



APEGGA

*The Association of
Professional Engineers, Geologists
and Geophysicists of Alberta*

***Responsibilities for
Engineering Services for
Building Projects***

v1.0

April 2001

Responsibilities for Engineering Services for Building Projects

FOREWORD

This guideline outlines engineers' responsibilities related to the design and construction of buildings. It replaces the following seven APEGGA guidelines that covered some, but not all, of the engineering disciplines and phases of the design and construction process:

- *Commissioning;*
- *Consultant Fees for Building Projects;*
- *Professional Practice in Building Design;*
- *Professional Practice in Building Projects Using Pre-manufactured Building Components;*
- *Required Detail Content in Electrical Drawings and Specifications for Constructions or Tender;*
- *Responsibility for Structural Design on General Engineering and Building Projects;* and
- *Review During Construction on Building Projects.*

This document differs from the previous guidelines in that it:

- Covers all of the major engineering disciplines involved in buildings;
- Covers all of the different phases of design, construction, and post-construction; and
- Deals with the concepts, which were introduced in the 1997 edition of the *Alberta Building Code*, of registered professionals of record, engineers of record and coordinating registered professionals for building projects.

The previous APEGGA guidelines had dealt primarily with the design-bid process. This document is intended to be generally applicable, or at least adaptable, to many types of project delivery methods.

This guideline is intended to satisfy the following objectives:

- Enhance the quality of engineering services provided to the owner of a building project;
- Maximize the safety of the public associated with engineering work on building projects;
- Encourage consistent methodologies and practices that will have a positive effect on the quality of the completed project;
- Reflect the intent of the Engineering, Geological and Geophysical Professions Act and Regulations; and
- Serve as a reference for the Discipline Committee in adjudicating allegations of unskilled practice of the profession.

Responsibilities for Engineering Services for Building Projects

v1.0

Participants

APEGGA's Practice Standards Committee (PSC) publishes practice standards, recommended practices and guidelines to promote high levels of professional service. A PSC subcommittee of the following individuals prepared the early drafts of this document:

Norm Webster, P.Eng., Chair
Mark Lasby, P.Eng.
Howard Leung, P.Eng.
Jim Sawers, P.Eng.
Dave Thurston, P.Eng.
Charlie Weir, P.Eng.

Through the later stages of development, additional individuals were added to provide technical input. At the time the document was completed, the subcommittee had the following membership:

Norm Webster, P.Eng., Chair
Gerry Carson, P.Eng.
Verlin Koch, P.Eng.
Rene Koltjes, P.Eng.
Tim McGinn, P.Eng.
Jim Oswell, P.Eng.
Fruch Pagnotta, P.Eng.
Marc Sabourin, P.Eng.
Jim Sawers, P.Eng.
Ron Skene
Alan Williams, P.Eng.

Comments that may help to improve this document should be addressed to:

Ray Chopiuk, P.Eng.
Director, Professional Practice
APEGGA
1500 Scotia One, 10060 Jasper Avenue
Edmonton, Alberta T5J 4A2
E-mail: rchopiuk@apegga.org
Fax: (780) 426-1877

Responsibilities for Engineering Services for Building Projects

v1.0

TABLE OF CONTENTS

1. OVERVIEW.....	1
1.1 SCOPE	1
1.2 PURPOSE	2
1.3 QUALIFICATION	2
2. DEFINITIONS	3
3. GENERAL PROJECT REQUIREMENTS AND ORGANIZATION	10
3.1 REGULATIONS PERTAINING TO INVOLVEMENT OF PROFESSIONAL ENGINEERS.....	11
3.2 SELECTION OF TEAM MEMBERS	11
3.3 COMPENSATION FOR PROFESSIONAL SERVICES	13
3.4 COMMON FORMS OF PROJECT ORGANIZATION.....	13
3.5 MANAGEMENT OF RISK.....	14
3.6 QUALITY MANAGEMENT	15
3.7 GENERAL RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS.....	17
4. GUIDELINES FOR PROFESSIONAL PRACTICE.....	30
4.1 GENERAL.....	30
4.2 BASIC ENGINEERING SERVICES	30
4.3 SUPPLEMENTAL SERVICES.....	47
APPENDIX A - TYPICAL ORGANIZATION RELATIONSHIPS.....	51
APPENDIX B - STRUCTURAL ENGINEERING CALCULATIONS AND DRAWINGS	52
B-1 GENERAL.....	52
B-2 STRUCTURAL CALCULATIONS	52
B-3 STRUCTURAL DRAWINGS.....	53
APPENDIX C - MECHANICAL ENGINEERING CALCULATIONS AND DRAWINGS.....	57
C-1 GENERAL.....	57
C-2 SITE	57
C-3 PLUMBING AND DRAINAGE	58
C-4 HEATING, VENTILATING, AIR CONDITIONING, AND REFRIGERATION (HVAC&R)/CONTROLS.....	61
C-5 FIRE PROTECTION.....	62
APPENDIX D - ELECTRICAL ENGINEERING CALCULATIONS AND DRAWINGS	64
D-1 GENERAL.....	64
D-2 SITE	64
D-3 POWER.....	64
D-4 LIGHTING	65
D-5 LIFE SAFETY SYSTEMS.....	66
D-6 COMMUNICATIONS	67

