



GUIDELINES FOR

STRUCTURAL

ENGINEERING SERVICES

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TABLE OF CONTENTS

LIST OF CONTRIBUTORS	1
1.0 INTRODUCTION	4
1.1 PURPOSE OF GUIDELINES	4
1.2 SCOPE OF GUIDELINES	5
1.3 QUALIFICATION	5
2.0 DEFINITIONS	6
3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES	9
3.1 COMMON FORMS OF PROJECT ORGANIZATION	9
3.2 RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS	9
3.2.1 Owner	9
3.2.2 Prime Consultant	10
3.2.3 Structural Engineer of Record	10
3.2.4 Supplementary Structural Engineers	11
3.2.5 General Contractor	12
3.3 SELECTION OF CONSULTANTS	12
4.0 GUIDELINES FOR PROFESSIONAL PRACTICE	13
4.1 SOLE USE OF DOCUMENTS	13
4.2 SCOPE OF SERVICES	13
4.3 BASIC STRUCTURAL ENGINEERING SERVICES	14
4.3.1 Conceptual or Schematic Design Stage	14
4.3.2 Design Development Stage	16
4.3.3 Contract Documents Stage	17
4.3.4 Tendering Stage	23
4.3.5 Construction Stage	23
4.4 ADDITIONAL STRUCTURAL ENGINEERING SERVICES	28
4.5 FABRICATION DRAWINGS AND DOCUMENTS	31

4.5.1	Structural Element Drawings	31
4.5.2	Erection Drawings	31
4.5.3	Shop Fabrication/Connection Design Drawings	31
4.5.4	Construction Engineering Drawings	31

GUIDELINES FOR STRUCTURAL ENGINEERING SERVICES

1.0 INTRODUCTION

1.1 PURPOSE OF GUIDELINES

The "Guidelines for Structural Engineering Services" have been prepared by a sub-committee of the Professional Engineers and Geoscientists of Newfoundland and Labrador (PEGNL) and have been adopted by the PEGNL board.

The Guidelines have been prepared to set out the standards of practice which Members shall meet and follow in providing professional engineering services. PEGNL and its board have duty to regulate the practice of engineering and geoscience in the province of Newfoundland and Labrador according to the *Engineers and Geoscientists Act, 2008 (Act)* and a commitment to maintain the quality of the services Members provide to Clients and the public, and have published these Guidelines for that purpose.

It is anticipated that variations in the application of these Guidelines may be required. A Member shall always exercise professional judgement in providing services. It is not intended that the Guidelines be used as a legal document or to alter contracts between Members and Clients.

However, a variation that detracts from the overall purpose of the Guidelines should never be made. The Guidelines are intended to establish minimum standards of practice which Members shall meet to fulfil the Member's professional obligations, especially in regard to the primary duty to protect the public. The board of PEGNL intends that failure to meet these standards may give rise to disciplinary proceedings.

Finally, PEGNL supports the proposition that Members should receive fair and adequate compensation for services rendered and that this principle applies to the services provided to comply with these Guidelines. In no event will low fees be justification for services which do not meet all required codes and standards. Members may wish to discuss these Guidelines with their Clients when receiving instructions for assignments and reaching agreements regarding compensation.

1.2 SCOPE OF GUIDELINES

These Guidelines apply to the practice of Structural Engineering.

The Guidelines outline the professional services which should be provided by the *Structural Engineer of Record (SER)*. They specify tasks which should be performed by the *SER* to achieve designs which are in the best interest of the *Client* and the public and which are properly coordinated with the work of other design, fabrication and construction team participants. These Guidelines should assist in maintaining the integrity of the overall and detailed designs. This includes, but is not limited to, structural engineering services performed within the Province of Newfoundland and Labrador (but not necessarily for Newfoundland and Labrador Projects) and structural engineering services for Newfoundland and Labrador Projects.

1.3 QUALIFICATION

Notwithstanding the purpose and scope of the Guidelines in sections 1 through 4, the decision by the *SER* not to use one or more of these Guidelines does not mean that the *SER* is legally negligent or unprofessional in the performance of professional services, if *Due Care* has been exercised.

2.0 DEFINITIONS

Act

The Engineers and Geoscientists Act

Additional Services:

Services, as set out in section 4.4, which the *SER* may provide in addition to the *Basic Services*.

As-Built Drawings:

Drawings which are prepared from measurements taken on site to depict accurately the actual sizes of elements of the construction.

Authority Having Jurisdiction (AHJ):

The governmental body with authority to administer and enforce the applicable codes or the local by-laws.

Basic Services:

The services provided by the *SER* as set out in section 4.3.

Client:

The party who engages the *SER* to provide professional structural engineering services.

Connections:

Refers to the device(s) used to connect two or more structural elements in a design. Normally these include bolts, pins, rivets and welds.

Contract Documents:

All documents including the engineering and architectural drawings and specifications as defined in the construction contract(s) for the project.

