The Association of Professional Engineers and Geoscientists of BC

# Guidelines for
# **Professional Structural Engineering Services for Part 9 Buildings in British Columbia**

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# PREFACE

The APEGBC *Guidelines for Professional Structural Engineering Services for Part 9 Buildings in British Columbia* were prepared by the Executive of the Division of Structural Engineers (DSE)[1], a Division of the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC). The DSE advises the Council of APEGBC on matters related to the practice of structural engineering in British Columbia.

The Building Codes Committee and the Consulting Practice Committee of APEGBC also provided input to these guidelines, which were adopted by APEGBC's Council. APEGBC is committed to maintaining the high quality of services *members* provide to their *clients* and the public. *Members* are professionally accountable for their work under the *Engineers and Geoscientists Act*, which is enforced by APEGBC.

The intent of the Guidelines is to establish standards of practice that *members* should follow to fulfill their professional obligations, especially in regard to their primary duties to protect the safety, health and welfare of the public; to protect the environment; and to promote health and safety within the workplace. Failure to meet the intent of these guidelines could be evidence of unprofessional conduct and lead to disciplinary proceedings by APEGBC.

APEGBC supports the principle that *members* should receive fair and adequate compensation for professional services, including the services provided to comply with these guidelines. Low fees are not a justification for services that do not meet the standards set out in these guidelines. *Members* may wish to discuss these guidelines with their *clients* when receiving instructions for scope of services and reaching agreements regarding compensation.

1 *On January 3, 2008, the DSE was formally dissolved to facilitate the formation of the Structural Engineers Association of British Columbia (SEABC). The Professional Practice Committee (PPC) of SEABC continues the function of the DSE through liaison with APEGBC on professional practice issues.*


# DEFINITIONS

The following definitions are specific to the *Guidelines for Structural Engineering Services for Part 9 Buildings*.

## *Authority Having Jurisdiction (AHJ)*

The government body (usually municipal) with authority to administer and enforce the *British Columbia Building Code* (*BCBC)* or the local building by-law.

## *Building Code*

Is defined as the *British Columbia Building Code* (BCBC), *Vancouver Building Bylaw* (VBBL) or the *National Building Code of Canada* (NBC).

## *Client*

The party who owns the building or is formally acting as the owner's representative.

## *Coordinating Registered Professional*

Coordinates the design documents and field reviews of all applicable registered professionals for the duration of the project and coordinates the submission of the *LOAs* of the various registered professionals. The *Coordinating Registered Professional* could be an architect or an engineer.

## *Letters of Assurance (LOA)*

Administrative forms required by Division C Part 2 of the applicable *Building Code* before permits are issued. The forms certify to the *Authority Having Jurisdiction* that appropriate professionals have been retained and that engineering calculations have been performed in accordance with Part 4 – structural design (where required).

## *Member*

A *Member* in good standing of the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC).

## *Part 9 Buildings*

Buildings which fall under the definition of Part 9 as identified in the applicable *Building Code.*

## *Primary Structural System*

The combination of elements which support the building's self weight and the applicable live load based on occupancy, use of the space and environmental loads such as wind, snow and seismic forces.

## *Secondary Structural Elements*

Elements that are structurally significant for the function they serve but do not contribute to the overall strength or stability of the *primary structural system*. Examples of *secondary structural elements* are: prefabricated glazing systems, cladding, and seismic restraints for architectural, mechanical and electrical elements.


## *Specialty Structural Elements*

Structural elements which are designed by the specialty structural engineer. These elements, normally fabricated off-site, may require specialized fabrication equipment or a proprietary fabrication process not usually available at the job site (for example open web steel joists, wood trusses, combination wood and metal or plywood joists, precast concrete elements, and other prefabricated structural components).