**Responsibilities for Engineering Services
for Building Projects**

v1.0

D-7 BUILDING CONTROL SYSTEMS	68
D-8 GROUNDING	69
D-9 SPECIAL SYSTEMS	69
D-10 RISERS AND SINGLE LINES	69
D-11 SCHEDULES	70
APPENDIX E – GEOTECHNICAL ENGINEERING SERVICES	71
E-1 INTRODUCTION	71
E-2 REPORTING	72
APPENDIX F – POTENTIAL RESPONSIBILITY GAPS AND CONFLICTS.....	74
F-1 INTRODUCTION	74
F-2 EXAMPLES OF POSSIBLE RESPONSIBILITY GAPS.....	74
F-3 CAUTIONARY NOTES	79
APPENDIX G – LETTERS OF COMMITMENT, LETTERS OF COMPLIANCE, AND SCHEDULES.....	81
G-1 APPLICABLE STANDATA.....	81
G-2 LETTERS OF COMMITMENT AND COMPLIANCE FROM COORDINATING REGISTERED PROFESSIONAL, REGISTERED PROFESSIONAL OF RECORD AND SPECIALTY PROFESSIONALS	81

Responsibilities for Engineering Services for Building Projects

v1.0

1. OVERVIEW

The *Alberta Building Code* requires that qualified professionals assume responsibility for design of building projects that fall within the scope of the code. The concepts of registered professional of record, engineer of record and coordinating registered professional were introduced in the 1997 *Alberta Building Code*. This document provides guidance on incorporating those professional responsibilities into the contractual and organizational relationships typically used for building projects.

Notwithstanding their duties under common law, APEGGA members are subject to the special responsibilities to protect the public interest as indicated in the *Code of Ethics* under the Engineering, Geological and Geophysical Professions Act and the Regulations. Professional engineers cannot contract out of those responsibilities.

This document addresses the responsibilities of all of the major engineering disciplines involved in building projects. All phases of the basic engineering services that would normally be provided under typical contractual arrangements are outlined. The implications of alternative methods of project delivery, other than design-bid, are also addressed.

The appendices provide further information with respect to:

- Typical organizational relationships found on building projects;
- The normal scope of engineering services for the engineers of record; and
- Discussion of potential situations where responsibilities between disciplines may be unclear.

1.1 Scope

This document sets out recommended practices related to the design and construction of building projects that APEGGA members should meet and follow in providing professional engineering services. It describes the roles and responsibilities of engineers and outlines the professional services that the project team participants should generally provide.

The scope does not extend to buildings that are exempt from the jurisdiction of the Safety Codes Act, such as farm buildings and small buildings described in the *Alberta Building Code*. Buildings that are exempt from the Safety Codes Act and the Engineering, Geological and Geophysical Professions Act and Regulations do not require the involvement of a professional engineer except in specific circumstances dictated by the authority having jurisdiction. Nevertheless, work on exempted buildings must be performed to the same standards applied to non-exempted buildings.

Responsibilities for Engineering Services for Building Projects

v1.0

1.2 Purpose

This document is intended to establish minimum standards of practice for APEGGA members to follow in fulfilling their professional obligations, especially in regard to their primary duty to protect the public. Variations in the application of this document may be required, but members must always exercise professional judgment in providing services.

This guideline is intended not only to help avoid the recurrence of some problems that have arisen in the past but also to help address changes in the *Alberta Building Code* regarding definitions of the responsibilities of registered professionals.

1.3 Qualification

Notwithstanding the purpose and scope of this guideline, the decision by an engineer not to use this document does not mean that he or she is negligent or unprofessional in the performance of professional services. Any such judgment will depend upon a detailed analysis of all the facts to determine if another qualified engineer in circumstances of a similar nature would have conducted himself or herself in a similar manner.

Responsibilities for Engineering Services for Building Projects

2. DEFINITIONS

For the purposes of this document, the following terms and definitions apply.

2.1 As-Built Drawings

Drawings that are prepared from measurements taken on site to depict accurately the actual characteristics (size, shape, depth, trade name, location, type, etc.) of elements of the construction.

2.2 Association (APEGGA)

The Association of Professional Engineers, Geologists and Geophysicists of Alberta.

2.3 Authority Having Jurisdiction (Authority)

Authority having jurisdiction means a safety codes officer in the building discipline appointed pursuant to the Safety Codes Act.

2.4 Basic Services

The services provided by the registered professionals of record, as defined in Section 4.0.

2.5 Building

Building means any structure used or intended for supporting or sheltering any use or occupancy.

2.6 Client

The party who engages the coordinating registered professional or registered professionals of record to provide professional engineering services for any work in regard to the building.

2.7 Code

The current edition of the *Alberta Building Code* proclaimed under the Safety Codes Act.

Responsibilities for Engineering Services for Building Projects

v1.0

2.8 Commissioning

Commissioning encompasses the architectural, structural, mechanical, electrical, process and specialty systems, and is defined as "the process of proving the performance of the equipment and systems to determine their capability to meet performance requirements."

