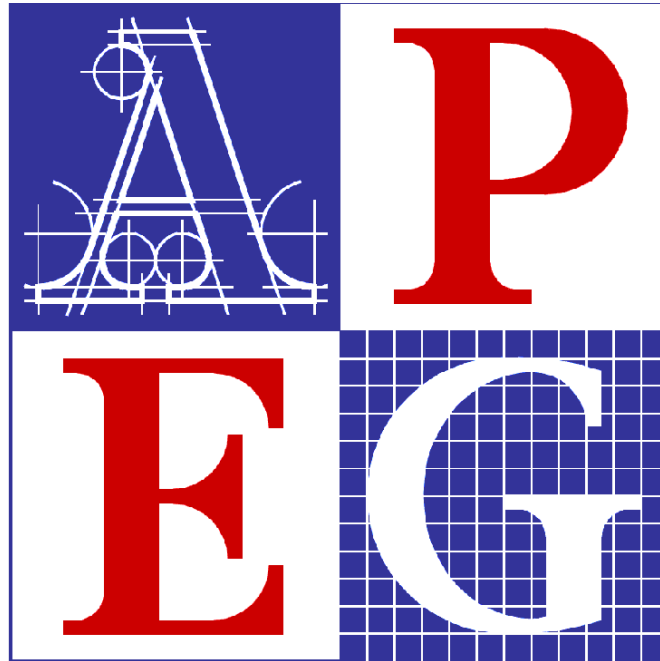


APEGBC



Professional Engineers
and Geoscientists of BC

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Guidelines for Professional Structural Engineering Services for Part 3 Building Projects

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1 DEFINITIONS

The following definitions are specific to these guidelines. These words and terms are italicized in the text.

Additional Structural Engineering Services (Additional Services)

The structural engineering services provided by a *structural engineer of record* for a building project that are in addition to the *basic structural engineering services*.

APEGBC

Association of Professional Engineers and Geoscientists of British Columbia.

Authority Having Jurisdiction

The jurisdictional body (usually municipal) with authority to administer and enforce the *British Columbia Building Code (BCBC)*, the City of Vancouver *Building Bylaw (VBB)*, the *National Building Code (NBC)* or a local building bylaw or code.

Basic Structural Engineering Services (Basic Services)

The structural engineering services provided by a *structural engineer of record* that are basic to a building project.

Client

A party who contracts with a *structural engineer of record* to provide structural engineering services.

Contract Documents

The documents, including engineering and architectural drawings and *specifications*, that are referenced in contracts for construction of a building.

Coordinating Registered Professional (CRP)

A *member* of APEGBC, or a *member* of the Architectural Institute of British Columbia, who has the responsibility to coordinate the design and *field reviews* of various *registered professionals* for a building project. The role of the *CRP* is clearly defined in Division C, Appendix A-2.2.7 in the *BCBC* and further documented in the Letters of Assurance contained in the *BCBC*.

Design/Build Contractor

A contractor retained by an *owner* to be responsible for both the design and construction aspects of a building project.

Design Drawings

Drawings (except *final design drawings*, see below), including *site instructions*, prepared by a *registered professional* at any stage of a building project. *Design drawings*, including those submitted for building permitting, or other purposes, must be signed, sealed and dated by the *registered professional of record* who assumes overall responsibility for the particular aspect of the design which they prepared.

Direct Supervision

Taking responsibility for the control and conduct of an assisting *member* or *licensee*¹, a less experienced *member*, an Engineer-in-Training (EIT) or a *non-member*.

¹ In these guidelines, *members* and *licensees* are collectively referred to as *members*.

Field Review

Field reviews can be provided by the *registered professional of record* responsible for the *primary structural system* (the *structural engineer of record*), or the structural engineer providing supporting structural engineering services to the *registered professional of record*.

Field review is a defined term in the *BCBC 2006* as follows:

Field review means a review of the work

- (a) at a project site of a development to which a building permit relates, and
- (b) where applicable, at fabrication locations where building components are fabricated for use at the project site

that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the *registered professional* for which the building permit is issued.

Final Design Drawings

Design drawings prepared by a *registered professional* to reflect design changes made during construction of a building project. These drawings are intended to incorporate addenda, change orders and other significant design changes, but not necessarily *site instructions*. These drawings must be signed, sealed and dated by the *registered professional* who assumes overall responsibility for the design.

General Contractor

A contractor who has a contract with an *owner* for construction of all, or a portion, of a building project.

Licensee

A registered *licensee* in-good-standing with *APEGBC* which includes limited licensees.

Member

A registered *member* in-good-standing with *APEGBC*.

Non-Structural Element

A design element of a building that is not a *primary structural element*, *secondary structural element*, or *specialty structural element*. Examples can include non-bearing partitions and suspended ceilings.

Owner

A party who owns a building, or will own a building once construction is complete.

Primary Structural Element

A beam, column or other structural design element that, when combined with others, forms the *primary structural system*.

Primary Structural System

A combination of *primary structural elements* that support a building's self weight and applicable live loads based on occupancy, use of the space and environmental loads, such as wind, snow and seismic forces.

Record Drawings

Drawings prepared as a record to confirm what was constructed. The types of information provided vary, but can include measurements, elevations and sizes. They are typically prepared by a *general or sub-contractor*. They can be signed, sealed and dated by a *member* retained by a *general or sub-contractor*, but are typically not signed, sealed or dated by the *registered professional* responsible for the particular aspect of the design reflected in the drawings, unless provided for in their contractual obligations.

Registered Professional (RP)

A *Registered Professional (RP)* is defined in the *BCBC* as:

- a) a person who is registered or licensed to practice as an architect under the *Architects Act*, or
- b) a person who is registered or licensed to practice as a professional engineer under the *Engineers and Geoscientists Act*.”

For the purposes of the *Engineers and Geoscientists Act* (the *Act*) this can include professional engineers and *licensees* including limited licensees having the appropriate scope of practice all of whom must be qualified by training or experience to provide designs for building projects.

Registered Professional of Record (RPR)

Defined in the *BCBC* as a *RP* retained to undertake design work and *field review* pursuant to Clause 2.2.7.2(1)(6) in Division C in the *BCBC*.

Secondary Structural Element

A structural design element that is structurally significant for the function it serves but does not contribute to the overall strength or stability of the *primary structural system*. The design and *field review* of *secondary structural elements* may fall under the responsibility of the *structural engineer of record* or the *RP* providing supporting engineering services as the *supporting registered professional*. Examples can include elevator support rails and beams, curtain wall systems, cladding, and seismic restraints for architectural, mechanical and electrical design elements.

Site Instructions

Drawings prepared and used to make minor adjustments to a design. *Site instructions* must be signed, sealed and dated by the *RP* who assumes overall responsibility for the design.

Specialty Structural Element

A structural design element that is designed and *field reviewed* by a *specialty structural engineer* providing structural engineering services as a *supporting registered professional*. These elements, normally fabricated off-site, typically require specialized fabrication equipment or a proprietary fabrication process not usually available at the project site. Examples can include open-web steel joists, wood trusses, combination wood and metal or plywood joists, precast concrete elements, seismic dampers and base-isolation devices and anchors, and other miscellaneous prefabricated structural components of wood or metal buildings.

Specialty Structural Engineer

A *member* who designs and supervises the preparation of documents for a *specialty structural element* while acting as a *supporting registered professional* providing supplementary supporting structural engineering services to the *structural engineer of record*.

Specification

A written description of the materials, standards of quality and construction requirements for design elements of a building project.

Struct.Eng.

A designation which reflects a grade of membership granted by APEGBC to a professional engineer or *licensee* who has demonstrated to APEGBC that they have the requisite qualifications for that grade of membership. APEGBC recommends that the *structural engineer of record* for buildings which fall under part of the BCBC, VBB or NBC have the *Struct.Eng.* designation. Some *authorities having jurisdiction* stipulate that only a *Struct.Eng.* can take professional responsibility for structural engineering services on certain types of buildings.

Structural Engineer of Record (SER) or RPR for the Primary Structural System

A *member* with general responsibility for the structural integrity of the *primary structural system* and for general conformance of *secondary structural elements* and *specialty structural elements* with the *primary structural system*. A *SER* may be required to be registered as *Struct.Eng.* (see above). The *SER* takes overall responsibility as the *RPR* for all items under the structural discipline on the Schedule B of the Letters of Assurance in the BCBC.