Due Care:

The level of care which would be found by reasonable and knowledgeable people to be adequate in the specific circumstances in which the term was used.

Fabricator:

The contractor responsible for the supply and/or fabrication of components to satisfy a specific contract.

Falsework:

Any temporary structure used to support or access a permanent structure until it becomes self supporting including temporary supports, scaffolding and formwork.

Field Services:

The services provided by an engineer as set out in Section 4.3.5 to ascertain if the structural construction work is generally in accordance with the Structural Contract Documents. Field

Services are not necessarily performed by the SER. Field services may be performed by engineers other than the SER.

General Contractor:

The contractor who has a contract with the *Owner* for the construction of all or a portion of the project.

Member:

An individual or permit holder in good standing with *PEGNL*.

Non-Structural Elements:

Elements that are not part of the *Primary Structural System* or of *Secondary Structural Elements*. Examples of *Non-Structural Elements* are: non-bearing partitions and suspended ceilings.

Owner:

The person, company or other entity who controls the property under consideration and has the authority of ownership.

PEGNL:

Professional Engineers and Geoscientists Newfoundland and Labrador.

Primary Structural Element:

A beam, column, truss, slab, foundation or other structural element which forms part of the primary structural system. Each element within the primary structural system is necessary for the stability of the structure as a whole. For a building the Primary Structural System typically consists of both the foundations and the superstructure.

Primary Structural System:

The combination of the primary structural elements that support the building's self weight and the applicable live load based on occupancy, use of the spaces and environmental loads, such as wind, snow and vibration forces.

Prime Consultant:

The individual who, or firm which, is registered with the *PEGNL* or the Newfoundland Association of Architects, and who or which has the responsibility to coordinate the design and the field reviews of the various design professionals (such as structural, mechanical, electrical, geotechnical, architectural) for the project.

Professional Engineer:

A person who holds a certificate of registration to engage in the practice of engineering under the *Engineers and Geoscientists Act, 2008* or its successor.

Record Drawings:

Drawings which represent the final drawings issued and which normally incorporate such items as addenda, change orders and significant modifications made during construction.

Site measurements need not be incorporated onto these drawings unless significant differences from the specified dimensions occur. Variations from the *Contract Documents* may be noted, where appropriate, with remarks or comments. Record drawings shall contain the professional engineering seal of the engineer responsible for the content as well as the Permit to Practice seal.

Secondary Structural Elements:

Elements which 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: elevator support rails and beams, wall systems, cladding, and seismic restraints for architectural, mechanical and electrical elements.

Structural Engineer of Record (SER):

The *Professional Engineer* who produces and is responsible for the structural design documents which are issued for construction of the *Primary Structural System*.

Subcontractor:

The person, company or other entity who contracts with the *General Contractor* to perform a specified part of the *General Contractor's* work.

Submittal(s):

Items required by the *Contract Documents* to be submitted such as requests for payment, progress reports, shop drawings, manufacturer's literature on equipment, concrete mix designs, aggregate gradation reports, schedules, etc. *Submittals* are normally used by the *SER* to aid in determining if the work and work products conform with the intent of the *Contract Documents*.

Supplementary Structural Elements:

Structural elements which are designed by the *Supplementary 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 prefabricated wood or metal buildings). *Supplementary Structural elements* may form part of the *Primary Structural System*.

Supplementary Structural Engineer:

The *Member* who prepares the design and supervises the preparation of documents for any of the *Supplementary Structural Elements*.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

3.1 COMMON FORMS OF PROJECT ORGANIZATION

Project organizations vary according to the needs of the project and the parties. Various common organizational forms are in use such as those listed below but other forms are possible.

1. *Structural Engineer of Record (SER)/Prime Consultants Contract*
2. *Structural Engineer of Record (SER)/Owner Contract*
3. *Design/Build Contract*

3.2 RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS

3.2.1 OWNER

It is not the mandate of this guideline to stipulate the responsibilities of the *Owner*. However, in order that the design and construction of the project may be carried out in a manner that meets appropriate standards of public safety and the requirements of applicable regulations, the *Owner* should:

- 3.2.1.1 Retain or cause to be retained an *SER* with responsibility for the design of the *Primary Structural System*;
- 3.2.1.2 Cooperate with the *SER* to set out a written description of the scope of the *SER's* services as referred to in paragraph 3.2.3.4, and an adequate written description of the project;
- 3.2.1.3 Before the commencement of the *SER's* services, finalize or cause to be finalized a written agreement with the *SER* (directly with the *Owner* or with the *Prime Consultant* or with another appropriate party);
- 3.2.1.4 Cooperate with the *Prime Consultant* and the *SER* in establishing a realistic schedule for the provision of design services;
- 3.2.1.5 Authorize in writing any *Additional Services* that may be required beyond the scope of the *SER's* contract;
- 3.2.1.6 Assure that all required approvals, licences and permits from the *Authorities Having Jurisdiction* are obtained prior to proceeding with construction;
- 3.2.1.7 Recognize that drawings, Specifications and other documents prepared by the

SER are for the project and that such documents shall not be used or copied for other projects without the agreement of the *SER* and without advice from a qualified design professional;

- 3.2.1.8 Recognize that, because code interpretation of the *Authority Having Jurisdiction* may differ from that of the *SER*, some changes may occur;
- 3.2.1.9 Recognize that, even with a well-qualified design team and with a design, meeting reasonable criteria and standards, some unforeseen changes may occur and that accordingly a reasonable contingency should be included in the *Owner's* budget.