2.9 Constructor (contractor)

Constructor means a person who contracts with an owner or his or her authorized agent to undertake a project, and includes an owner who contracts with more than one person for the work on a project or undertakes the work on a project or any part thereof.

2.10 Contract Documents

All documents including the engineering and architectural drawings and specifications as defined in the construction contracts for the construction of the building.

Contract documents should clearly convey the intent of the design, particularly with respect to completeness, physical location and sizes, ratings and capacity, and coordination with other disciplines for the construction of the building.

2.11 Coordinating Registered Professional (CRP)

Coordinating registered professional means a registered professional retained to coordinate all design work and field reviews of the registered professionals of record required for the project.

2.12 Designer

Designer means the person responsible for the design.

2.13 Distributor

The person, company or other entity that represents the manufacturer of pre-manufactured building components as a sales organization.

Responsibilities for Engineering Services for Building Projects

v1.0

2.14 Due Care

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

2.15 Electrical Engineer of Record (EER)

The member with general responsibility for the electrical integrity and completeness of the electrical systems as provided by Section 3.0 of these guidelines.

2.16 Engineering Work

Engineering work means the preparation of designs, plans, drawings, detail drawings, specifications or graphic representations for electrical, mechanical and structural systems or components in buildings, and includes any applicable geotechnical engineering work.

2.17 Erector

The sub-contractor responsible for the erection of structural and other components to satisfy a specific portion of a contract.

2.18 Fabricator

The sub-contractor responsible for the supply and fabrication of components to satisfy a specific portion of a contract.

2.19 Farm Building

Farm building means a building or part thereof that does not contain a residential occupancy and that is associated with and located on land devoted to practice of farming, and used essentially for housing of equipment or livestock, or the production, storage or processing of agricultural and horticultural produce or feeds.

2.20 Field Review

Field review means a review of the work:

- a) at the project site of a development to which a building permit relates, and

Responsibilities for Engineering Services for Building Projects

v1.0

- b) where applicable, at fabrication locations where building components are fabricated for use at the project site for which the building permit is issued. It covers situations where a registered professional in his or her professional discretion considers it necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the registered professional.

2.21 Geotechnical Engineer of Record: (GER)

The member with general responsibility for the integrity and completeness of the geotechnical aspects of a project as provided by Section 3.0 of the guideline.

2.22 Mechanical Engineer of Record: (MER)

The member with general responsibility for the integrity of the mechanical systems as provided by Section 3.0 of the guideline.

2.23 Member

A registered professional engineer in good standing of the association.

2.24 Non-Structural Elements

Elements of a building 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.

2.25 Operating and Maintenance Manual

A collection of information containing all the necessary technical information on building systems for the building owner/user to carry out maintenance and operation.

2.26 Owner

Owner includes a lessee, a person in charge, a person who has care and control and a person who holds himself or herself out as having the powers and authority of ownership or who for the time being exercises the powers of ownership.

Responsibilities for Engineering Services for Building Projects

v1.0

2.27 Primary Structural Element

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

2.28 Primary Structural System

The combination of the basic 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.

2.29 Permit Number

The number issued to a permit holder (a partnership, corporation or other entity that practices engineering, geology or geophysics in its own name) pursuant to the Engineering, Geological and Geophysical Professions Act.

2.30 Quality Assurance

Evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

2.31 Quality Control

Monitoring specific project results to determine if they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory results.

2.32 Quality Planning

Identifying which quality standards are relevant to the project and determining how to satisfy them.

2.33 Record Drawings

Drawings that represent the final drawings issued and that 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.

Responsibilities for Engineering Services for Building Projects

v1.0

2.34 Registered Professional

Registered professional means a person who is registered or licensed to practice as:

- a) an architect under the Architects Act, or
- b) an engineer under the Engineering, Geological and Geophysical Professions Act.

2.35 Registered Professional of Record (RPR)

Registered professional of record means a registered professional retained to be responsible for the integrity and completeness of the design and field reviews of one or more of the following systems for a project:

- a) architectural;
- b) structural (SER);
- c) mechanical (MER);
- d) electrical (EER);
- e) geotechnical (GER).

2.36 Review Professional

The individual or firm engaged in accordance with the *Alberta Building Code* to determine whether or not construction conforms to final design.

2.37 Secondary Structural Elements

Elements that are structurally significant for the function they serve but do not contribute to the overall strength or stability of the primary structural system. Examples of secondary structural elements are elevator support rails and beams, curtain-wall systems, cladding, and vibration restraints for architectural, mechanical and electrical elements.

2.38 Specialty Elements

Elements that are designed by the specialty professional. 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, prefabricated wood or metal buildings, noise and vibration isolation devices, elevators). They also include

Responsibilities for Engineering Services for Building Projects

v1.0

elements, such as civil engineering works, which do not fall under the disciplines named in 2.35.

2.39 Specialty Professional

The member who prepares the design and supervises the preparation of documents for specialty elements of the project. The specialty professional shall seal specific element designs and documents prepared by or under the supervision of the specialty professional and is responsible for the design, and, in some cases, field review of such elements.

2.40 Structural Engineer of Record (SER)

The member with general responsibility for the structural integrity and completeness of the structural systems as provided by Section 3.0 of this guideline.