## *Structural Engineer*

A *Member* who is responsible for the design, structural integrity, and preparation of documents for a particular *secondary structural element* and/or a *specialty structural element*. There may be several *structural engineers* working on a *Part 9 Building* but only one *SER.*

## *Structural Engineer of Record (SER)*

The *Member* with responsibility for the structural integrity of the *primary structural system* and for substantial conformance of the *secondary structural elements* and *specialty structural elements* with the *primary structural system* and for evaluating the effects of *secondary structural elements* on the *primary structural system*.


# 1.0 INTRODUCTION

These guidelines apply to the practice of structural engineering for buildings, or parts of buildings or renovations to existing buildings, governed by Part 9 of the *Building Code*. Considerations which municipalities or *Authorities Having Jurisdiction* may have in relation to the practice of *members* are also discussed. The guidelines set out the general standards of professional practice that *members* should follow.

*Members* must exercise professional judgment when providing professional services; as such, the application of the guidelines can vary depending on the circumstances. The guidelines may be used to assist *members* in establishing the scope of services and the contract terms with their *clients*.

## 1.1 Key Issues for *Part 9 Buildings*

The three key issues that should not be overlooked in the design of *Part 9 Buildings* are:

- The potential lack of a design for wind or earthquake loads. Conformance to the prescriptive provisions of Part 9 of the Building Code does not guarantee that a *Part 9 Building* will be able to resist wind or earthquake loads (BCBC 2006 – Division B, Appendix A, Clause A-9.4.1.1.(3), CWC Guide 2004). 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. The inherent weakening effect of these non-traditional features may need to be mitigated by explicit design for lateral loads.

- In most new *Part 9 Buildings*, some components need to be designed to Part 4 of the Building Code. These components need to be properly supported and integrated into the overall building. Whenever any component design to Part 4 is required, the *Authority Having Jurisdiction* may require *Letters of Assurance (LOA)* along with the application for a building permit (per Division C Part 2 of BCBC 2006).

  The problem is that the component designer may not be able to provide the LOA if he or she is not also designing the structural support and integration of the components into the overall building. The latter function is normally performed by an *SER*. However, the owner or developer may not have engaged an *SER* on the basis that current provincial legislation does not require an *SER* for *Part 9 Buildings*.

  The initial lack of an *SER* could lead to (a) issues concerning the support and integration of the Part 4 components into the overall building, (b) delays in the application for a building permit pending the appointment of an *SER* to sign the *LOA*, and, (c) potential late changes to the design of the building.

- The *Building Code* requires that an existing building should not be weakened by renovations or additions. However, the lateral load resistance of a building may be affected by increasing the size of the openings in the floors, walls or roof elements as part of a renovation or addition. The net effect may be difficult to evaluate for a *Part 9 Building* since there may not have been any explicit lateral load design for the existing building.

## 1.2 Permitting Requirements for *Part 9 Buildings*

The permitting requirements for *Part 9 Buildings* may vary significantly from one *Authority Having Jurisdiction* to the next. These variations may relate to some of the above issues, and:

(a) The variation in seismic or wind hazards across the province.

(b) The fact that the *Letters of Assurance* for structural design are preferably provided by the *SER.*

It is recommended that *members* check with the *Authority Having Jurisdiction* for the latest requirements before starting work on a *Part 9 Building* project. Some municipalities may in fact always require the engagement of an *SER*.

## 1.3 Design in Accordance With Good Engineering Practice

*Members* of APEGBC are required to design in accordance with good engineering practice. In terms of *Part 9 Buildings*, this means that the vulnerability of the *primary structural system* to lateral loads should be evaluated and mitigated as necessary. In the case of wood frame structures, the *Engineering Guide for Wood Frame Construction* (*CWC Guide 2004*) is now specifically referenced as good engineering practice in the latest codes (*NBCC 2005* and *BCBC 2006* - Part 9 and Division B, Appendix A, Clause A-9.4.1.1.(3). Further details are given in this guideline and in the City of Vancouver Bulletins 2001-011-BU and 2003-001-AD/BU revised April 19, 2007.