3.2.2 PRIME CONSULTANT

To enable the *SER* to perform his duties properly, the *Prime Consultant* should:

- 3.2.2.1 Interpret and define the needs of the *Owner* and in so doing define the *Owner's* intended functions and needs. The *Prime Consultant* should identify any special design criteria such as equipment and other loads, and span requirements and should advise the *SER* accordingly;
- 3.2.2.2 Outline the scope of assignment to each design professional for design, preparation of *Contract Documents*, review of work during construction and contract administration;
- 3.2.2.3 Provide timely information in sufficient detail as required by the *SER* to adequately perform his/her duties;
- 3.2.2.4 Coordinate and review the designs, drawings and other *Contract Documents* produced by all participants of the design team;
- 3.2.2.5 Coordinate communication of information between the *Owner*, the contractor and the design professionals, including the *SER*, so that the work proceeds in a manner that complies with applicable codes and regulations and meets the *Owner's* needs;
- 3.2.2.6 Inform the *SER* of tender call results;
- 3.2.2.7 Provide the *SER* with one (1) complete set of *Contract Documents*.

3.2.3 STRUCTURAL ENGINEER OF RECORD

- 3.2.3.1 The *Structural Engineer of Record (SER)* is responsible for the integrity of the design of the *Primary Structural System* shown on *Contract Documents* prepared

by the *SER*. The *SER* is not assumed to be responsible for the *Secondary Structural Systems* unless agreed with the Prime Consultant and/or Owner in the scope of services. For each Primary Structural System there can only be one *SER*. For example, you cannot have one *SER* for the foundations and another for the main structure.

3.2.3.2 The *SER* may rely on other *Members* to be responsible for elements of the *Primary Structural System* but the *SER* has the overall responsibility to see that all design is undertaken as is necessary to achieve a *Primary Structural System* that meets acceptable engineering standards. In this event the *SER* shall require the other *Members* to sign and seal the documents for such elements.

3.2.3.3 Unless otherwise noted, the *SER* is not responsible for the design of any *Supplementary Structural Elements* or *Non-Structural Elements*. However, the *SER* remains responsible for designing the *Primary Structural System* to accommodate these elements and for allowing for their effects on the *Primary Structural System*. For this purpose the *SER* is responsible to review these elements.

3.2.3.4 The *SER*, *Prime Consultant* and/or *Client* is responsible for setting out a written description of the scope of the *SER*'s services sufficient to enable and permit the *SER* to meet the design and field review requirements of these Guidelines and applicable codes and regulations.

3.2.3.5 If the *Owner* or *Prime Consultant* fails or refuses to carry out the obligations as set out in Sections 3.2.1 and 3.2.2, the *SER* should:

- (a) provide written notice to the *Owner* advising the *Owner* of the *SER*'s concerns and recommendations;
- (b) consider whether the *SER* can continue with the project,

3.2.3.6 While an *SER* can provide the field reviews during construction, the owner may elect to use an alternative firm (depending upon the municipality). Unless specified in the agreement with the *Owner/Prime Consultant*, the *SER* is then not responsible for field review of construction.

3.2.4 SUPPLEMENTARY STRUCTURAL ENGINEERS

3.2.4.1 The *SER* should define clearly the scope of work to be performed by the *Supplementary Structural Engineer*. The *Supplementary Structural Engineers* are responsible for the integrity of their design.

3.2.5. GENERAL CONTRACTOR

It is not the mandate of this guideline to stipulate the responsibilities of the *General Contractor*, however, the *Contract Documents* should clearly state that:

- 3.2.5.1 The *General Contractor* is responsible for all labour, materials, equipment and plant required to complete the work;
- 3.2.5.2 The *General Contractor* is responsible for the construction methods, temporary bracing and shoring, techniques, sequences, procedures, safety precautions and programs associated with the construction work, all as set out in the *Contract Documents*;
- 3.2.5.3 The *General Contractor* is responsible for coordinating the work of the *Sub-Contractors* and for checking the *Sub-Contractors'* work;
- 3.2.5.4 The *General Contractor* is responsible for verifying that the work is complete prior to requesting a field review by the *SER*;
- 3.2.5.5 The *General Contractor* is responsible for checking all submittals prior to submitting to *SER/Prime*
- 3.2.5.6 The *General Contractor* is responsible for providing reasonable written notice to the *SER* when components are ready for field review;
- 3.2.5.7 The *SER's* (or *designate's*) field review does not relieve the *General Contractor* from his responsibilities to complete the work in conformance with the *Contract Documents* and Applicable codes and Regulations;
- 3.2.5.8 All potential *General Contractors* and *Subcontractors* submitting bids are advised to visit the site prior to the tender closing.