2.41 Submittals

Items required by the contract documents to be submitted by the constructor, such as requests for payment, progress reports, shop drawings, manufacturer's literature on equipment, concrete-mix designs, aggregate-gradation reports, schedules. Submittals are normally used by the registered professional of record to aid in ascertaining whether the work substantially complies in all material respects with the plans and supporting documents prepared by the registered professional of record.

2.42 Supplemental Services

Services that the registered professional of record may provide in addition to the basic services.

2.43 Work

Work means any activity, duty or function regulated by this guide or the *Alberta Building Code*, and carried out on or about the construction site or on, in or about a building.

Responsibilities for Engineering Services for Building Projects

v1.0

3. GENERAL PROJECT REQUIREMENTS AND ORGANIZATION

Professional services may be performed by engineers and architects employed by different organizations or by separate departments within a large organization. Coordination of the engineering work and construction activities requires special care and attention. To produce quality engineering work, members of a project team need to understand and accept their respective responsibilities for integrity and completeness in the design and construction process. They must participate in the established quality-control procedures for the specific assignment and communicate with other members of the project team. Finally, they must document their actions to provide a record for checking purposes or audit by their professional peers.

Allocation of responsibilities on building projects is not always well defined.

1. On any particular building project, there are several engineering disciplines and many contractual parties involved.
2. There can be various contractual parties and many potential types of contractual arrangements. For example, a design professional could be a prime consultant or a sub-consultant, and could be engaged by an owner, constructor or sub-constructor.
3. In addition, there are many types of “project delivery methods”, each with its peculiarities (e.g. traditional design-bid, fast-tracked, design-build, etc.).
4. Some aspects of professional responsibilities are not always clearly defined – they may not be specifically attached to a particular discipline or to a particular registered professional of record.
5. Certain aspects of design for building construction are sometimes undertaken without involvement of design professionals where, in fact, there should have been such involvement.

Consequently, there is a potential for some responsibilities to be unassigned or to be unclear.

APEGGA supports the proposition that members should receive fair and adequate compensation for services rendered and that this principle applies to the services outlined in this document. In no event will low fees be justification for services that do not meet this guideline. Members may wish to discuss this document with owners or with employers when receiving instructions for assignments and reaching agreements regarding the work to be carried out and compensation.

APEGGA requires that its members, both individual and corporate, only undertake such assignments for which they are qualified by virtue of their training and experience. If a company's area of professional practice is limited to structural engineering, it must restrict its advertising and representations to reflect that limitation. Its proposals should indicate the

Responsibilities for Engineering Services for Building Projects

v1.0

organizational arrangement with respect to professional services in the geotechnical, electrical and mechanical engineering disciplines. Companies that offer design-build services for a building project to the public are required to provide the professional services to complete the project in accordance with the *Alberta Building Code*, the Safety Codes Act and the Engineering, Geological and Geophysical Professions Act. They are required to utilize registered professionals who will assume responsibility for the various areas of practice in which they offer services.

3.1 Regulations Pertaining to Involvement of Professional Engineers

Involvement by registered professional is mandated by various laws and regulations, e.g., the *Alberta Building Code* or the Engineering, Geological and Geophysical Professions Act. The purpose of involvement by professional engineers is primarily to help protect public safety. The *Alberta Building Code* requires that a qualified professional assume responsibility for design of building projects that fall within the respective sections of the code.

In addition, the coordinating registered professional named to assume responsibility for the total project design must be capable of coordinating the design team made up of one or more professional disciplines.

The *Alberta Building Code* also requires that a professional engineer undertake a field review of the construction relative to the design.

3.2 Selection Of team members

The recommended procedures for selecting a consultant are as described in the APEGGA guideline *Selecting Engineering, Geological and Geophysical Firms*.

3.2.1 Selection of Coordinating Registered Professional

The owner prepares, with qualified assistance if necessary, a comprehensive scope of assignment prior to selection of the coordinating registered professional and the negotiation of a fee basis that is appropriate for the proposed project.

The owner should select a professional with appropriate qualifications and experience. The professional selected may be in-house staff, a consultant or a design-build constructor. The selection process should emphasize capability to provide overall professional services, including design, contract administration and field review for the total building project. If a design-build constructor is selected, the design-build constructor assumes the responsibilities of the coordinating registered professional. The design-build constructor must have suitably qualified professional staff to carry out these duties or retain a professional consultant to assume the responsibilities of the coordinating registered professional.

Responsibilities for Engineering Services for Building Projects

v1.0

The scope of the assignment, prepared by the owner, should establish owner needs, including preferences or restrictions regarding the use of pre-manufactured building components and other conceptual considerations.

3.2.2 Selection of Registered Professionals of Record

Depending upon the organization of the project, the coordinating registered professional, the owner or the constructor selects registered professionals of record and specialty professionals based on their competence and capacity to undertake the assignment.

3.2.3 Selection of Specialty Professionals

Specialty professionals are selected based on the particular needs of the project. They may be selected by the owner, coordinating registered professional, registered professionals of record, or constructor or sub-constructor to the constructor.