# 2.0 MEMBER QUALIFICATIONS AND RESPONSIBILITIES

## 2.1 Qualifications

The Code of Ethics of APEGBC states that *members* and licensees shall*:*

> *"undertake and accept responsibility for professional assignments only when qualified by training or experience;"*

It is APEGBC's position that a *member* or licensee who has suitable training or experience in this field of practice is appropriately qualified for the services covered in these guidelines. A *member* or licensee with the *Structural Engineer* (Struct.Eng.) designation is not required for the services covered in these guidelines.

## 2.2 Structural Design of New Buildings and *Letters of Assurance*

*Members* may be involved in the structural design of *Part 9 Buildings* in two different ways:

(a) As a *structural engineer* designing a *secondary structural element*, a *specialty structural element*[2] (e.g., roof trusses), or, an independent part of the building not covered by the prescriptive requirements of *Part 9 Buildings* (as required by the *Building Code*).

(b) As the *SER* responsible for the *primary structural system.* Note that current provincial legislation does not mandate the engagement of a *SER* for *Part 9 Buildings*. However, an *SER* is often required to provide the appropriate *LOA's*.

Even if there are several *members* working on different Part 4 components of a *Part 9 Building* this does not automatically mean that one of them is acting as the *SER*. This can be problematic. The lack of an *SER* could contribute to a lack of clarity concerning professional responsibilities as follows:

### 2.2.1 Situation with an *SER* Formally Engaged on the Project

- The *SER* coordinates the design of the various Part 4 *specialty structural elements* to make sure that they are designed consistently.
- Each of the designers of the Part 4 *specialty structural elements* would normally submit APEGBC's Schedule S (APEGBC 2005) to the *SER.*
- The *SER* would review the shop drawings for the *secondary structural elements* and the *specialty structural elements* to make sure that they are properly accommodated into the *primary structural system* and to make sure that there is a complete load path to the foundation.

2 *Note: Some pre-engineered specialty components such as manufactured beams may not require design by a Structural Engineer provided that the design is covered by manufacturer's literature as referenced in the product evaluation report prepared by the Canadian Construction Material Centre.*

- The *SER* would sign and seal the *LOAs* to the *Authority Having Jurisdiction* (Note: In this case, the procedure for *Part 9 Buildings* is the same as for Part 3 buildings).

- Scopes of work and professional responsibilities are clear. The *SER* works with the specialty designers to establish the site-specific loads and design criteria and coordinates with the specialty designers to achieve a *primary structural system* that meets acceptable engineering standards.

### 2.2.2 Situation Without an *SER* Formally Engaged on the Project

- There is no proper recipient for the Schedule S (Schedule S is a certification from a component designer to the engineer of record in the same discipline - in this case the *SER* (APEGBC 2005: Bulletin K).

- Schedule S is not a substitute for a *LOA* because Schedule S has no status in the *Building Code*.

- *Authorities Having Jurisdiction* may still require *LOA*s because they generally cannot take on the responsibility of checking that designs of buildings or components have been carried out in accordance with Part 4.

- In the absence of an *SER*, the designer of a Part 4 component may be asked by the *Authority Having Jurisdiction* to sign a *LOA* instead of a Schedule S.

- The designer of the Part 4 component may not be able to sign a *LOA* on the basis that this would require a significant change to his or her scope of work. Note that as a rule, no changes of the wording on the *LOAs* are permitted (APEGBC 2005: Bulletin K). As a result, a *structural engineer* signing a *LOA* generally has to sign for anchorage and seismic restraint.

- There may be a delay in the processing of the building permit due to the issues concerning (a) whether *LOAs* are required, and, (b) who can justifiably sign such letters.

- The *Authority Having Jurisdiction* may delay the issuance of an occupancy permit upon completion of construction due to the lack of a *LOA* from the *SER*.

- If there is no *SER*, no *LOA* and no Schedule S, there is an increased risk that some aspects of the structural design may be overlooked.