Sub-Contractor

A contractor who has a sub-contract with a *general contractor* to provide labour, materials and equipment for the construction and quality control of portions of a building project.

Submittals

Documents required to be submitted by a *general contractor*, such as a request for payment, progress report, shop drawing, manufacturer's literature on equipment, concrete mix design, aggregate gradation report, or work schedule. A *submittal* is commonly used by the *SER* to help determine if the work and work products conform with the intent of the *contract documents*.

Supporting Registered Professional (SRP)

The *RP* providing supplementary supporting design and/or *field review* services for structural building components, or sub components to the *SER* (e.g. *specialty structural elements*, *secondary structural elements*). Schedules S-B and S-C as identified in Appendix A of AIBC/APEGBC Practice Note 16, are recommended mechanisms for the *RPR* to receive assurance from the *SRP* providing supporting engineering services; confirming that the plans and supporting documents relating to the supporting engineering services for a particular structural component, or sub component substantially comply, in all material respects, with the applicable requirements of the BCBC.

Sustainable Goal

A goal to try to balance economics, environmental issues and social issues for a building project and/or a built environment so that they are truly sustainable. Also referred to as a "high performance" goal or "green design".

2 INTRODUCTION

In 1993, the Council of the Association of Professional Engineers and Geoscientists of the Province of British Columbia (*APEGBC*)² adopted the first edition of *Guidelines for Structural Engineering Services for Building Projects*³. In 2007, members of the Professional Practice Committee of the Structural Engineering Association of BC (SEABC) reviewed the 1993 document, and produced this new document. *APEGBC* Council formally adopted this guideline in December 2008.

The Guideline was updated in December 2010 to provide consistency with the designations used in the *BCBC* and with the Letters of Assurance in the *BCBC* (See Appendix B).

These guidelines form part of *APEGBC*'s ongoing commitment to maintain the quality of services that its *members* and *licensees*⁴ provide to both their *clients* and the public. Professional Engineers and Professional Geoscientists are professionally accountable for their work under the *Act*, the *Act* that is enforced by *APEGBC*.

2.1 PURPOSE OF GUIDELINES

These guidelines set out the standards of practice that a *member* should follow and meet in providing structural engineering services for building projects. Refer to Section 2.2 for the scope of building projects to which these guidelines apply.

A *member* must exercise judgment when providing professional services. As such, application of these guidelines will vary depending on the circumstances, however, the services should meet the intent of these guidelines.

APEGBC supports the principle that a *member* should receive fair and adequate compensation for professional services, including services provided to comply with these guidelines. An insufficient fee does not justify services that do not meet the intent of these guidelines. *Members* should refer to *APEGBC's/CEBC's Budget Guidelines for Consulting Engineering Services (2009)*. A *member* may wish to discuss both these guidelines and the recommended fee guidelines with his/her *client* when discussing an assignment and reaching an agreement regarding compensation.

These guidelines can be used to assist in establishing the scope of professional services and terms of reference of a *member's* agreement with his/her *client*. It is not intended, however, that these guidelines be used as a legal document or to alter contracts between a *member* and a *client*.

By following these guidelines, a *member* should fulfill his/her professional obligations, especially with regards to *APEGBC's Code of Ethics* Principle 1 which is to hold paramount the safety, health and welfare of the public, protection of the environment and promote health and safety in the workplace. Failure of a *member* to meet the intent of these guidelines could be evidence of unprofessional conduct and lead to disciplinary proceedings by *APEGBC*.

² Words or terms in italics are defined in Section 1 of these guidelines.

³ refer to Section 6 – References and Bibliography, for references to, and sources of, referenced documents.

⁴ In these guidelines, *members* and *licensees* are collectively referred to as *members*.

2.2 SCOPE OF GUIDELINES

These guidelines apply to the practice of structural engineering for buildings which fall under Part 3 of the *BCBC*, *VBB* or the *NBC*, or parts of buildings, governed by Part 4 of the *BCBC*, the *VBB*, the *NBC*.

These guidelines outline structural engineering services that should typically be provided by the *SER* in a building project. They specify tasks that should be performed by the *SER* to achieve designs that are in the best interest of the *client* and the public, and that are appropriately coordinated with the work of other *registered professionals*, the *general contractor and sub-contractors* associated with the building project. These guidelines should assist in maintaining the integrity of the overall and detailed designs.

These guidelines also discuss the role of the *RP* providing supplementary supporting structural engineering services (*SRP*) to the *SER* acting as the *RPR* for the *primary structural system* which can include the services of a *specialty structural engineer*. Section 5 of these guidelines discusses the delegation of responsibility from a *SER* or *SRP* to a less experienced *member*, an *EIT* or a non-*member* under the *direct supervision* of the *SER* or *SRP*.

Appendix B of these guidelines discusses the *BCBC* and *VBB* Letters of Assurance (LOA) for design and *field reviews* that an *authority having jurisdiction* can require from a *member*.

2.3 QUALIFICATION OF THESE GUIDELINES

Notwithstanding the purpose and scope of these guidelines, a *member's* decision not to follow one or more of these guidelines does not necessarily mean that the *member* has failed to meet his/her professional obligations. Such decisions depend upon the *member's* exercise of professional judgment including weighing facts and circumstances particular to a project. Determining whether a *member* has met his/her professional obligations will involve a comparison of the *member's* services to these guidelines and the range of actions of a reasonable and prudent *member* in similar circumstances.

3 PROJECT ORGANIZATION AND RESPONSIBILITIES

3.1 COMMON FORMS OF PROJECT ORGANIZATION

The organization of building projects vary according to the needs of the project and the parties involved. Three common organizational charts are provided in Appendix A. They identify some examples of how a project can be organized, including the reporting relationship of various *RPs*.

Charts 1 and 2 indicate that the *owner* retains a *CRP* to act as the prime consultant for the building project. Chart 1 shows that the *SER* has a contractual relationship with the *owner*. Chart 2 shows that the *SER* has a contractual relationship with the *CRP*. Chart 3 indicates that the *owner* retains a *design/build contractor* to oversee the building project and the *SER* has a contractual relationship with the *design/build contractor*. Therefore, the *SER's client* can either be the *owner*, the *CRP* or the *design/build contractor*.

The three charts indicate that the *SER* interfaces with the *registered professionals*, the *general contractor* and the testing and inspection companies associated with the building project.

Regardless of the project organization, the various participants have particular responsibilities as described below.

3.2 RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS

3.2.1 *Owner*

As discussed in Section 3.1, the *owner* can also be the *client* of the *SER*. Regardless of the contractual relationship between the *owner* and *SER*, to ensure the design and construction of the building project meets appropriate standards of public safety and the requirements of applicable building codes, the *owner* should assume the following responsibilities. (Note, that regardless of the type of *RP*, the *owner's* responsibilities are similar).

The *owner* should:

- proceed with a building project only after securing adequate financing, recognizing that a reasonable contingency should be included;
- ensure a *CRP* or *design/build contractor*, and appropriate *RPs* are retained;
- ensure required approvals, licences and permits from the *authorities having jurisdiction* are obtained;
- develop, along with the *CRP* or the *design/build contractor*, an appropriate written description of the building project;
- ensure appropriate scopes of work and realistic schedules of work are developed for *RPs*;
- ensure contracts are finalized with *RPs* before their services are required;
- ensure the contracts with *RPs* are amended to include services required beyond the original scopes of work;
- recognize that designs, *design drawings*, *specifications*, *contract documents* and other documents prepared by *RPs* are for that building project only and should not be used or copied for other building projects without consent of the *RPs*;
- recognize that some design changes may be required because interpretations of building codes can differ between the *authority having jurisdiction* and *RPs*; and
- confirm if the *SER* is to apply *APEGBC's Sustainability Guidelines* to the building project and the specific nature of the services to be provided.

If the *owner* does not assume the above responsibilities, *RPs* should:

- consider recommending to the *owner* in writing that he/she fulfills his/her responsibilities; or
- consider withdrawing from the building project.

3.2.2 *Coordinating Registered Professional (CRP)*

The role of the *CRP* as described in the LOA Schedule A, is to coordinate the design work and *field reviews* of the *RPs* required for the project in order to ascertain that the design will substantially comply with the relevant building code.

The role of the *CRP* is clearly defined in Division C, Appendix A-2.2.7 in the *BCBC*.