In the case of pre-manufactured buildings, the coordinating registered professional in conjunction with the owner will determine if a pre-manufactured building is appropriate for the project. The coordinating registered professional may review available pre-manufactured building components and may prepare a comprehensive request for bids or proposals. The request would describe various requirements, including design criteria, loads, applicable codes, specifications and other relevant information, such as, but not limited to, delivery and cost.

The coordinating registered professional and the owner must recognize that, in selecting pre-manufactured building component suppliers, they are also selecting the specialty professionals employed by those suppliers. These specialty professionals must be evaluated with respect to their competence and capacity to undertake the assignment. Specialty professionals must be registered in the Province of Alberta, otherwise professional responsibility could rest with the registered professional of record.

3.2.4 Selection of Professional to Perform Field Review

The registered professionals of record of the project would normally perform field reviews. Where this is not practical or acceptable to either party, a professional with appropriate qualifications and experience should be selected.

The registered professional of record should have input into the selection of the registered professional engaged to perform the field review. The choice of registered professional engaged to perform field review should be subject to the approval of the applicable registered professional of record.

The registered professional engaged to perform field review prepares a confirmation of engagement. It describes the scope of services, taking into account the complexity of the project, the experience of the constructor and any other special circumstances.

Responsibilities for Engineering Services for Building Projects

v1.0

The registered professional of record should satisfy himself or herself that the allocation of responsibilities and services for field review are appropriate for the specific project. In some projects, it is essential for the registered professional of record to maintain a certain level of involvement throughout the project to determine that the intent of the design is understood and followed.

3.2.5 Selection of Constructor

The owner selects by tender or negotiation, from a list of qualified companies, a firm to construct the building.

Refer to section 3.4 for alternative forms of project organization and delivery.

3.3 Compensation for professional services

Members of APEGGA are authorized to offer professional services to the public either as individuals or as corporate entities. Engineers are expected to negotiate scope of services and fees necessary to provide a level of professional service that fully satisfies the requirements of the Engineering, Geological and Geophysical Professions Act. Engineers must avoid competition that is based primarily on the cost of their professional services without due consideration for other factors.

These principles are outlined in the guideline *Recommended Conditions of Engagement and Schedule of Professional Fees for Building Projects*, which was prepared jointly by APEGGA and the Alberta Association of Architects. The guideline is endorsed and supported by the Consulting Engineers of Alberta.

It is APEGGA's objective to encourage negotiations on fees and scope of services that result in professional services that optimize client benefits on building projects. The cost of professional services on a building project is typically a small percentage of the capital and operating cost of the developed facility. Care should be taken to select fully competent professionals. It is also important to select a basis of fees that complements the services required to meet the needs of the project and to obtain the desired quality of the completed work.

3.4 Common forms of project organization

The principles of professional responsibility on which this guideline is based are the same as those used in other practice guidelines published by APEGGA. The principles are not intended to restrict the various organizational arrangements commonly used on projects. The principles presented in this guideline apply to all types of project organizational relationships and project delivery methods. For example, they apply to design-build projects contracted between an owner and a constructor, and they also apply to the traditional arrangement of the design-bid contract.

Responsibilities for Engineering Services for Building Projects

v1.0

The following are descriptions of four typical organizational relationships commonly used for building projects. (Charts depicting these relationships are illustrated in Appendix A.)

Option 1 describes the organizational arrangement in which the owner engages a coordinating registered professional to coordinate all registered professionals of record and specialty professionals.

Option 2 describes an organizational arrangement in which the constructor engages a coordinating registered professional to coordinate all registered professionals of record and specialty professionals.

Option 3 describes an organizational relationship in which the constructor engages registered professionals of record and specialty professionals in the disciplines not available in-house. In this option, the coordinating registered professional may be within the constructor's organization.

Option 4 describes an organizational arrangement similar to Option 3, but in which the registered professionals of record are engaged by sub-contractors.

Many factors will influence the choice of organizational relationship for any particular project. In addition, many variations of organizational relationships, over and above those illustrated in Appendix A, are possible. For example, in Option 1 the mechanical engineer of record could be a part of the coordinating registered professional's organization or an independent consultant contracted to the coordinating registered professional. Under Options 2, 3 and 4, in which the owner contracts directly with a constructor, the owner may also directly retain his or her own bridging consultant(s). The bridging consultant assists the owner by preparing terms of reference, evaluating consultant's proposals and reviewing the consultant's work for general conformity to contract requirements.

Specialty professionals may be a part of or be contracted to any of the individual organizations indicated in Appendix A. For example, in Option 4 a specialty mechanical or structural system could be the responsibility of a specialty engineer who is employed by the constructor or sub-contractor.

Under all options, regardless of the contractual relationships, the responsibilities of the coordinating registered professional and the registered professionals of record remain as outlined in this guideline and as defined in the *Alberta Building Code*.

3.5 Management of risk

Management of risk for the owner, constructor, registered professionals and others is a consideration in every building project.

Responsibilities for Engineering Services for Building Projects

v1.0

Effective control of risk in a professional practice requires a quality-management program involving organizational and operational considerations. Important elements of such a program include:

- Effective documentation and communication of project requirements;
- Clear definition of the responsibilities of all project participants;
- An effective system of progress milestones with appropriate checks and reviews; and
- Adequate professional liability insurance coverage.