### 2.2.3 Should Designers of Part 4 Components Sign *Letters of Assurance*?

The question arises as to whether one of the designers of the Part 4 components should at some stage review the drawings for the overall structure, or for the support of the component, thus performing some or all of the functions of an *SER* as a prelude to signing *LOAs*. However, if the drawings for the supporting structure are not formally part of a *member's* scope of work, then the


*member* does not have control over these drawings in terms of the final details etc. A significant change in scope may be required and a component designer may not wish to take on this extra scope. (e.g., on the basis that his or her scope of practice and expertise is limited to roof trusses and not the design of complete buildings.)

An engineer designing Part 4 components may refuse to sign *LOAs* on the basis that they are not the *SER*. APEGBC supports this position, because, in the absence of an *SER*, it is very difficult for an engineer to sign a *LOA* for the structural aspects of a Part 4 component without taking on some of the responsibilities of an *SER*.

### 2.2.4 Definition of Scope for New Buildings

*Members* taking on the *SER* function and signing *LOAs* for a new building should clearly identify their scope in their contacts and discussions with the c*lient*. They should also specify that they are obligated to design to good engineering practice with regard to wind and seismic design of the overall structure (see Section 3.1).

*Members* designing only Part 4 components should explicitly exclude the *SER* function from their scope of work. Further, in excluding the *SER* function, each component designer should recommend to the *Client* that an *SER* be engaged up front for at least three reasons:

(a) to make sure that the Part 4 structural components are properly supported and connected,

(b) to make sure that there are no administrative delays associated with the initial lack of an *SER* to sign *LOAs*, and,

(c) to avoid the possibility of unexpected changes to the design or layout of the building as may be dictated by an *SER* engaged at a later stage to review and take responsibility for the overall design.

## 2.3 Renovations or Additions

*Members* should be aware that the existing *Part 9 Building* may have been designed using only the prescriptive requirements of Part 9 and there may not have previously been *any* professional engineer taking responsibility for the *primary structural system*.

Once again, *members* should clearly define their scope of services to *clients* concerning the renovation or addition to avoid giving the impression that they are taking responsibility for the design of the overall structure unless that is their specific intention. Note that unless the renovation is extensive it may be difficult or impossible to certify the design of the existing structure due to coverings or finishes.

# 3.0 PROFESSIONAL PRACTICE FOR NEW AND EXISTING BUILDINGS

## 3.1 Wind or Earthquake Design for New Buildings

Historically, many *Part 9 Buildings* have been designed entirely using prescriptive requirements contained in Part 9 of the *Building Code*. These requirements provide pre-engineered solutions which do not require additional engineering calculations.

The prescriptive requirements are retained as an option in Division B, Part 9, Section 9.4.1.1. of the *BCBC 2006* which states that:

> *"1) Subject to the application limitations defined elsewhere in this Part, structural members and their connections shall*
>
> *a) conform to requirements provided elsewhere in this Part,*
>
> *b) be designed according to good engineering practice such as that provided in the "Engineering Guide for Wood Frame Construction," published by the Canadian Wood Council, or*
>
> *c) be designed according to Part 4 using the loads and deflection and vibration limits specified in*
> *i) Part 9, or*
> *ii) Part 4."*

The prescriptive requirements are referenced in Option 1(a) of Division B, Part 9, Section 9.4.1.1 above. These requirements consider only the appropriate sizing of building components for gravity loads and do not give any information on the overall ability of the structure to resist wind or seismic loads.

Therefore, if ***only*** Option 1 (a) is followed, a *Part 9 Building* in a high-hazard region may have the same layout and design as a building in a low-hazard region. This is problematic, and in fact, the *Building Code* (*BCBC 2006* - Division B, Appendix A, Clause A – 9.4.1.1.(3) does discuss the need to consider the lateral resistance of *Part 9 Buildings*. This section explains that:

> "*There is, therefore, a tendency to assume that wind and earthquake loads do not need any particular consideration in the design of Part 9 Buildings…*
> *...However, not all Part 9 Buildings have configurations or details that will provide adequate resistance to lateral loads.*
> *...For example newer houses may have few interior partitions and very large openings in the exterior walls. Mercantile buildings might be long and narrow with almost entirely windowed walls on the ends…*
> *…In such cases, wind and earthquake loads do have to be taken into consideration*."