It is not intended that the *CRP* assume responsibility for the adequacy or accuracy of the technical design or subsequent *field reviews* of the *RPs* providing design and *field review* services. However, the *CRP* needs to provide a level of administrative overview beyond simply obtaining sealed drawings and LOAs whether or not the *CRP* has a contractual relationship with the *RPs* involved in the project. The *CRP* should assume the following responsibilities to enable *RPs* to perform their duties appropriately. These responsibilities may include the following activities:

- interpret the needs of the *owner* so that the designs will meet the intended function of the building project;
- identify and advise *RPs* of special design criteria, such as in the case of a *SER*, equipment, loads, and span requirements;
- develop the scope of work with *RPs* for designs, *specifications*, *contract documents*, *field reviews* and/or contract administration;
- provide timely and appropriately detailed information to allow *RPs* to adequately carry out their scope of work;
- coordinate and review designs, *specifications*, *contract documents* prepared by *RPs*;
- coordinate communications of information between the *owner*, the *general contractor*, and *RPs* so that the building project substantially complies in all material respects with the applicable building codes, and meets the *owner's* needs; and
- that APEGBC Bylaw 14(b)(4) regarding the completion of documented reviews of structural designs is complied with.

3.2.3 *Design/Build Contractor*

For *design/build contractor* building projects, the *design/build contractor* should assume the same responsibilities as the *CRP* to enable *design professionals* to perform their duties appropriately (refer to Section 3.2.2).

3.2.4 *Structural Engineer of Record (SER) or Registered Professional of Record (RPR)*

As discussed in Section 3.1, although the *SER* can have a contractual relationship directly with the *owner*, the *CRP* or the *design/build contractor*, he/she interfaces with most other *registered professionals*, the *general contractor* and the testing and inspection companies associated with the building project.

The *SER* should work with the *owner*, the *CRP* or the *design/build contractor* to develop a scope of work to enable and permit him/her to provide the required designs, *specifications*, *contract documents*, *field reviews* and/or contract administration as described in these guidelines and applicable building codes.

The *SER* is responsible for the integrity of the *primary structural system* of the building. Although the *SER* can rely on other *structural engineers* to be responsible for *primary structural elements*, the *SER* has the overall responsibility to ensure designs necessary to achieve a *primary structural system* meet acceptable standards. In situations where other *structural engineers* are acting as an *SRP* they are responsible for signing and sealing the documents related to the structural components (either *secondary* or *specialty structural elements*) they are responsible for.

The *SER* may be responsible for the design of *secondary structural elements*, *specialty structural elements* or *non-structural elements*. However, the *SER* remains responsible for designing the *primary structural system* to accommodate these other elements, and for allowing for their effects on the *primary structural system*. For this purpose, the *SER* is responsible for the review of these elements.

The *SER* must sign, seal and date the appropriate BCBC or VBB LOAs for design and *field reviews* regarding the designs and supporting documents he/she prepares. This includes taking responsibility for all structural items under Schedule B of the LOA and crossing out and initialling only those items not applicable to the project. When required by the *authorities having jurisdiction*, the *SER* should coordinate the preparation and submission of the *final design drawings*.

The *SER* should be familiar with and, where appropriate, apply *APEGBC's Sustainability Guidelines* to the work.

3.2.5 *Specialty Structural Engineer or Supporting Registered Professional (SRP)*

Where a *specialty structural engineer* is engaged directly by the *SER* (Appendix B, Chart 3, for example), the *specialty structural engineer* should work with the *SER* to clearly develop the *specialty structural engineer's* scope of work. The *specialty structural engineer* is responsible for the integrity of his/her designs and must sign, seal and date the documents prepared in their professional capacity or under their *direct supervision*. As the *specialty structural engineer* acts as a *SRP* in that they provide supporting engineering services to the *SER* they submit to the *SER* sealed, signed and dated Model Schedules S-B and S-C as identified in Appendix A of AIBC/APEGBC Practice Note 16.

3.2.6 *General Contractor*

A *general contractor* has a contractual relationship with an *owner*. This contract typically states that the *general contractor* is responsible for the labour, materials and equipment for the building project, and that he/she is responsible for the construction methods, techniques, sequences, procedures, safety precautions and programs associated with the construction, as set out in the *contract documents*.

The *general contractor* is responsible for the *general contractor's* work and supervision of the work of *sub-contractors*, co-ordinating the work of *sub-contractors* and for inspecting *sub-contractors'* work prior to *field reviews* by the *SER*, and the *SRP*, where applicable. The *general contractor* is responsible for providing reasonable notice to the *SER* and the *SRP* when components are ready for *field review*.

The *general contractor* must provide independent quality control.

3.3 SELECTION OF CONSULTANTS

The recommended procedures for selecting an engineering consultant are described in Consulting Engineers of British Columbia's documents *Appointing Your Consulting Engineer Using Qualifications Based Selection*, *Selecting a Professional Consultant* prepared by the Federation of Canadian Municipalities and the National Research Council and in APEGBC's document *Advice on Hiring a Professional Engineer or Professional Geoscientist in British Columbia*.

4 GUIDELINES FOR PROFESSIONAL PRACTICE

The following sub-sections outline the services that a *SER* should provide for a building project. These services can assist a *SER* in explaining his/her services to a *client*, whether that *client* is an *owner*, a *CRP* or a *design/build contractor*. These outlines are not intended to be exhaustive, and should not detract from other provisions of these guidelines.

4.1 SCOPE OF WORK

Before commencement of services, the *SER* should meet with the *client* to:

- develop the scope of work for *basic services* and *additional services*;
- reach agreement on fees, payment schedule and professional liability insurance; and
- reach agreement on, and complete a Contract⁵.

For a "fast-track" project, in addition to the above, the *SER* should:

- establish with the *client*, terms and conditions under which preliminary or partially completed *contract documents* can be issued in advance, and clearly define the requirements for partially completed *contract documents*;
- advise the *client* that no part of the designs, *specifications* or *field reviews* is complete before *contract documents*, including those of other *RPs*, have been completed; and
- ensure that scheduling will not adversely affect the quality and safety of the services of *RPs*.

4.2 BASIC STRUCTURAL ENGINEERING SERVICES (BASIC SERVICES)

The typical stages of *basic services* for a building project may include:

- conceptual or schematic design;
- design development;
- *contract documents*, including designs for the *primary structural system*, structural calculations, structural *design drawings* and *specifications*;
- tendering; and
- construction, including review of *submittals* and *field reviews*.

Each stage discussed below contains items that relate to the typical sequence of a building project. For various reasons, certain *basic services* can be performed out of typical sequence or in different stages.

4.2.1 Conceptual or Schematic Design Stage

In the conceptual or schematic design stage, the *SER* may:

- in conjunction with the *client* and other *RPs*:
 - review functional, aesthetic, cost and scheduling requirements;
 - review existing *design drawings*;
 - conduct a preliminary site visit;
 - review applicable building codes and restrictions and other factors affecting the design;
 - develop *sustainable goals*; and
 - prepare a preliminary design concept.
- assist the *owner*, *CRP* and/or *design/build contractor* to:
 - determine the need for specialists, such as geotechnical, material testing, vibration analysis and wind tunnel testing;

⁵ "Documents No. 31, 32" prepared by the Association of Consulting Engineers of Canada or the Sample Terms of Agreement prepared by ENCON (Bulletin No. 99Q, June 1997) are recommended as a basis for a contract.

- develop or review the project schedule, including milestone dates;
 - develop channels of communication;
 - determine the responsibility for showing overall and detail dimensions on the *design drawings*;
 - determine design drawing standards and *specifications* format; and
 - determine the timing of meetings during each stage of the project.
- with respect to the *primary structural system*:
 - establish comparative information to help select a *primary structural system*;
 - establish structural design criteria;
 - develop the structural scheme, and alternate schemes where appropriate, considering materials, systems and budgets;
 - establish the requirements of other *RPs* and establish dates that information affecting the structural design will be needed from other *RPs*;
 - establish criteria for other *RPs* and review their reports;
 - describe the *primary structural system*, detailing significant *primary structural elements* and materials;
 - report on the *primary structural system* considering economy, performance, capital cost, compatibility with other design elements and requirements of relevant codes and authorities;
 - provide, if required, brief outline *specifications* for proposed materials;
 - explain in writing to the *client*, for his/her consideration, proposed new structural construction materials or techniques and the alternatives, including the short and long term advantages and disadvantages;
 - recommend the *primary structural system*; and
 - prepare a summary report that defines the selected *primary structural system* and rationalizes its selection.