Professional liability insurance is an important aspect of risk management for the owner and registered professionals. Professional liability insurance can be provided by comprehensive project-specific insurance acquired by the owner, or, more commonly, practice policies purchased by the professional firms.

3.6 Quality management

Quality management includes the processes required to ensure that the project will satisfy the needs for which it was undertaken and will meet the project specifications. It further includes all activities of the overall management function that determine the quality policy, objectives and responsibilities. It also covers implementation by means such as quality planning, quality control, quality assurance and quality improvement. Project quality management addresses both the management of the project and the product of the project.

The APEGGA *Professional Practice Guideline* outlines the management of technical quality and the requirement for the development and implementation of a professional practice management plan. (The *Professional Practice Guideline* references the American Society of Civil Engineers' *Quality in the Construction Project*, which deals with quality assurance and quality control.)

Fundamental principles of quality management include:

- Securing and assigning suitably qualified staff;
- Defining responsibilities;
- Ensuring that the project scope is defined and understood; and
- Ensuring that timelines are appropriate.

The principles of care and due diligence in the discovery and elimination of errors or omissions in a design assignment apply to all projects. The documentation of the entire

Responsibilities for Engineering Services for Building Projects

v1.0

design process – commencing with the pre-design report through summaries of assumption, design criteria, design notes, drawings and specifications – provides the framework on which a quality-management program is based.

The following is a summary of the key elements of an effective quality management program for building projects.

3.6.1 Review of Project Scope

The project scope should be reviewed at key points in the design process to ensure that the project will meet the owner's expressed needs and is achievable within the specified constraints or regulatory requirements. Checks could occur at completion of a pre-design report and at intervals through the preparation of tender documents (e.g. 50%, 75%, 95% and 100%.)

3.6.2 Preparation and Distribution

This includes preparation and distribution to the design team of comprehensive design criteria, including geotechnical and other special considerations.

3.6.3 Coordination of Decisions

Covers coordination of decisions being made by the coordinating registered professional and the registered professionals of record, constructor and any other affected parties.

3.6.4 Review and Checking of Design

Review and checking of the design, drawings and specifications by the registered professional of record should include:

- Owner program;
- Pre-design reports;
- Design criteria, assumptions, design notes, calculations, dimensions, selection of materials, conflicts, clarity, errors, omissions and accuracy;
- Conflicts with design of other registered professionals of record; and

Responsibilities for Engineering Services for Building Projects

v1.0

- Verification of calculations, including computer calculations, by alternate methods.

3.6.5 Independent Reviews

The registered professional of record should ensure special precautions, such as independent reviews, are done where appropriate and that assumptions and judgments are objectively analysed and found to be soundly based.

3.6.6 Application of Professional Stamps

Professional stamps are applied to the design documents after the respective registered professionals of record have checked the documents thoroughly.

3.6.7 Communication and Coordination

The degree of formality in documenting the various communications on a design assignment will vary with the scope and complexity of the project. Decisions and directives should be communicated in writing.

Meetings between the coordinating registered professional and the client should be recorded by minutes or confirming letter. Information, such as design criteria, should be communicated by letter and copies provided to all members of the design team.

Regular coordination meetings between the coordinating registered professional and members of the design team should be conducted with an agenda and minutes should be distributed.

Decisions and directives by the coordinating registered professional should be communicated in writing with copies to all members of the design team. Communications among members of the design team on key assumptions and decisions should also be in writing and copies provided to the coordinating registered professional.

Documents, such as drawings and specifications, should be distributed with transmittal forms.

Project documentation should clearly establish a historical record of the design process, including all of the key decisions.

3.7 General Responsibilities Of Organization Participants

Organization participants have different responsibilities, as outlined below.

Responsibilities for Engineering Services for Building Projects

3.7.1 Owner

To carry out the design and construction of the project in a manner that meets appropriate standards of public safety and the requirements of applicable building regulations, the owner should take the following actions.

- a) Obtain adequate financing before proceeding with the project.
- b) Establish contractual relationships to ensure that the project team includes a coordinating registered professional and registered professionals of record in the applicable disciplines.
- c) Co-operate with the coordinating registered professional to develop an adequate written description of the needs, expectations and constraints to be considered in the project assignment.
- d) Co-operate with the coordinating registered professional and registered professionals of record to set out a written description of the scope of service of the coordinating registered professional and of the registered professionals of record.
- e) Co-operate with the coordinating registered professional to establish a realistic schedule for the provision of the coordinating registered professional's services.
- f) Acquire the right to construct on the property.
- g) Acquire the zoning approvals for the project.
- h) Ensure that all required approvals, licences and permits from the authorities having jurisdiction are obtained.
- i) Enter into a contract with a constructor for the construction of the project.
- j) Respond to the various reports and other recommendations by the coordinating registered professional with decisions on all aspects of the project. (Owner decisions that overrule public safety and environmental considerations must be dealt with by any registered professional associated with the project, in accordance with the applicable professional code of ethics.)
- k) Recognize that, because code interpretation of the authority having jurisdiction may differ from that of the coordinating registered professional and the registered professionals of record, some changes may be required by the authority.
- l) Provide for a reasonable contingency in the project budget, recognizing that unforeseen circumstances can arise.