3.3 SELECTION OF CONSULTANTS

The recommended procedures for selecting a consultant are as described in the "Selection by Ability" booklet published by PEGNL.

4.0 GUIDELINES FOR PROFESSIONAL PRACTICE

The following are guidelines for the services which an *SER* should consider providing as part of good practice. They may assist an *SER* in explaining structural engineering services to a *Client*. These guidelines deal in an advisory way with manners of practice and procedure rather than with matters of substantive engineering.

4.1 SOLE USE OF DOCUMENTS

The following clause should appear on all drawings and specifications.

"These design documents are prepared solely for the use of the party with whom the *SER* has entered into a contract. There are no representations of any kind made by the *SER* to any other party".

4.2 SCOPE OF SERVICES

Before commencement of design services, the *SER* shall meet with the *Client* to:

- 4.2.1 Determine the terms of reference and the scope of work for *Basic Services* and *Additional Services*;
- 4.2.2 Reach agreement on fees, payment schedule and professional liability insurance coverage;
- 4.2.3 Reach agreement on a contract.
- 4.2.4 For a "fast-track" project, in addition to the above, the *SER* should:
 - (a) Establish with the *Client* the terms and conditions under which preliminary or partially complete *Contract Documents* may be issued in advance and clearly define the requirements for partially complete *Contract Documents*;
 - (b) Advise the *Client* that no part of the structural documents can be considered complete before all *Contract Documents* including architectural, mechanical and electrical drawings are completed.

4.3 BASIC STRUCTURAL ENGINEERING SERVICES

The usual stages of the *Basic Services*, discussed as follows, are generally organized in an agreement according to the sequential stages of a typical project. Because of the requirements of the specific project, certain *Basic Services* activities may be required to be performed out of the normal sequence or in different stages than indicated in the scope of services.

4.3.1 CONCEPTUAL OR SCHEMATIC DESIGN STAGE

In the Conceptual or Schematic Stage, the *SER* may:

- 4.3.1.1 Attend, as required, periodic meetings with the *Client* and design team to obtain the *Client's* instructions regarding functional, aesthetic, cost and scheduling requirements, to prepare a concept design, and to report on the structural systems. Give due consideration to economy, performance, capital cost, compatibility with other design elements and requirements of relevant codes and authorities;
- 4.3.1.2 If required, assist the *Prime Consultant* and/or *Owner* in:
 - (a) Defining the need for any specialist consultants who may be required for the project with respect to the *Primary Structural System*, such as geotechnical, material testing, vibration analysis and wind tunnel testing;
 - (b) Developing or reviewing the project schedule, including any milestone dates;
 - (c) Determining channels of communication;
 - (d) Determining the extent for showing overall and detail dimensions on the drawings (the responsibility for coordinating dimensions, etc., between the various disciplines remains with the *Prime Consultant*);
 - (e) Determining the number and timing of project team meetings during each stage of the project;
- 4.3.1.3 Establish dates by which information affecting the structural design will be needed from other disciplines, such as electrical and mechanical;
- 4.3.1.4 Conduct field reviews and review existing drawings where appropriate;
- 4.3.1.5 Establish criteria relating to the *Primary Structural System* for the geotechnical consultant and other consultants as required. Comment on reports presented;
- 4.3.1.6 Establish structural design criteria for the *Primary Structural Systems*;

- 4.3.1.7 Check applicable codes, regulations, restrictions, insurance requirements and other factors affecting the design of the project;
- 4.3.1.8 Prepare a conceptual cost estimate or cooperate appropriately with others responsible for reporting the estimate, if required;
- 4.3.1.9 Establish, where appropriate, comparative information to be used in selection of a *Primary Structural System* for the project;
- 4.3.1.10 Develop the structural scheme for the *Primary Structural Systems*, together with alternate schemes where appropriate. Consider materials and systems suitable to the project requirements. Consider the requirements of the other design professionals and provide the information relating to the *Primary Structural System* they require;
- 4.3.1.11 Describe the *Primary Structural System(s)* detailing each significant component and material as appropriate;
- 4.3.1.12 Inform the *Client* of all new construction materials or new techniques the *SER* proposes for use in the project and the alternatives, including the risks, advantages and disadvantages over both the short and long term, so that the *Client* can weigh the choices and make an informed decision before the *SER* proceeds further as appropriate;
- 4.3.1.13 If required, recommend to the *Client* a *Primary Structural System*. Review the effect of the selection on the structural construction budget for the project.
- 4.3.1.14 A *Client* may assume responsibility for all or some of the foregoing Conceptual or Schematic Design Stage activities provided:
- (a) the *SER's* ability to satisfy the requirements of the subsequent stages of these Guidelines is unimpaired;
 - (b) the *Client* realizes that the *SER* is not responsible for such preliminary design activities and their effect on the selection of the *Primary Structural System*.