A *client* may assume responsibility for some or all of the foregoing conceptual or schematic design stage activities, provided:

- the responsibility for the conceptual or schematic design stage activities is clearly defined in writing and relieves the *SER* of responsibility for the effects of such activities on the selection of the *primary structural system*, costs, and/or scheduling;
- the *SER* can make appropriate decisions with regard to engineering and safety; and
- the *SER* can satisfy the requirements of subsequent stages of these guidelines.

4.2.2 Design Development Stage

In the design development stage, the selected preliminary design is developed in sufficient detail to enable commencement of the final design and construction documents by *RPs*. During this stage, the *SER* may:

- attend meetings with the *client* and other *RPs*;
- consider reviewing the *sustainable goals* and other strategies identified during the conceptual or schematic design stage;
- identify desired standards, such as: deflection of slabs and beams, potential vibration, lateral drift, concrete and masonry crack control, foundation settlement, soil-structure interaction, permanent seismic movements and deformations;
- review reports by specialists such as geotechnical, material testing, vibration analysis and wind tunnel testing;
- prepare preliminary structural analysis and design calculations for typical *primary structural elements*;
- prepare preliminary foundation *design drawings* based on recommendations by the geotechnical engineer;

- prepare preliminary framing design and *design drawings* showing layouts of typical areas;
- prepare or edit outline *specifications* for structural elements;
- coordinate structural design with deflection and lateral movement criteria to meet requirements of other *RPs*; and
- prepare design documentation for review and approval by the *client*.

4.2.3 Contract Documents Stage

This stage includes designing the *primary structural system*, preparing structural calculations to support the design, preparing structural *design drawings*, and preparing *specifications*.

4.2.3.1 Primary Structural System

In conjunction with designing the *primary structural system*, the *SER* may:

- with respect to *primary structural elements*, such as connection details and proprietary products:
 - determine and specify in the *contract documents* which elements will be designed by *SRPs*;
 - specify types of elements, their positions within the structure and methods of connecting to the *primary structural system*;
 - specify loads and design criteria for use by *SRPs* in their design; and
 - review the design of *specialty structural elements* and *secondary structural elements* for conformity with the *primary structural system*.
- with respect to *non-structural elements* attached to the *primary structural system*:
 - review the effect of the elements on the *primary structural system*;
 - design the *primary structural system* to accept and support such elements; and
 - provide information regarding the supporting capability and physical attachment limitations of the *primary structural system*.

The above design responsibilities may be delegated to an assisting *member*, a less experienced *member*, and Engineer-in-Training (EIT) or a non-*member* who carries out the work under the *direct supervision* of the *SER*. Refer to Section 5 – Delegation of Responsibility.

In addition the *SER* may:

- attend coordination meetings with the *client* and other *RPs*;
- assist in the coordination with the *authority having jurisdiction*;
- assist in establishing testing and inspection requirements; and
- comply with fire resistance requirements as determined by the *CRP* or specialty consultants.

4.2.3.2 Structural Calculations

The *SER* must prepare calculations to support his/her structural designs. The structural calculations should be dated, legible and retained in the project file. A hard copy of input and output of computer analysis should be included in the project file, along with a description of the software used.

In general, structural calculations typically will include:

- design criteria, including:
 - discussion and description of the design basis including assumptions;
 - building codes referenced, with edition dates;

- list of live loads, environmental loads such as wind, snow and seismic criteria, and special loads and provisions greater than building code requirements, as requested by the *client* or otherwise used by the *SER*;
- *specifications* for materials used;
- geotechnical report information and design criteria; and
- deflection limitations of structural elements and systems
- location diagrams for structural elements;
- vertical load analysis and design of roof structures, floor structures, frames or trusses, columns, walls and foundations;
- lateral load analysis and design for seismic and wind forces;
- computer analysis and design results; and
- special analysis, such as dynamic and vibration analyses.

Documentation of in-house checks and independent reviews of the final structural design and documents, to confirm the adequacy and appropriateness of the design, must be retained. Checking of designs must meet the requirements of APEGBC's Bylaw 14(b)(2), *Quality Management*. Independent review must conform to APEGBC's Bylaw 14(b)(4). The documentation should include the names of the designers, design checkers and independent reviewers.

The project design file should contain a table of contents or index to the structural calculations.

4.2.3.3 Structural *Design Drawings*

Structural *design drawings* should show the locations, sizes, reinforcement and details of *structural elements* at appropriate scales, to enable the fabrication, installation, and connection of the elements in a reasonable sequence by a reasonably competent *general or sub-contractor* who is familiar with the techniques of construction for the specified materials.

As a minimum, floor levels, column spacings, structural wall locations and offsets are to be coordinated with the architectural drawings to confirm consistency of dimensions. Elevations, sections, and details should be of appropriate scale, number, and extent to portray the relationship of *structural elements* to each other and their interconnection(s). Care should be taken to determine that details noted "typical" are applicable to the condition being portrayed and that their location and extent are explicit.

Structural *design drawings* should define the complete extent and detail of the work, including sufficient detail to enable determination of dead loads, effects and loads used for the design, and sufficient information to allow the design to be checked.

Design drawings can vary depending on the complexity of the project and the materials used, but may include:

- (a) structural notes:
- codes and standards, with dates of issue, to which the design conforms;
 - design criteria indicating superimposed vertical and horizontal loads (designated as unfactored loads) used in the design including live loads, environmental loads and dead loads (such as landscape, partition and equipment loads) not otherwise shown on the structural *design drawings*;
 - reference to the geotechnical report on which the foundation design is based;
 - brief material *specifications*;
 - absolute or relative deflection criteria for *primary structural elements*;
 - where forces are shown, their clear identification as factored or unfactored;

- pertinent design standards (eg, CSA or ASTM); and
 - reference to *design drawings* and *specifications* prepared by other *RPs*.
- (b) typical details
- (c) foundation plans and schedules:
- allowable soil-bearing capacity, pile capacities and lateral earth pressures for retaining structures;
 - sizes, locations, dimensions and details of foundations;
 - assumed bearing strata or elevation(s);
 - estimated pile length(s) or source of this information;
 - location of known existing services and existing foundations that conflict with structural foundations, or reference to the source where this information can be found;
 - if underpinning or temporary shoring is specified to be designed by others, indication on the *design drawings* of the areas designated to be shored or underpinned; and
 - if shoring or underpinning is designed by the *SER*, indication of details and construction sequences.
- (d) floor and roof framing plans and details:
- general gridline dimensions and overall building dimensions;
 - sizes, locations, dimensions and details of structural elements;
 - elevations, including slopes and depressions;
 - lateral load resisting system;
 - governing forces, moments, shears or torsion required for the preparation of shop and detail *design drawings*;
 - reinforcing bar sizes and details with fabrication and placing criteria;
 - locations and details of control, construction, contraction and expansion joints;
 - locations, sizes and reinforcement of significant openings; and
 - provision for future extensions.
- (e) schedules and details for columns, beams and walls:
- structural element sizes;
 - elevation of bottom of columns;
 - reinforcing steel and splice details for concrete columns;
 - splice locations for structural steel columns;
 - structural details of masonry or reinforced concrete walls including lintels, details and reinforcing of significant openings; and
 - stiffeners, lateral bracing and local reinforcements for steel elements.
- (f) connections:
- where connections are to be designed by a *specialty structural engineer*, acting as a *SRP*, *design drawings* should indicate required information and governing forces;
 - where connections are designed by the *SER*, *design drawings* should show dimensions and comprehensive connection details;
 - the *SER* should consider design of the connections when sizing the structural elements, such as HSS truss joints and post-tensioned anchorages; and
 - general arrangement and details at intersections of different structural materials.
- (g) sequence of construction, if this is critical to the functioning of the building project.

4.2.3.4 Specifications

Specifications are prepared using a format suitable for inclusion in the *contract documents*.

Specifications may include information on the following:

- applicable standards, building codes and/or bylaws;
- *submittals* required;
- quality control requirements;
- materials;
- workmanship and fabrication;
- tolerances;
- information of temporary works and erection information, where necessary, to ensure the intent and integrity of the design;
- testing and inspection;
- notification by the *general contractor* before significant segments of the work begin;
- warranties; and
- performance criteria for design by *SRPs* engaged to provide supporting structural engineering services.