Responsibilities for Engineering Services for Building Projects

v1.0

-
- m) Authorize in writing any additional services that may be required.
 - n) Recognize that drawings, specifications and other documents prepared by the coordinating registered professional and the registered professionals of record are for the project. Such documents should not be used or copied for other projects without the agreement of the coordinating registered professional and registered professionals of record, and without advice from a qualified design professional.
 - o) Ensure that registered professionals are engaged to review during construction in accordance with the requirements of the *Alberta Building Code*.
 - p) Assume the role of prime constructor, under Alberta Safety Codes Act, or delegate this role to the constructor or other party that is qualified and engaged specifically for that role.
 - q) Notify the authority in writing of any change in name of the registered professional retained to review during construction.
 - r) Ensure that the registered professional of record or professional retained to review during construction submits completed schedules. The schedules are to be signed by the responsible professional in each of the applicable disciplines and should indicate the review of construction conforms to the drawings, specifications and the *Alberta Building Code*.
 - s) If required by the authority, make applications in writing, for an occupancy permit or permission in writing to occupy part or all of the building, after determining that public safety requirements of the *Alberta Building Code* have been met.

If the owner fails or refuses to carry out the obligations as set out in paragraph 3.7.1, the coordinating registered professional should:

- Give notice to the owner advising the latter of the coordinating registered professional's recommendations; and
- Consider whether the coordinating registered professional can continue with the project, since the coordinating registered professional must comply with the minimum requirements of applicable regulations and codes of ethics.

3.7.2 Coordinating Registered Professional

As defined in the *Alberta Building Code*, the coordinating registered professional is responsible for coordinating the design and field reviews. To achieve this, and to enable the owner and registered professionals of record to perform their duties properly, the coordinating registered professional should meet the following criteria.

**Responsibilities for Engineering Services
for Building Projects**

v1.0

-
- a) Ascertain that the necessary and appropriate registered professionals are retained and that they have qualifications to perform the project assignment.
 - b) Direct and coordinate the design team through all phases of the project.
 - c) Establish procedures for timely and clear communication and documentation of decisions by the owner, registered professionals and constructor that affect the other parties.
 - d) Interpret and define for the registered professionals of record the needs of the owner in order to assist the owner in defining his or her intended functions and needs.
 - e) Establish in conjunction with the registered professionals of record the scope of work of each engineer of record for design, preparation of contract documents, field review and contract administration, including definition of basic services and additional services.
 - f) Establish contractual arrangements, and fees, and payment schedules. Association of Consulting Engineers of Canada documents No. 31, 32 or 32-S are recommended as a basis for such contracts.
 - g) Co-operate with the registered professionals of record to determine the design criteria for the assignment, including the applicable codes or other regulatory requirements.
 - h) Coordinate and review the designs, drawings and other contract documents produced by all participants of the design team.
 - i) Advise the owner with respect to tendering procedures or other project delivery methods.
 - j) Advise the owner of the requirements for field review.
 - k) Advise the owner with respect to the incorporation of commissioning into the design and specifications for the project.
 - l) Prepare or assist the owner in preparing, tender and contract documents.
 - m) Prepare documents for submission to authorities for applicable permits at appropriate stages of the work, including Schedule A-1, A-2, B-1, B-2, and C as applicable, as required by the *Alberta Building Code*.
 - n) Monitor the scope, schedule and budget of the design and construction of the project as it progresses. Resolve with the owner any changes needed to the scope, schedule and budget.

Responsibilities for Engineering Services for Building Projects

v1.0

If the coordinating registered professional fails or refuses to carry out the obligations as set out in paragraph 3.7.2, the registered professional of record should:

- Give notice to the coordinating registered professional advising the latter of the registered professionals of record's recommendations; and
- Consider whether the registered professionals of record can continue with the project. The registered professionals of record must comply with the minimum requirements of applicable regulations and the *Code of Ethics*.

3.7.3 All Registered Professionals of Record

As defined in the *Alberta Building Code*, the registered professional of record in each discipline is:

- Responsible for coordinating the design and field reviews; and
- Responsible for integrity and completeness of the design and field review in their respective discipline.

"Integrity and Completeness" is considered to mean:

- Responsibility is assigned or delegated for all aspects within the discipline;
- The divisions between the respective areas of responsibilities are clearly defined and avoid overlaps;
- The design criteria or assumptions are consistent among the different areas within the discipline;
- Work is delegated to specialty professionals as required; and
- Reviews are made where required to determine if delegation was understood.

The registered professional of record may rely on a specialty professional to be responsible for design and field review of elements in the respective disciplines. Nevertheless, the registered professional of record has the overall responsibility to ensure that all design is undertaken as is necessary to achieve a system that meets acceptable engineering standards. In addition, the registered professional of record must require the other members of the design team to sign and seal the documents for such elements.

A professional engineer, as required under the *Code of Ethics*, must only undertake work for which he or she is competent or qualified. Therefore, a registered professional of record is entitled to assume that if a professional engineer undertakes an assignment for a portion of the work within the discipline then the specialty professional is assumed to

Responsibilities for Engineering Services for Building Projects

v1.0

be competent and qualified. However, if evidence arises that suggests the specialty professional is not competent or qualified, then the registered professional of record must undertake such additional work to ascertain whether the person is competent.

