some resistance to lateral loads.

City Hall 453 West 12th Avenue Vancouver BC V5Y 1V4 vancouver.ca
Office of the Chief Building Official tel: 604.873.7515 fax: 604.873.7100

Braced Wall Lines - consist of a number of Braced Wall Panels used in combination within prescribed limits of the CWC Guide.

The basic design principle is that, when braced wall panels have adequate strength and spacing for the load conditions, there is sufficient redundancy built into the system and the lateral design requirements will be satisfied. Roof and floor structures are required to be sheathed with sufficient strength and rigidity to act as diaphragms. This calls for panel-type sheathing or diagonal continuous lumber sheathing.

Note: The CWC Guide, Page B-4, shows the maximum spacing between Braced Wall Lines for specific lateral loads within the limits of the above three categories.

PROCEDURE

The applicable lateral load design methodology may be determined as follows:

STEP 1 - One & Two Family Dwellings Deemed to Meet Part 9 Provisions Without Further Review

1.1 Confirm that the following basic conditions of Part 9 have been met:

- The building is a one or two family dwelling.
- The building area does not exceed 600 m^2.
- The building height does not exceed 3 storeys.
- Wood system members (e.g., joists and studs) are spaced no more than 600 mm o.c.
- The clear span of wood members is not greater than 12.2 m.
- The design live load for floors is not greater than 2.4 kPa.

Note: Except for 1 and 2 family dwellings having a building area not more than 600 m^2 and/or a building height not more than 3 storeys, all Part 9 buildings must meet the requirements of Part 4. Please refer to Sentence 1.3.3.2.(2) of Division A of the VBBL.

1.2 Confirm that there is sufficient length of braced wall panels (i.e., built in redundancy) in the plan to meet the lateral design requirements. The following conditions should be met: (Please refer to Page B-5 of the CWC Guide.)

- The perpendicular distance between braced wall lines must not be greater than 7.6 m.
- The offset of any braced wall panel within the braced wall line must not be more than 1.2 m.
- The distance of any braced wall panel from the corner of the building must not be more than 2.4 m.
- The centre to centre spacing of braced wall panels along the braced wall line must not be more than 7.6 m.
- The minimum length of any braced wall panel must not be less than 1.2 m.

1.3 Confirm that the lateral load limitations for the exterior walls have not been exceeded. Please refer to Page B-7 of the CWC Guide.

1.4 Confirm that all exterior and interior braced walls are supported on continuous foundations, except as noted on Page B-5 of the CWC Guide.

1.5 Confirm that the height of any knee wall (cripple wall) is not more than 1.2 m.

If the structure meets the above requirements, it is deemed to satisfy the lateral load provisions of Part 9 and no further action is required. It is anticipated that the majority of 1 & 2 family dwellings will meet these requirements. If the above noted conditions are not satisfied, proceed to STEP 2.

STEP 2 - Design by a Registered Professional to Section C of the CWC Guide

Section C describes a modified methodology for the lateral load design of Part 9 wood frame buildings. While this methodology exhibits some redundancy, it is not deemed to meet the intent of Part 9 (as described in Section B of the CWC Guide) without some quantitative assessment of the effect of lateral loads on the building.

Section C of the CWC Guide may be applied under the following conditions:

- The building is a one or two family dwelling within the limitations of Part 9.
- The clear span of wood members is not greater than 12.2 m.
- The specified live load for the main floor may exceed the 2.4 kPa limit of Part 9 provided the live load does not exceed 4.8 kPa.
- There is not sufficient redundancy in the design plan to meet the lateral design requirements of Section B of the CWC Guide.
- The roof slope does not exceed 45^{o}.
- The clear span of arched members is not more than 6 m.

If the above conditions have been met within the limits of the CWC Guide, the intent of the By-law is deemed to have been met. For all other cases, proceed to STEP 3.

STEP 3 - Design by a Professional Engineer to Part 4 of the Vancouver Building By-law

Wind and earthquake design is required to be carried out by a Professional Engineer in accordance with Part 4 of the Vancouver Building By-law where the conditions of Step 1 and 2 are not satisfied.

D. H. Jackson, P.Eng.
CHIEF BUILDING OFFICIAL

W. M. Johnston, P.Eng
DEPUTY CHIEF BUILDING OFFICIAL