*"The CWC Guide contains alternative solutions and provides information on the applicability of the Part 9 prescriptive structural requirements to further assist designers and building officials to identify the appropriate design approach…"*

### 3.1.1 Use of the Engineering Guide for Wood Frame Construction (*CWC Guide 2004*)

It is not good engineering practice to design *Part 9 Buildings* using only Option 1(a) of Division B, Part 9, Section 9.4.1.1 of the *BCBC 2006* without a rational evaluation as to whether the vulnerability due to the structural layout and the local wind or seismic hazard make this appropriate. A more detailed discussion of the issue of vulnerability is given in Appendix A at the end of this guideline.

The *CWC Guide 2004* referenced in Option 1(b) of Division B, Part 9, Section 9.4.1.1 of *BCBC 2006* is a key tool for evaluating whether or not the prescriptive requirements of Option 1(a) are adequate. If the *CWC Guide* evaluation shows that the prescriptive requirements are unlikely to be adequate then either:

(a) the layout should be modified as necessary; or

(b) the *SER* should perform explicit lateral load design per Options 1(b) or 1(c) (as required) in order to produce a *primary structural system* consistent with good structural engineering practice.

### 3.1.2 Effect of Geotechnical Conditions on Seismic Evaluations or Calculations

The evaluation charts in the *CWC Guide 2004* are based on the short period spectral acceleration Sa(0.2) without modification by the acceleration-based site coefficient Fa. Therefore, geotechnical information is not required for this evaluation as to whether or not the prescriptive requirements of the *Building Code* are likely to be adequate.

The acceleration-based site coefficients, Fa, are used to perform designs to Part 4. However, *Part 9 Buildings* are usually short-period structures and in regions of moderate to high seismic risk (where the use of Part 4 is more likely) it is generally possible to use a peak-of-the-spectrum approach without significant conservatism. That being the case, a geotechnical evaluation is frequently not required solely for the purpose of seismic calculations.

In addition, engineers must be familiar with the *Geotechnical Slope Stability Seismic Regulation M268* made pursuant to Section 692 (d) of the *Local Government Act*. This regulation applies to structural designs of *Part 9 Buildings* located on sites where slope stability could impact the structural integrity of a building from a life safety perspective.

The *Geotechnical Slope Stability (Seismic) Regulation* uses a 10% in 50 year seismic hazard probability level for slope stability assessment. For building sites where this regulation applies, engineers carrying out the structural design of a *Part 9 Building*, are to liaise with the professional engineer or professional geoscientist engaged to carry out the seismic slope stability assessment to ensure any relevant considerations are included in the structural design.

## 3.2 Design of Part 4 *Specialty Structural Elements*

The design of Part 4 specialty components for a *Part 9 Building* is generally no different from the design of Part 4 specialty components for a Part 3 building with the following exceptions:

- The load, deflection and vibration criteria may be reduced in accordance with Part 9, and
- If there is no *SER* initially engaged on the project, the designer of the Part 4 specialty component may have to deal with some additional coordination with *Clients*, *Authorities Having Jurisdiction*, and the designers of other Part 4 specialty components (see Section 2.2.2).

A specialty component designer should not convert his or her scope of work to that of an *SER* without due diligence. If no *SER* has been engaged previously, it is likely that the *primary structural system*, at that stage, has only conformed to the prescriptive requirements of Part 9. In that case, a *member* converting his or her scope of work may find that the layout/design does not meet the requirements for good engineering practice (see Section 3.1). This could mean that the *member* will need to make significant changes to the design or the layout.