4.3.2 DESIGN DEVELOPMENT STAGE

In the Design Development Stage when the selected scheme is developed in sufficient detail to enable commencement of the final design and construction documents by all participants of the design team, the *SER* may:

- 4.3.2.1 Attend, if required, meetings with the *Client* and design team;
- 4.3.2.2 Identify desired standards of quality and the effect of such standards on serviceability requirements such as:
 - (a) Deflection of slabs and beams and the effect of deflection on non-structural items such as curtain walls and glazing;
 - (b) Control or advise of potential vibration induced by footfall or machinery;
 - (c) Lateral drift of the structure;
 - (d) Crack control in concrete and masonry structural elements;
 - (e) Foundation settlement;
 - (f) Soil-structure interaction;
 - (g) Seismic deformations (permanent) and movements.
- 4.3.2.3 Review reports by specialist consultants, such as geotechnical, dynamics or wind tunnel;
- 4.3.2.4 Prepare preliminary structural analysis and design calculations for typical structural elements of the *Primary Structural System*;
- 4.3.2.5 Prepare preliminary foundation drawings based on recommendations by the geotechnical consultant;
- 4.3.2.6 Prepare preliminary framing design and drawings showing layouts of typical areas;
- 4.3.2.7 Prepare or edit the "outline Specifications" for structural items, as required;
- 4.3.2.8 Coordinate structural design with deflection and lateral movement criteria to meet the requirements of the other design team participants;
- 4.3.2.9 Prepare a preliminary cost estimate or cooperate appropriately with others responsible for reporting the estimate if requested;

4.3.2.10 Submit a design development report for review and approval by the *Client* if requested.

4.3.3 CONTRACT DOCUMENT STAGE

4.3.3.1 General:

- (a) Design the *Primary Structural System*;
- (b) Determine and specify in the *Contract Documents* which structural elements, such as connection details and proprietary products, are to be designed by *Supplementary Structural Engineers*. Specify the type of element, its position within the structure and the method of connecting to the *Primary Structural System*. Specify the loads and design criteria for use by the *Supplementary Structural Engineer* in his/her design;
- (c) Review the effect of *Non-Structural Elements* attached to the *Primary Structural System* and design the structure to accept and support such items. Provide information regarding the supporting capability and physical attachment limitations of the *Primary Structural System* if requested;
- (d) Attend periodic coordination meetings, as required;
- (e) Assist in coordination with the *Authority Having Jurisdiction*, as required;
- (f) Assist in establishing testing and inspection requirements;
- (g) Comply with fire resistance requirements as determined by the *Prime Consultant* or others;
- (h) Seal documents as required by the *Engineers and Geoscientists Act, 2008*.

4.3.3.2 Structural Calculations

The *SER* shall prepare structural calculations to support all structural designs. The structural calculations shall be prepared legibly and presentably and filed by the *SER* for record purposes. Hard copy of input and output of any computer analysis, if applicable, shall be included as well as description of the software used.

In general, structural calculations include but are not limited to:

- (a) Design criteria:
 - Discussion and description of design basis including assumptions;

- Codes and standards used with edition dates;
 - List of dead loads, live loads, snow loads, seismic factors and wind load criteria and any special loads and provisions that exceed or vary from code and standard requirements as requested by the *Client* or otherwise used by the *SER*;
 - Structural material specification for concrete, reinforcing steel, masonry, structural steel, wood and other materials used;
 - Geotechnical report information and design criteria;
 - Deflection limitations of structural elements and systems.
- (b) Location drawings for structural elements;
- (c) Vertical load analysis and design of:
- Roof structures;
 - Floor structures;
 - Frames or trusses;
 - Columns;
 - Walls;
 - Foundations.
- (d) Lateral load analysis and design for seismic and wind forces;
- (e) Computer analysis and design results, if applicable;
- (f) Special studies and analysis (dynamic, vibration, etc.) where used;
- (g) Review of the final structural design and documents to confirm the adequacy and appropriateness of the design;
- (h) The names of the structural design engineer(s) and design review engineer;
- (i) Table of contents for, or index to, the structural calculations.

4.3.3.3 Structural Drawings

Structural drawings typically show the locations, sizes, reinforcing, and connections of the structural elements in sufficient scale and detail to enable the fabrication, installation, and connection of the members in a reasonable sequence by a competent contractor familiar with the techniques of construction for the specified materials.

Framing plans may refer to architectural drawings for dimensions where appropriate and mutually agreed to by the *SER* and the architect. Elevations, sections, and details shall be of appropriate scale, number and extent to portray the relationship of members to each other and their interconnections(s). Care shall be taken to ascertain and determine that details noted "typical" are applicable to the condition being portrayed and that their location and extent are explicit.

The drawings should define the complete extent and detail of the work.