Where appropriate *specifications* can be abbreviated and become part of the structural *design drawings*.

Specifications should specify that the *SER's* review of *submittals* and *field reviews*, as well as testing and inspection by independent companies reporting to the *client*, are carried out to inform the *client* of the quality of the *general contractor's* performance, and that these reviews, tests and inspections do not relieve the *general contractor* of his/her responsibilities and are not for the benefit of the *general contractor*.

4.2.4 Tendering Stage

The role of the *SER* in the tendering stage, if required by the *client*, *CRP* and/or *design/build contractor*, is to assist to:

- prepare the contract;
- prepare pre-qualification documents;
- review bidders' qualifications;
- obtain required approvals, licences and permits; and
- analyze and evaluate tenders submitted.

The *SER* should:

- prepare the appropriate LOA and documents required by the *authority having jurisdiction*;
- and
- provide structural addenda and clarification of structural documents, as required.

4.2.5 Construction Stage

It is essential that *basic services* during the construction stage be provided for systems for which the *SER* is responsible. It is preferable that the *basic services* be provided by the *SER*, however, where practical, the *SER* can delegate these duties to others. Refer to Section 5 – Delegation of Responsibility.

Services by the *SER* during the construction stage should not be construed to relieve the *general contractor* of his/her responsibility for constructing the building in accordance with the *contract documents*, controlling the progress, providing safe working conditions, and/or correcting deviations from the project requirements.

Some items reviewed by the *SER* can also require review by other *RP*s on the design team or by testing and inspection companies. Such items can include piles, anchors, precast concrete elements, structural steel, welding, proprietary products, and other *secondary structural elements* or *specialty structural elements* designed by *SRP*'s.

4.2.5.1 General Services During Construction (Field Services)

General services during construction (field services) may include, the following, but can vary depending on the complexity of the project:

- attend construction meetings;
- confirm communication channels and procedures;
- assist in confirming, reporting and scheduling procedures for testing and inspections;
- assist in confirming procedures for shop drawings and other *submittals*;
- confirm that qualifications of fabricators meet the *specifications*;
- advise the *CRP*, *design/build contractor* and/or *general contractor* on the interpretation of structural *design drawings* and *specifications* and, if required, issue supplementary details and instructions;
- advise the *client* on the validity of charges for additions or deletions from the contract and on the issue of change orders;
- review and comment on the *general contractor's* applications for progress payments;
- estimate completed work and materials on site for payment according to the terms of the construction contract;
- review reports from the testing and inspection companies to determine if the element complies with the *contract documents*;
- conduct substantial and total performance inspections of structural elements of the project, noting deficiencies and inspect and document completed corrections; and
- coordinate the preparation of and submit *final design drawings* to the *authority having jurisdiction*.

4.2.5.2 Review of *Submittals*

After being reviewed by the *general contractor*, the *SER* should review *submittals* for general compliance with the *contract documents*, excluding matters such as checking dimensions or quantities or the review of the *general contractor's* safety measures or methods of construction.

In addition, the *SER* should:

- review shop drawings for conformance with the *contract documents* and the intent of the design;
- confirm, when required by the *contract documents*, that shop drawings have been signed, sealed and dated by the responsible *specialty structural engineer* acting as an *SRP* (the *specialty structural engineer* may be responsible for the design of speciality structural elements and connections); and
- review shop drawings and other *submittals* of pre-engineered or proprietary structural elements for type, position, and connection to *primary structural elements* and for criteria and loads used for the design.

4.2.5.3 *Field Reviews*

Field reviews should be carried out at intervals appropriate to the stage of construction to observe the quality and the progress of the construction of those elements designed by the *SER*. When construction is complete, a final *field review* should also be carried out. The timing and number of *field reviews* are at the discretion of the *RP* having responsibility.

At the *SER's* discretion, *field reviews* should also be carried out on proprietary products, connections and including *secondary structural elements* and *specialty structural elements*. The *SRP* responsible for these structural elements should carry out the *field review* of the relevant structural elements he/she has designed at the appropriate stage of construction and report this in writing to the *SER* through the use of Model Schedules S-B and S-C as contained in Appendix A of AIBC/APEGBC Practice Note 16.

Field review reports should be prepared after each *field review* and should outline observations and deficiencies in the work and bring them to the attention of the *general contractor's* site representative.

Field review reports should be distributed to the *general contractor's* site representative, the *general contractor*, the *CRP* and/or the *design/build contractor*. Where the *owner* directly retains the services of the *SER*, it is recommended that the *owner* also be sent copies of *field review* reports.

4.3 **ADDITIONAL STRUCTURAL ENGINEERING SERVICES (ADDITIONAL SERVICES)**

In addition to the *basic services* described in Section 4.2, the *SER* can provide *additional services* if it is agreeable with both the *SER* and the *client*. Such an agreement should be in an *additional services* contract.

Additional services are typically not considered essential to the *basic services*, and are not part of the *basic services* that a *SER* should provide under these guidelines. *Additional services* can include design, preparation of documents, review, and *field review*.

Additional services can be related, but are not limited, to:

- changes in scope, complexity, diversity or magnitude of the original building project, or after selection of the *primary structural system*;
- imposed extended time schedules for design or construction;
- existing buildings and structures including surveys;
- preparation of documents for demolition;
- filing application for, and obtaining, permits;
- seismic analysis beyond that required to meet the requirements of the relevant building code;
- seismic restraints for *non-structural elements*;
- special physical model analysis such as wind-tunnel tests or shaking table tests;
- dynamic analysis beyond that required by the appropriate building codes (e.g. spectrum analysis or time-history response analysis);
- review of designs and *specifications* by other *design professionals*, not included in the *basic services*, to confirm compatibility with the *primary structural system*;
- *specialty structural elements* and *non-structural elements* not included in *basic services*, such as: curtain walls, building facings, cladding, antennae, elevators, storage tanks, and exterior landscape elements;
- structural fire-resistance requirements;
- alternate designs or products or substitute systems, requested by the *client* or the *general contractor*;
- preparation or assistance with cost estimates, or reviewing cost estimates prepared by others;
- translation of *contract documents*, conversion to other units, or special preparation of *design drawings* for reduction;

- preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- review of *general contractor's* design or installation for temporary loading, shoring, bracing, formwork or falsework for excavations and construction, underpinning adjacent structures, and erection sequence instructions;
- review of the *general contractor's* methods, procedures and construction equipment;
- changes due to construction cost over-runs outside the control of the *SER*;
- changes or corrections due to errors or omissions by the *general contractor*;
- damage as a result of natural or human-related events;
- continuous or detailed *field reviews* during construction;
- review of additional *submittals* when required because of improper or incomplete *submittals*;
- quantity take-offs and preparation of bills of materials;
- preparation of fabrication drawings, reinforcing steel bending schedules or other types of shop drawings;
- preparation of *record drawings*;
- tenant-related design services; and
- services as an expert witness.

4.4 FABRICATION, MANUFACTURER AND CONSTRUCTION DRAWINGS AND DOCUMENTS

The fabricator or manufacturer should produce drawings and documents to represent the work covered under his/her contract with the *general contractor or sub-contractor*. These drawings and documents should be prepared by the fabricator or manufacturer after reviewing the designs, *specifications* and *contract documents* supplied by the *SER* and following the resolution of requested changes or errors.

Typical fabricator or manufacturer drawings and documents may include:

- structural *design drawings* and documents for proprietary structural elements, such as open web steel joists;
- erection drawings and documents that specifically show the location of structural elements, connections and components to be supplied by the fabricator; and
- shop fabrication/connection drawings and documents that provide information necessary for shop personnel to fabricate and assemble the items.

When these drawings and documents incorporate designs by a *SRP*, the *design drawings* and documents must be signed, sealed and dated by the *SRP*. To clarify responsibility, the *SRP* can qualify the extent of work which he/she has designed on the Schedule S-B and Schedule S-C identified in Appendix A of AIBC/APEGBC Practice Note 16.

Construction *design drawings* and documents are produced by the *general or sub-contractor* for elements such as temporary loading, shoring, bracing, formwork or falsework for excavations and construction, underpinning adjacent structures, and erection sequence instructions. These drawings and documents must be signed, sealed and dated by a qualified *member*.