## 3.3 Renovations and Additions

The existing building may have been designed using only the prescriptive requirements of Part 9. Nevertheless, there may be inherent lateral load resistance if the building uses a traditional wood frame layout (*CWC Guide 2004*). However, a major renovation or addition could significantly weaken or overload the very elements that give more traditional *Part 9 Buildings* their inherent resistance to wind or earthquake loads (e.g. uninterrupted walls, or floor or roof diaphragms).

Generally the renovation or addition should be designed to current standards and the modifications should not weaken the existing building. Division A, Part 1, Clause 1.1.1.2 of the *BCBC 2006* gives direction in this matter and reads as follows:

> *"1.1.1.2 Application to Existing Buildings*
> *1) Where a building is altered, rehabilitated, renovated or repaired, or there is a change in occupancy, the level of life safety and building performance shall not be decreased below a level that already exists."*

The *structural engineer* can conform to the code philosophy by ensuring that the design and construction plans for an addition or renovation to a *Part 9 Building* are such that one of the following rational schemes is explicitly selected:

(a) The addition or renovation is structurally independent from the existing building and does not interact with the existing building to resist lateral loads. In this case, the addition or renovation does not weaken the existing structure and the addition or renovation conforms to Section 3.1 of these guidelines.

(b) The addition is connected to the existing structure such that the *entire structure* conforms to

Section 3.1 of these guidelines. In this case, the existing structure needs to be evaluated and strengthened - where required.

(c) The addition is connected to the existing structure but designed such that its own lateral load resistance meets the full requirements of Section 3.1 of these guidelines as if the addition were isolated new construction. This option should only be selected if the addition does not diminish the lateral load resistance of the original structure.

(d) The addition is connected to the existing structure but designed so that the lateral resistance of the addition is at least equal to the lateral resistance of any portion of the existing building that is removed to create the addition. Further, the addition does not increase the lateral forces carried by the intact elements of the existing building by more than 5%. In this case, the engineer provides an explicit calculation or note to demonstrate that he or she is satisfied that the 5% criterion has been met. The addition should be connected appropriately to the existing structure to provide any replacement resistance that is required.

For each addition or renovation, it is recommended that the *structural engineer* document which of the above schemes has been selected. This information should be retained in the project files.

## 3.4 Observation of Deficiencies

In carrying out their specific structural engineering services, *members* may become aware of a deficiency in other aspects of the building that involves the practice of professional engineering. In such instances, the engineer must act in a fashion which is consistent with the intent of the APEGBC Bylaw 14(a)(9) under the Code of Ethics which states that *members* and licensees shall:

> *"report to their association or other appropriate agencies any hazardous, illegal or unethical professional decisions or practices by members, licensees, or others;"*

On this basis, the engineer observing a deficiency in other aspects of the building has a duty to report it to the owner or their representative. If the owner or their representative does not respond appropriately, then the observing *structural engineer* must inform APEGBC and the *Authority Having Jurisdiction* of the deficiency.

A particular issue for *Part 9 Buildings* occurs when a *member* engaged to carry out *any* structural engineering services notes that the *primary structural system* likely does not meet the standard for good engineering practice in terms of the lateral load resistance. In that case, the engineer should verbally inform the *client* of the risk issue in accordance with APEGBC Bylaw 14(a)(8) under the Code of Ethics which states that *members* and licensees shall:

> *"present clearly to employers and clients the possible consequences if professional decisions or judgments are overruled or disregarded;"*

If the *client* does not wish to proceed with any actions to mitigate the risk then it is recommended that the *member* express their concerns in writing, and, note that he or she cannot take responsibility for the *primary structural system*. It is recommended that in such communication the *member* note that all *members* of APEGBC are obligated to design in accordance with good engineering practice.