The drawings, which may vary depending on the complexity of the job and the materials, should include but not necessarily be limited to the following:

(a) Structural Notes:

- Design criteria indicating all superimposed vertical and horizontal loads used in the design including live, snow, earthquake, wind and dead loads (such as landscape, partition and equipment loads) not shown on the structural drawings. These loads should be designated as unfactored;
- Reference to the geotechnical report on which the foundation design is based;
- Brief material specifications including standards and grades;
- Absolute or relative deflection criteria for structural members;
- Where forces are shown, the forces should be clearly identified as factored or unfactored;
- Pertinent design standards;
- Reference to drawings and Specifications prepared by other participants of the design team.

(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 all foundations;
- Assumed bearing strata or elevation(s);
- Estimated pile length(s) or source of this information;
- Location of know existing underground services and/or structures 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 drawings of the areas designated to be shored or underpinned. If shoring or underpinning is designed by the *SER*, indication of all 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 all 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 drawings;
- Reinforcing bar sizes and details with fabrication and placing criteria;
- Locations and details of control, construction, contraction and expansion joints;
- Locations, sizes and reinforcing of significant openings;
- provision for future extensions;
- Location and magnitude of any additional superimposed loads, which are not part of the normal dead and/or live load.

(e) Schedules and Details for Columns, Beams and Walls:

- Element sizes;
- Elevation of bottom of columns;

- Reinforcing steel and splice details for concrete columns;
- Type and location of splices for structural steel columns;
- Details of structural masonry or reinforced concrete walls including lintels, details and reinforcing of significant openings;
- Stiffeners, lateral bracing and local reinforcement.

(f) Connections:

- The *SER* shall either: (1) Design all connections or (2) specify which connections are to be designed by the *Supplementary Structural Engineer*;
- For structural steel projects wherein CSA W47.1 certified fabricators are specified, the *SER* shall clearly state who is responsible to do connection design;
- Where connections are specified to be designed by *Supplementary Structural Engineers*, indicate on the contract drawings all required information and governing forces. In such cases the *Supplementary Structural Engineer* shall seal, sign and date the fabrication and erection drawings that show connection design information;
- Where connections are designed by the *SER*, show all dimensions and comprehensive connection details requiring no further engineering input. Under these circumstances, the *SER* retains responsibility for these connections;
- The *SER* shall consider the design of the connections when sizing the structural members, e.g. HSS truss joints, post-tensioned anchorages;
- Show general arrangement and details at intersections of different structural materials.

(g) Sequence of construction, if this is critical to the functioning of the finished structure.

(f) General

- Engineers seal, signature and date of issue
- Purpose of each issue
- Applicable design and constructions codes and standards
- Sequence of work, if required for function of finished structure

- Expansion, construction and control of joint locations and details

4.3.3.4 Specifications

- (a) Specifications are prepared using a format suitable for inclusion with the *Contract Documents*;
- (b) The Specifications shall include information on the following:
 - standards, codes, by-laws governing work;
 - *Submittals* required;
 - quality control requirements;
 - materials;
 - workmanship and fabrication;
 - tolerances;
 - information for temporary works and erection information, where necessary, to ensure the intent and integrity of the design;
 - construction inspection and testing;
 - notification requirements by the contractor before significant segments of the work are begun;
 - warranties;
 - performance criteria for design by *Supplementary Structural Engineers*.
- (c) Where appropriate, the Specifications may be abbreviated and become part of the drawings;
- (d) The Specifications generally set out that the *SER's* review of *Submittals* and inspection of work as well as any testing by independent agencies reporting to the *Client* are undertaken to inform the *Client* of the quality of the contractor's performance and that this review and testing are not for the benefit of the contractor. **(The contractor shall provide their own independent quality control program.)**

4.3.4 TENDERING STAGE

- 4.3.1.4 Assist the *Client* in obtaining required approvals, licences and permits, as required. Prepare documents required by the *Authority Having Jurisdiction*;
- 4.3.2.1 Assist in the preparation of pre-qualification documents, if required;
- 4.3.3.6 Provide structural addenda and clarification of structural documents, as required.
- 4.3.4.5 Assist in analysis and evaluation of tenders submitted, as required;
- 4.3.5.3 Assist in reviewing bidder's qualifications, if required;
- 4.3.6.2 Assist in the preparation of the contract, if required;

4.3.5 CONSTRUCTION STAGE

It is essential that *Field Services* during construction be provided for the primary and secondary structural systems as well as supplementary structural elements.

It is preferable that the *Field Services* during construction be provided by the *SER*, however, where practical these duties may be delegated to others.

Field Services during construction by the *SER* should not be construed to relieve the contractor of the contractor's responsibility for executing the project in accordance with the *Contract Documents*, controlling the progress, providing safe working conditions, and correcting any deviations from the project requirements.

Some items reviewed by the *SER* may also require review by other members of the design team or by testing and inspection agencies. Such work may include piles, anchors, precast concrete elements, structural steel, welding, proprietary products, and *Secondary Structural Elements* designed by others.