5 DELEGATION OF RESPONSIBILITY

The *basic and additional structural engineering services* described in Section 4 must be carried out by a *SER* or a *SRP* with appropriate training or experience, or by an individual to whom the work is delegated (a delegatee). A delegatee can be an assisting *member*, a less experienced *member*, an *EIT* or a *non-member* but must be working under the *direct supervision* of the *member* responsible. The *Act* (Section 1(1)) states that *direct supervision* means that the *member* responsible takes full responsibility for the control and conduct of the work he/she delegates. Taking this responsibility is noted by the *member* responsible signing, sealing and dating the work delegated.

The *member* responsible should exercise his/her professional judgment and due diligence in determining what work should be delegated and how it is delegated. The *member* responsible must determine that the delegated services meet the required standards.

Direct supervision typically takes the form of specific instructions on what to do, check, confirm, test, observe, record and report back to the *member* responsible, and how to carry out those tasks. Where the work is more extensive or where engineering decisions/judgments are required, the *member* responsible should make those engineering decisions/judgments, or provide further direction/instruction to the delegatee.

When delegating work, the following should be considered:

- circumstances surrounding the project and whether it is appropriate to delegate;
- level, complexity or critical nature of work;
- level of training and experience of the delegatee;
- complexity of instruction required to be provided to the delegatee;
- level of engineering decisions/judgments that the delegatee will be required to make;
- level of detail required by the delegatee when reporting back to the *member* responsible;
- ability of the *member* responsible to confirm the results of the delegated work; and
- necessity for follow-up work by the *member* responsible.

6 QUALITY ASSURANCE/QUALITY CONTROL

The *SER* or *SRP* should carry out quality assurance/quality control (QA/QC) for all phases of his/her structural engineering work.

6.1 APEGBC QUALITY MANAGEMENT BYLAWS

As a minimum, a QA/QC program must satisfy the requirements of *APEGBC* Quality Management Bylaws 14(b) (1), (2), (3) and (4) with regards to:

- retention of complete project documentation for a minimum of 10 years;
- regular documented checking of structural engineering work using a written quality control process appropriate to the risk associated with the work;
- documented *field reviews* of projects during construction; and
- documented independent review of structural designs.

7 REFERENCES AND BIBLIOGRAPHY

Not all the following documents are referenced in the text. Some are related sources of useful information. Where documents are known to be on the world wide web, they are noted as [web].

APEGBC, Guideline on Shop Drawings [web]

APEGBC, Guidelines for Independent Review of Structural Designs [web]

APEGBC, Guidelines for Sustainability [web]

APEGBC/CEBC 2009, Budget Guidelines for Consulting Engineering Services [web]

APEGBC 2010, Letters of Assurance in the BC Building Code and Due Diligence, Bulletin K [web]

Association of Consulting Engineers of Canada Documents No. 31-2009, 32-2009 and 39 recommended as a basis for engineering contracts [web]

Association of Professional Engineers of Ontario 1998 Guideline for Professional Engineers Providing Structural Engineering Work in Buildings [web]

British Columbia Engineers and Geoscientists Act (RSBC 1996, Chapter 116, as amended) [web]

British Columbia Building and Safety Standards Branch 2010 Guide to the Letters of Assurance in the BC Building Code [web]

British Columbia Building and Safety Standards Branch 2006 British Columbia Building Code (Schedules B and C-B are available on the web)

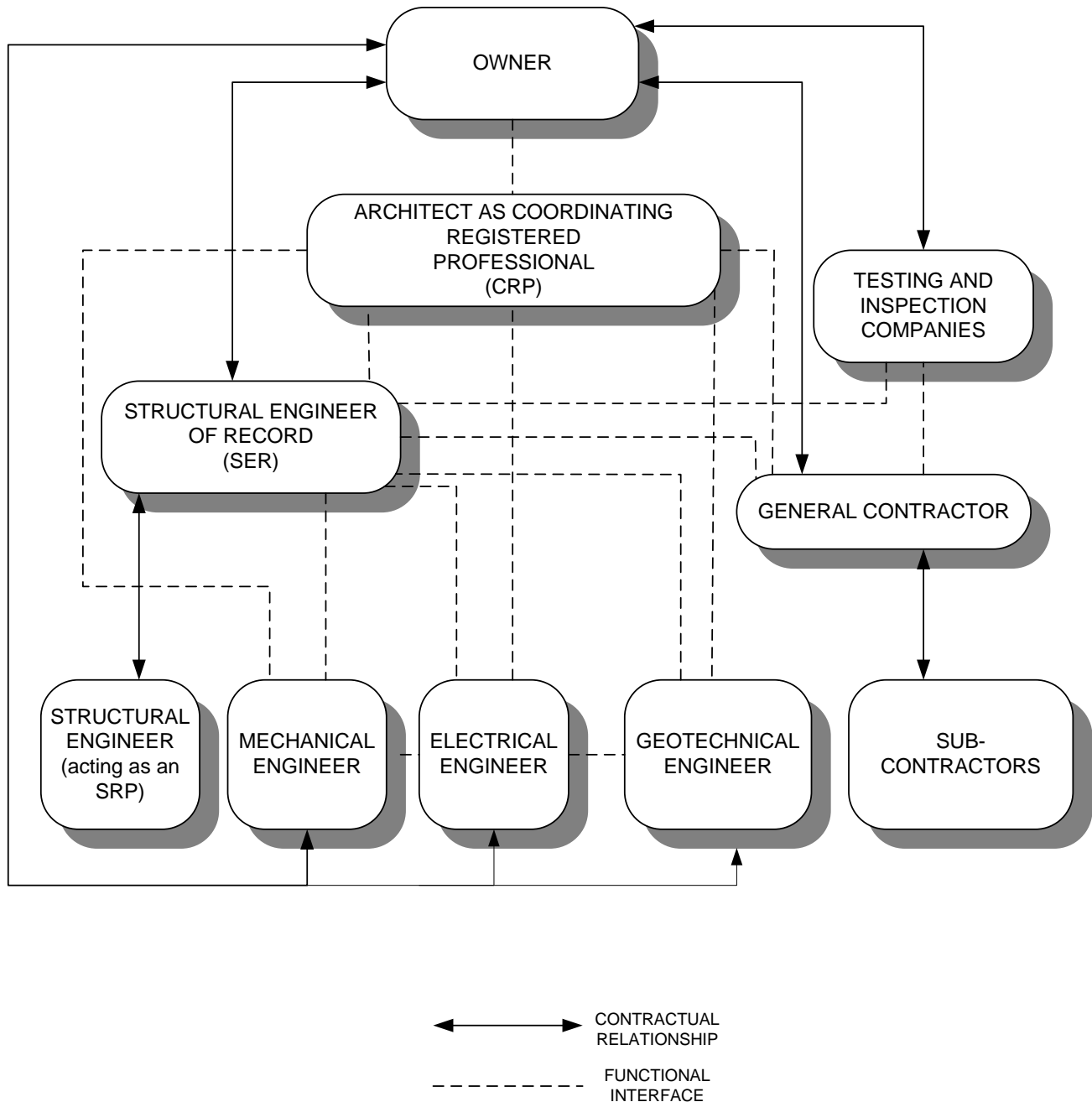
City of Vancouver The City of Vancouver Building By-law

InfraGuide Best Practices for Selecting a Professional Consultant 2006 [web]

Consulting Engineers Association of BC, Qualifications Based Selection Brochure 2006 [web]