In the event that a *member* becomes aware that another professional engineer was previously engaged or requested by the *client* to take professional responsibility for the *primary structural system* the *member* must act in accordance with APEGBC Bylaw 14(a)7 under the Code of Ethics which states that *members* and licensees shall:

> *"conduct themselves with fairness, courtesy and good faith towards clients, colleagues and others, give credit where it is due, and accept, as well as give, honest and fair professional comment"*


# 4.0 REFERENCE DOCUMENTS

- British Columbia Building Code (BCBC 2006)
- National Building Code of Canada (NBCC Canada 2005)
- Engineering Guide for Wood Frame Construction Published by the Canadian Wood Council (CWC Guide 2004)
- Vancouver Building Bylaw
- City of Vancouver Bulletin 2001-011-BU, Seismic Design of One and Two Family Dwellings, Revised April 19, 2007
- City of Vancouver Bulletin 2003-001-AD/BU, Guidelines for Seismic Evaluations of One and Two Family Dwellings, Revised April 19, 2007
- APEGBC Guidelines for Structural Engineering Services for Building Projects
- APEGBC (2005) Bulletin K: Letters of Assurance and Due Diligence including Appendix A – Specialty Engineer – Assurance of Professional Design and Field Review (Schedule S)

**Note:** APEGBC publications and bulletins are available for public download from the APEGBC website at www.apeg.bc.ca

# APPENDIX A: BUILDING CODE OPTIONS FOR PART 9 AND THE WIND OR SEISMIC RISK

The prescriptive requirements of Part 9 *of BCBC 2006*, as referenced by Division B, Part 9, Section 9.4.1.1. Option 1(a), consider only the appropriate sizing of components of buildings for gravity loads. They do not give any information on the overall ability of the structure to resist wind or seismic loads. Therefore, if ***only*** the prescriptive option is followed, a *Part 9 Building* in a high-hazard region (wind or seismic) may have the same structural design as a building in a low-hazard region. This can be problematic.

On the other hand, the Part 4 provisions of *BCBC 2006* inherently recognize that to provide a uniform level of protection for persons, high occupancy Part 3 buildings (such as stadiums) do not need to be made any more or less safe, in terms of the structural design, than low-occupancy Part 3 buildings. In other words, during an earthquake, the risk to 2000 people in a stadium should inherently be the same as the risk to 2000 people occupying say 500 low-occupancy buildings outside the stadium.

In both cases, the design goal for these Part 3 buildings is life safety[3]. The building may be heavily damaged but should not collapse. An extension of this argument is that it is not desirable to have a new stock of regularly occupied *Part 9 Buildings* that are not evaluated with regard to their ability to resist collapse.

Division B, Part 9, Section 9.4.1.1. Option 1(b) of Part 9 references the *CWC Guide 2004* as good engineering practice. The *CWC Guide 2004* notes that for the most part wood frame structures have performed well in earthquakes. Indeed, many traditional wood frame buildings (similar to those being constructed in Canada) have performed well when subjected to large earthquakes in the USA. However, the *Guide* goes on to indicate that poor performance has occurred in some cases where the layout and design has not conformed to the requirements of modern US codes.

From the Canadian perspective, the fact that non-traditional layouts may perform poorly is increasingly relevant given the tendency of modern *Part 9 Buildings* to have larger openings in the exterior walls and less interior partitions.

The *CWC Guide 2004* deals with the issue of structural layout versus the adequacy of the building in terms of its ability to resist wind or earthquake loads. The *Guide* provides triggers according to the layout and the local wind or seismic hazard. The triggers were developed from US codes but have been adapted for Canadian conditions.

APEGBC supports the evaluation, and, where necessary, the explicit lateral load design of new *Part 9 Buildings* using good engineering practice. The design of a *Part 9 Building* based ***solely*** on the prescriptive requirements of Division B, Part 9, Section 9.1.1.1. Option 1(a) is not recommended - unless an evaluation per Division B, Part 9, Section 9.1.1.1. Option 1(b) shows that this is acceptable for the particular building concerned.

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3 *This is deemed to be achieved in the structural design requirements of the applicable building code by the use of an importance factor of 1.0 (regular case). Higher importance factors are used for buildings such as post-disaster facilities.*


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