4.3.5.1 General Services During Construction

General Services, which may vary according to the complexity of the job, should include, but not necessarily be limited to, the following:

- (a) Attendance at construction meetings, if required;

- (b) Confirmation of communication channels and procedures;
- (c) Assistance in confirming, reporting and scheduling procedures for testing and inspections;
- (d) Recommendations to the *Client* on the timing and number of *SER* site visits. Consideration should be given to full time inspection for those elements which will no longer be available for inspection due to cover up, such as concrete pours, backfilling, etc;
- (e) Assistance in confirming procedures for shop drawings and other *Submittals*;
- (f) Confirmation that the qualifications of fabricators meet the Specifications;
- (g) Advising the contractor and the *Prime Consultant* on the interpretation of the structural drawings and Specifications and, if required, issuing supplementary details and instructions during the construction period;
- (h) Advising, the *Client* on the validity of charges for additions or deletions from the contract and on the issue of change orders, if requested;
- (i) Assist client in the development of an acceptable format and price breakdown structure to facilitate certification of construction progress payments;
- (j) Reviewing and commenting on the contractor's applications for progress payments, if requested. Estimating completed work and materials on site for payment according to the terms of the construction contract, if required;
- (k) Reviewing reports from the testing and inspection agencies to determine if the agency has verified compliance of the reported item of work with structural Contract Documents. Initiate any necessary action;
- (l) Conducting substantial and total performance inspections of the structural components of the project noting deficiencies observed and inspecting completed corrections;
- (n) Submitting *Record Drawings* to the *Authority Having Jurisdiction* if *Record Drawings* are required as part of the *SER's* responsibilities.

4.3.5.2 Review of *Submittals*

Submittals should be reviewed for general compliance with the structural Contract Documents. This review does not alleviate the contractor from ensuring that the *Submittals* are in accordance with the *Contract Documents*.

The *SER* shall:

- (a) Confirm that the *Submittals* have been reviewed and stamped by the *General Contractor* and relevant *Subcontractors* before review by the *SER*;
- (b) Review the shop drawings and other *Submittals* for general conformance with the *Contract Documents* and the intent of the design;
- (c) When required by the *Contract Documents*, confirm that the shop drawings bear the signature and seal of the responsible *Supplementary Structural Engineer*. The *Supplementary Structural Engineer* whose seal and signature appear on the drawings is responsible for the design of the *Supplementary Structural Elements* and connections indicated. To clarify responsibility, the *Supplementary Structural Engineer* may qualify the extent of work which has been designed by the *Supplementary Structural Engineer*. In the absence of a signature and professional seal by a *Supplementary Structural Engineer*, the *SER* may have responsibility for the design of the elements and connections shown on the *Submittals*;
- (d) Review shop drawings and other *Submittals* of pre-engineered or proprietary structural elements for type, position, and connection to elements of the *Primary Structural System* and for criteria and loads used for the design. Pre-engineered or proprietary structural elements shall bear the seal of a *Professional Engineer*.

(e) The following is the recommended stamp affixed to all *Submittals* signed and dated by the *SER*:

ABC ENGINEERING LIMITED	
<p>Shop Drawing review is solely for purpose of determining adherence to general design concept. Contractor shall remain responsible for any detail design inherent in the shop drawings and for all errors and omissions. Contractor shall remain responsible for confirmation and correlation of all dimensions for fabricated components at the job site.</p>	
REVIEWED <input type="checkbox"/>	
REVIEWED & MODIFIED <input type="checkbox"/>	
REVISE & RESUBMIT <input type="checkbox"/>	
Date Returned	Shop Drawing No.
Reviewed by	Job No.

4.3.5.3 Field Review

The *SER* should:

- (a) Visit or have a representative visit the site at intervals as agreed with the *Client* or required by the AHJ to observe the quality and the progress of the construction of those elements designed by the *SER*. At the discretion of the *SER*, proprietary products, connections and other structural elements which have been designed by *Supplementary Structural Engineers* should be inspected by those other engineers at the appropriate stage of construction and reported in writing to the *SER*;
- (b) Prepare site visit reports outlining observations and deficiencies in the work and bring them to the attention of the contractor's site representative;
- (c) Distribute site visit reports to the contractor and the *Prime Consultant*. Where the *Owner* directly retains the services of the *SER*, it is recommended that the *Owner* also be sent copies of the reports;
- (d) Conduct a final project review and advise the *Client* of all observed defects or deficiencies whether or not they have been previously reported. Include in this report any action recommended for correction or resolution of these defects or deficiencies. Inspected completed corrections.
- (e) Conduct warranty inspection, if required.

4.4 ADDITIONAL STRUCTURAL ENGINEERING SERVICES

In addition to the *Basic Services*, the *SER* may provide the following *Additional Services* if the *SER* and the *Client* reach appropriate mutual agreements. They are generally not considered intrinsic parts of the basic structural design services, as discussed in Section 4.3, and are not part of the minimum services which the *SER* should provide under these guidelines.