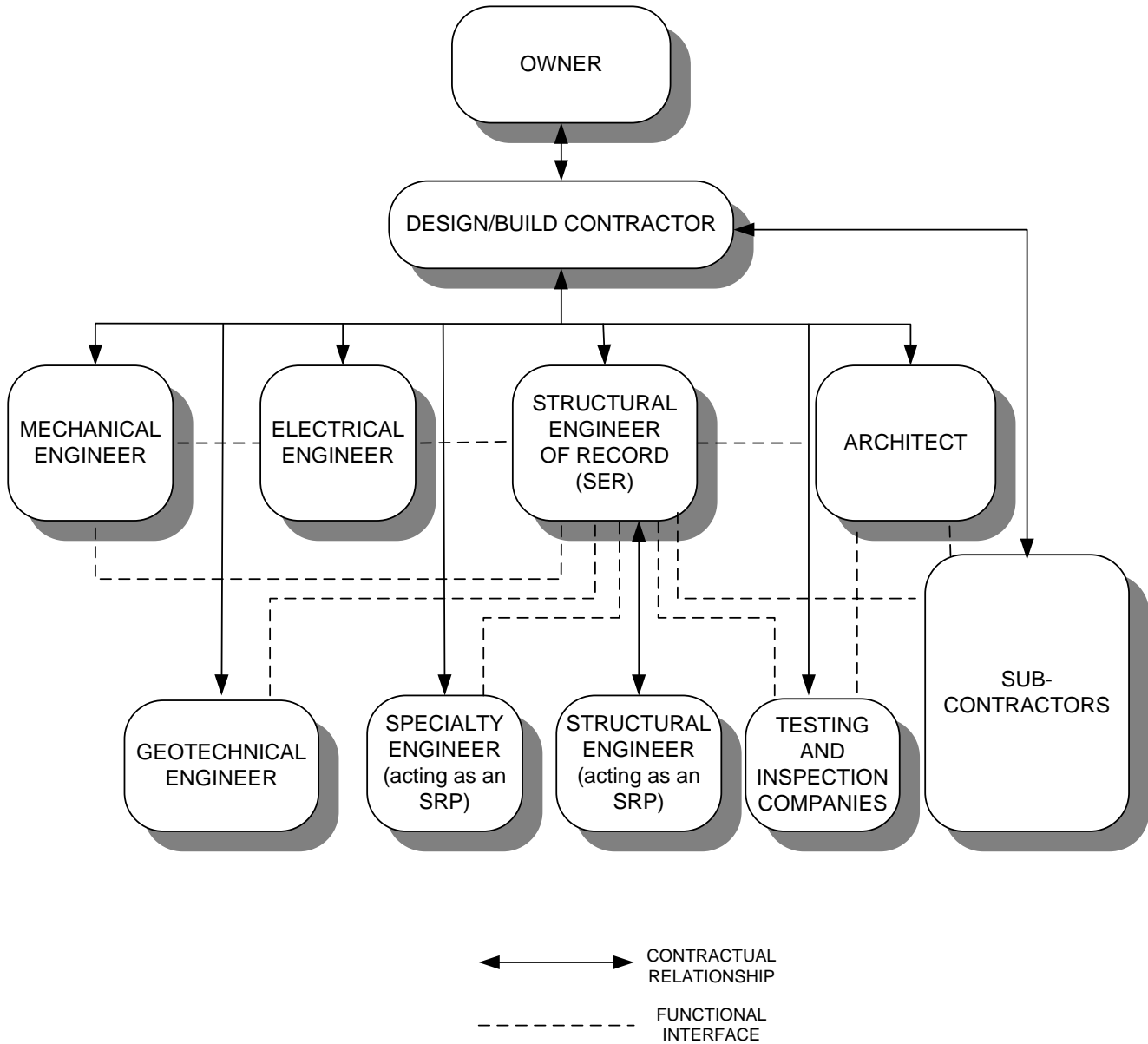
APPENDIX A: EXAMPLES OF ORGANIZATIONAL CHARTS

1. STRUCTURAL ENGINEER OF RECORD WORKING UNDER AN ARCHITECT ACTING AS THE COORDINATING REGISTERED PROFESSIONAL



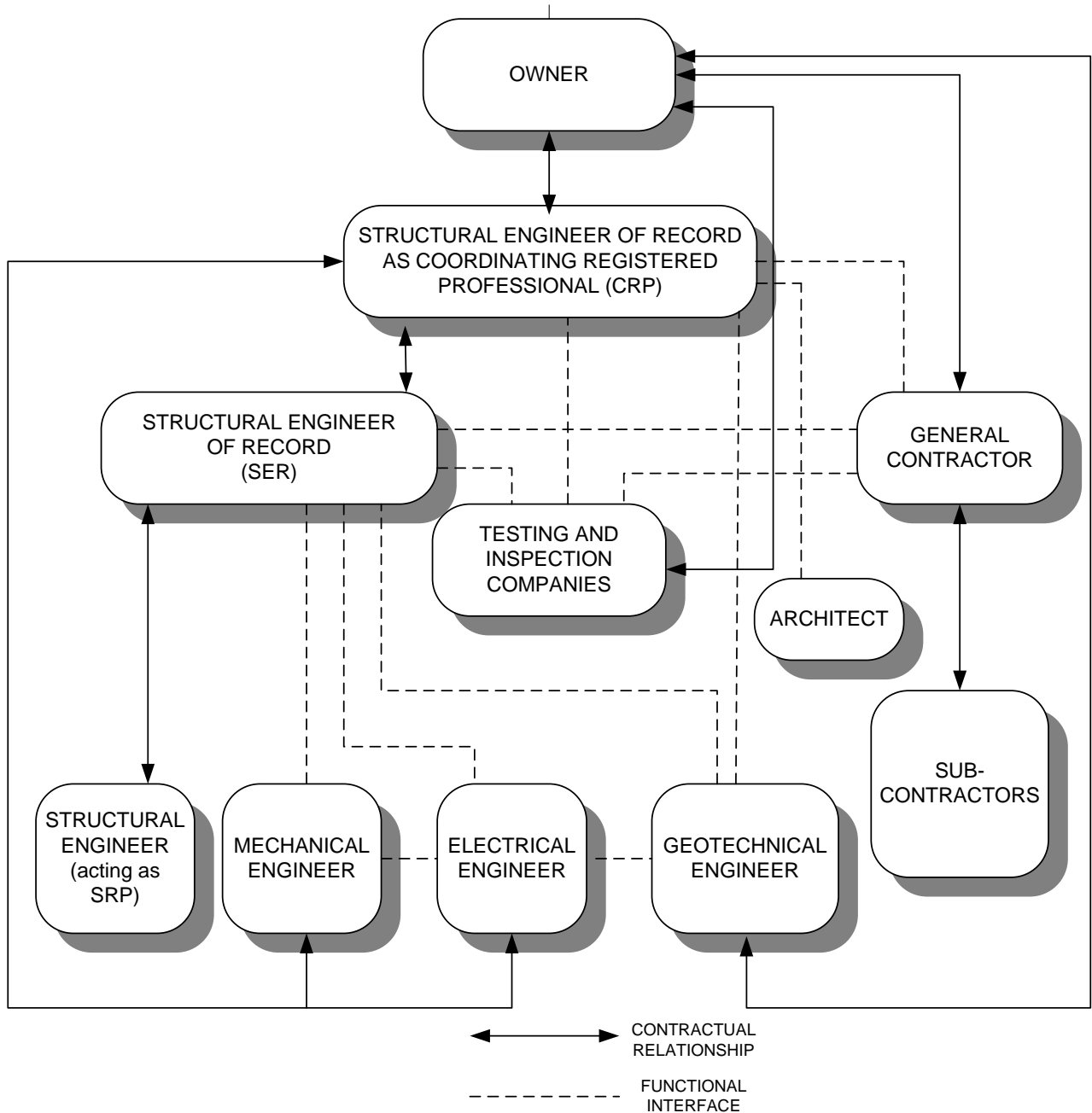
NOTE: 1: The Supporting Registered Professional (SRP) can be retained by the Owner, the Structural Engineer of Record, the General Contractor and/or Sub-contractor.
 2: The Coordinating Registered Professional is responsible for coordination of the other Registered Professionals engaged under the LOA.

2. DESIGN/BUILD CONTRACT



NOTE: The Supporting Registered Professional (SRP) may be retained by the Owner, the Structural Engineer of Record, and/or Sub-contractors.

3. STRUCTURAL ENGINEER AS THE COORDINATING REGISTERED PROFESSIONAL



- NOTE: 1. The Supporting Registered Professional (SRP) can be retained by the Owner, the Structural Engineer of Record, the General Contractors and/or Sub-contractors.
 2. The Coordinating Registered Professional is responsible for coordination of the other Registered Professionals engaged under the LOA.

APPENDIX B: LETTERS OF ASSURANCE (LOAS)

LOAs were introduced in 1990 in the VBB, and in 1992 in the BCBC and continue to be referenced in the current editions of the VBB and BCBC. They were developed after discussions among the City of Vancouver, the BC Building Policy Branch, the Architectural Institute of British Columbia and APEGBC, and in close consultation with the Building Officials Association of BC. The LOA's were last updated in 2010.

The intent of the LOA is to assure the *authority having jurisdiction* that for a particular building project:

- the activities of the various *RPRs* are coordinated;
- the design documents submitted in support of the application for a building permit substantially comply with the BCBC or VBB;
- building designs substantially comply with the requirements of the BCBC or VBB; and
- the *RPR* will undertake, and has undertaken, the necessary *field reviews* to determine that building construction substantially complies with the BCBC or VBB.

Schedule B identifies the various *RPRs* who acknowledge responsibility for their designs and that they substantially comply with the BCBC or VBB respecting safety, except for construction safety aspects. Schedules B also provide a commitment that the *RPRs* will be responsible for *field reviews* required for the project.

Schedule C-B confirms that the necessary *field reviews* have been completed by the *RPR*, and the finished project substantially conforms to the design, and the BCBC or VBB.

A *RPR* acting as the *SER* should only undertake design and *field review* for the items identified on the LOA for their discipline based on their competency. As such, a *RPR*, or *owner*, may require supplementary supporting engineering services for a particular structural component, or sub-component. In instances where supporting engineering services are required, it is recommended that appropriate assurances should be obtained by the relevant *RPR* from the *SRP* (who could be engaged by the *RPR*; the *owner*; a contractor, sub-trade or supplier) providing the supporting design service and/or field service. Upon receipt of assurance from such *SRP* that a particular component, or sub-component substantially complies, in all material respects, with the applicable requirements of the *BCBC*, the *RPR* can complete and submit the LOA for his or her discipline. Please refer to AIBC/APEGBC Practice Note 16 to view the model supporting LOAs Schedules S-B and S-C, that APEGBC and the AIBC have recommended for use by *registered professionals* acting as a *SRP*.

For further reference to the BCBC and VBB LOA refer to:

- *British Columbia Building Code*, Letters of Assurance [web]
- *The City of Vancouver Building Bylaw*, Letters of Assurance [web]
- *Guide to the Letters of Assurance in the British Columbia Building Code* [web]
- *APEGBC Bulletin K - Letters of Assurance in the BC Building Code and Due Diligence*
- *AIBC/APEGBC Practice Note 16: Professional Design and Field Review by a Supporting Registered Professional*.

Where unanticipated conditions are observed, the *design professional* should provide recommendations and additional *field reviews* to achieve the design objectives. A *design professional* has the responsibility to ensure deficiencies identified in *field reviews*, for which he/she is responsible, are addressed adequately.

Where the requirements of the *BCBC* or *VBB* are at variance with standard practice, there are provisions for “generally accepted design” or “established local practice” to satisfy the requirements.

A.1 Schedule B

Descriptions of the various items set out in Schedule B that relate to structural engineering practices are presented below.

With respect to the items under the heading of “Structural”, the purpose is to clearly identify the *RP* who has the overall responsibility for these items as the *RPR* acting as the *SER*.

The *SER* has the responsibility for the design and *field review* of the *primary structural system*. As well, the *SER* has responsibility for the coordination and general conformance of the *secondary structural elements* and/or *specialty structural elements* with the *primary structural system*.

Only the *SER* acting as the *RPR* for the *primary structural system* should sign off for the structural items on Schedule B.

The following sections cover the relevant structural items within Schedule B.

A.1.1 Structural Engineer of Record (SER) or RPR for the Primary Structural System

The numbers provided for each of the items discussed below are consistent with those in Schedule B.

2.1 Structural capacity of structural components of the building, including anchorage and seismic restraint.

The *SER* is responsible for the design and *field reviews* of the *primary structural elements* of the base building structure, including foundation structures, framing of base building against gravity loading, and bracing of base building against lateral forces.

The *SER*'s responsibility for *secondary structural elements* and *specialty structural elements* is to ensure loads placed on the *primary structural system* are taken into consideration in the design of that system.

2.2 Structural aspects of deep foundations

The *SER* is responsible for the design and *field reviews* of the structural aspects of deep foundations that support the base building structure. This is opposed to the geotechnical engineer who has responsibility for the ability of the soil to support the imposed loads from the building and the deep foundation.

Structural *field reviews* are required for piles where the structural capacity of the shaft is dependent on the workmanship of the *general or sub-contractor*, such as cast-in-place reinforced concrete shafts.

2.3 Review of all applicable shop drawings

The *SER* is responsible for reviewing shop drawings to ensure suitable application to, and integration with, the overall *primary structural system*. This review does not include checking of the design of the applicable structural sub-system. Correctness of dimensions are also excluded from such reviews; for which the applicable *general or sub-contractor* is responsible. See *APEGBC's Guideline on Shop Drawings* for more details.

2.4 Structural aspects of unbonded post-tensioned concrete design and construction

The *SER* is responsible for the design and *field reviews* of unbonded post-tensioned concrete systems within the base building structure. While the *SER* usually designs the material aspects of this system, a *specialty structural engineer* providing services as an *SRP* usually designs the layout of the tendons and anchors.

Specialty structural engineers acting as an *SRP* working on behalf of the *general contractor* provide the layout of the post-tensioning tendons and anchors, and testing and inspection companies using *specialty structural engineers* providing full time *field review* of the construction workmanship. The *SER* is responsible to review the work of both these *specialty structural engineers* and by completing this item in Schedule B the *SER* takes overall responsibility for this aspect of the structural design.

A 1.2 Supporting Registered Professional (SRP)

The following are services commonly provided by a *SRP* and fall under other disciplines, for example architecture, mechanical, plumbing, fire suppression and electrical. In such circumstances the architect or the *RPR* for the relevant discipline typically initials the respective item, and the *SRP* completes a Schedule S-B and S-C for the *secondary structural element* or *specialty structural element* for which he/she provided design and *field reviews* and submits it to the *SER*, the architect or other *RPR*, and/or the *CRP*, as appropriate. The *specialty SRP* should ensure that the design of the *secondary structural element* or *specialty structural element* is coordinated with the design of the *primary structural system*.

Architectural 1.6 Supporting Registered Professionals providing supplementary structural engineering services of non-structural sub-systems

This item pertains to structural capacity of architectural components, including anchorage and seismic restraint. Anchorage and seismic restraint pertains to the itemized architectural elements only and does not include primary structural components listed in under “Structural”. This work can include guardrails and handrails, wall cladding systems, non-load bearing block walls, exterior glazing, window systems, and signage.

The architect or *CRP* would sign the Schedule B. A *SRP* would typically carry out the design and *field reviews* unless the *SER* wishes to take responsibility. The *SRP* or *SER* would submit a Schedule S-B and S-C to the architect or *CRP*.

The *SRP* does not take responsibility for the structural integrity of the architectural components themselves.

Mechanical 3.5 Structural capacity of mechanical components, including anchorage and seismic restraint

This work can include anchorages, supports and restraints for heating, ventilation and air conditioning mechanical units, related ventilation ducting, and elevating devices.

The mechanical *RPR* typically initials this item. The design of the anchorage and seismic restraints is typically carried out by a *SRP* who submits a Schedule S-B and S-C to the mechanical *RPR*.

Neither the mechanical *RPR* or the *SPR* take responsibility for the structural integrity of the mechanical components themselves.

Plumbing 4.7 Structural capacity of plumbing components, including anchorage and seismic restraint

This work can include anchorages, supports and restraints for tanks, pumps, and related piping.

The plumbing *RPR* typically initials this item. The design of the anchorage and seismic restraints of the plumbing component is typically carried out by a *SRP* who submits a Schedule S-B and S-C to the plumbing *RPR*.

Neither the plumbing *RPR* or the *SRP* takes responsibility for the structural integrity of the plumbing components themselves.

Fire Suppression Systems 5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint

This work can include anchorages, supports and restraints for piping or sprinkler lines.

The *RPR* for the fire suppression systems typically initials this item. The design of the anchorage and seismic restraints of sprinkler components is typically carried out by a *SRP* who submits a Schedule S-B and S-C to the *RPR* for fire suppression systems.

Neither the *RPR* for fire suppression systems or the *SRP* takes responsibility for the structural integrity of the sprinkler components itself.

Electrical 6.5 Structural capacity of electrical components, including anchorage and seismic restraints

This work can include anchorages, supports and restraints for transformers, panels, and lighting equipment.

The electrical *RPR* typically initials this item. The design of the anchorage and seismic restraints of electrical components is typically carried out by a *SRP* who submits a Schedule S-B and S-C to the electrical *RPR*.

Neither the electrical *RPR* or the *SRP* takes responsibility for the structural integrity of the electrical components themselves.