Examples of *Additional Services* are:

- 4.4.1 Design work resulting from changes to the project as originally described and agreed to under the contract between the *SER* and *Client*, such as changes in scope, complexity, diversity or magnitude of the project;
- 4.4.2 Preparation of alternate structural designs and related documentation after selection of the *Primary Structural System* made during the conceptual and schematic design stage;
- 4.4.3 Review, design and preparation of documentation of alternate systems, if requested by the *Prime Consultant*, the *Client* or the contractor;
- 4.4.4 Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- 4.4.5 Review of alternate designs or products after completion of the *Contract Documents*;
- 4.4.6 Work resulting from changes necessary because of construction cost over-run which is outside the control of the *SER*;
- 4.4.7 Translation of *Contract Documents* into a second language, conversion to other units, or special preparation of drawings for reduction;
- 4.4.8 Work associated with *Non-Structural Elements* beyond those described under *Basic Services*;
- 4.4.9 Review of design drawings or Specifications prepared by others to determine adequacy of anchorage of *Non-Structural Elements*;
- 4.4.10 Preparing or assisting with detailed cost estimates;
- 4.4.11 Quantity take-offs and preparation of bills of materials;
- 4.4.12 Seismic risk analysis;
- 4.4.13 Special dynamic analysis beyond that required by codes such as spectrum or

- time-history response to seismic forces or floor-response to vibratory equipment;
- 4.4.14 Design of seismic restraints for mechanical or electrical equipment, architectural features and other *Non-Structural Elements*;
 - 4.4.15 Special physical model analysis such as wind-tunnel tests or shaking table tests;
 - 4.4.16 Field investigation of existing buildings and structures including surveys of existing construction;
 - 4.4.17 Filing application for and obtaining permits that are normally the responsibility of others;
 - 4.4.18 Preparation of demolition documents;
 - 4.4.19 Determination of structural fire-resistance requirements;
 - 4.4.20 Tenant-related design services;
 - 4.4.21 Preparation of shop or fabrication drawings;
 - 4.4.22 Preparation of reinforcing steel bending schedules or other types of shop drawings;
 - 4.4.23 Continuous or detailed inspections of construction;
 - 4.4.24 Design review or field observations of shoring or of bracing for excavations and building or of underpinning of adjacent structures;
 - 4.4.25 Design or review of the contractor's methods, procedures and construction equipment with respect to the effect on the structure;
 - 4.4.26 Design or review of the contractor's design of formwork, falsework or construction bracing;
 - 4.4.27 Review of additional *Submittals* when occasioned by improper or incomplete *Submittals*;
 - 4.4.28 Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor;
 - 4.4.29 Extra work arising from disputes due to problems outside the control of the *SER*;

- 4.4.30 Preparation of *Record Drawings* of the structures;
- 4.4.31 Work due to extended time schedules for design or construction beyond the control of the *Prime Consultant* or *SER*;
- 4.4.32 Services as an expert witness in connection with any public hearing, arbitration, or court proceedings concerning the project, including attendant preparation for same;
- 4.4.33 Work resulting from damage as the result of fires, man-made disasters, or natural disasters;
- 4.4.34 Overtime work requiring premium pay when authorized;
- 4.4.35 Travelling time outside of normal requirements;
- 4.4.36 Preparation of *As-Built Drawings*.

4.5 FABRICATION DRAWINGS AND DOCUMENTS

The *Fabricator* or manufacturer shall produce all necessary drawings and documents to represent the work covered by the contract with the contractor. These drawings and documents are prepared following a review of the design drawings, Specifications and *Contract Documents* supplied by the *SER* and following the resolution of any error or requested changes. Fabrication drawings and documents usually include:

4.5.1 STRUCTURAL ELEMENT /CONNECTION DESIGN DRAWINGS

The drawings for proprietary structural elements, such as open web steel joists, shall be sealed, signed and dated by the *Supplementary Structural Engineer* who designed these items;

4.5.2 ERECTION DRAWINGS

These drawings shall specifically show the location of structural members, connections and components to be supplied by the *fabricator*. When these drawings incorporate design by the *Supplementary Structural Engineer*, the drawings shall be sealed, signed and dated by the *Supplementary Structural Engineer*. To clarify responsibility, the *Supplementary Structural Engineer* may qualify the extent of work which has been designed by him/her;

4.5.3 SHOP FABRICATION

These drawings produced by the *fabricator* shall provide all information necessary for shop personnel to fabricate and assemble the items. The drawings shall be sealed, signed and dated when incorporating design by a *Supplementary Structural Engineer*.

4.5.4 CONSTRUCTION ENGINEERING DRAWINGS

These drawings or documents produced by the contractor shall cover temporary loadings, temporary bracing and shoring, falsework and erection sequence instructions. The drawings shall be sealed, signed and dated by a qualified *Professional Engineer*.