3.7.3.1 Scope of Services

The respective registered professionals of record should, together with the coordinating registered professional, set out a written description of the scope of services of the registered professionals of record sufficient to enable them to meet the design and field review requirements of these guidelines and applicable building regulations.

3.7.3.2 Interdisciplinary Coordination

The respective registered professionals of record should inform other members of the design team of design decisions that will affect their disciplines, check for conflicts between disciplines and clarify areas where responsibilities are unclear. For example, there is sometimes a need to clarify the responsibilities between the disciplines of two or more registered professionals or disciplines in the following areas:

- Responsibility for coordinating the work of a specialty engineer;
- Responsibility for specification or field review of excavation and back-fill. (Either the coordinating registered professional, architect of record, structural engineer of record, or geotechnical engineer of record could be responsible for these particular activities. Therefore, on a project, the responsibility must be clearly understood.);
- Interface among disciplines (e.g. power requirements for mechanical controls);
- Space requirements (e.g. for mechanical and electrical rooms); and
- Responsibility for structural engineering input for secondary structural elements.

3.7.3.3 Monitoring Quality

The respective registered professionals of record should establish and monitor quality-control procedures for the engineering services of the respective disciplines. The former should also ascertain that the design conforms to the applicable codes and regulations.

3.7.3.4 Fast-Track Projects

In the case of "fast-track" projects, in addition, the registered professionals of record should:

- Establish with the coordinating registered professional the terms and conditions for issuing in advance preliminary or partially complete contract

Responsibilities for Engineering Services for Building Projects

v1.0

documents, and clearly define the requirements for partially complete contract documents; and

- Advise the coordinating registered professional that no part of specific design discipline documents, such as structural, can be considered complete before all contract documents, including architectural, mechanical and electrical drawings, are completed.

3.7.4 Structural Engineer of Record

The structural engineer of record may rely on other registered professionals to be responsible for elements of the primary structural system. However, the structural engineer of record has the overall responsibility to reasonably ascertain that all design is undertaken as is necessary to achieve a primary structural system that meets acceptable engineering standards. The structural engineer of record must require the other registered professionals to sign and seal the documents for such elements.

Where the primary structural system is designed by another professional engineer (specialty professional), as in the case of a pre-manufactured building, the structural engineer of record must obtain a letter of certification from the specialty professional for the portions of primary structural system designed by the specialty professional. The letter of certification must be signed and sealed by the specialty professional. The specialty professional must be a member or licensee of APEGGA. (See Appendix G for a discussion of letters of certification.)

The structural engineer of record is not responsible for the design of any secondary structural elements or any non-structural elements. However, the structural engineer of record remains responsible for designing the primary structural system to accommodate these elements and for allowing for their effects on the primary structural system. The structural engineer of record is responsible for reviewing these elements.

3.7.5 Geotechnical Engineer of Record

The geotechnical engineer of record has overall responsibility for the provision of geotechnical and foundation parameters on which the geotechnical aspects are designed. The geotechnical engineer of record should ensure that the design parameters provided meet acceptable engineering standards.

Where the geotechnical engineer of record provides geotechnical and foundation parameters to another registered professional, such as the structural engineer of record who undertakes the design of the foundations, the geotechnical engineer of record should review the final design to determine if the information and parameters provided have been correctly interpreted. A letter of review, signed and sealed by the geotechnical engineer of record, should be issued.

Responsibilities for Engineering Services for Building Projects

v1.0

3.7.6 Specialty Professionals

3.7.6.1 General

Specialty professionals could include engineers or other professionals with special expertise. The expertise could be in fields such as material testing, vibrations, wind-tunnel testing, acoustics, fire protection and fire code, systems verification and testing, commissioning, environmental impact assessment, manufacturing or other process design, kitchen layout, parking design, civil engineering, transportation engineering, landscaping, surveying, elevators or structural engineering for architectural components (e.g. glass, curtain wall and other cladding systems).

The specialty professional's work would be related to that of the coordinating registered professional or one of the registered professionals of record. The specialty professional should establish his or her scope of work, including preparation of contract documents and field review, together with any other professionals whose work has an impact on his or her discipline. The scope of work should be sufficient to meet the requirements of the registered professional of record to which his or her work is related.

The specialty professionals should:

- Inform other members of the design team of decisions that will affect their disciplines, check for conflicts between disciplines and clarify responsibilities if they are unclear;
- Establish and monitor quality-control procedures for the engineering services of their respective disciplines; and
- In their area of work, prepare design drawings and specifications for their respective disciplines in the format established by the coordinating registered professional or the registered professionals of record.

The registered professional of record to whom the work is related should define clearly the scope of work to be performed by the specialty professionals. The specialty professionals are responsible for the integrity and completeness of their design. The specialty professionals may be engaged by the owner, coordinating registered professional, one of the registered professionals of record or constructor.

Unless otherwise noted, the registered professional of record who is responsible for specifying an element or piece of equipment is responsible for assuring completion of the design and field review of any support, vibration restraint and seismic restraint for that element or piece of equipment. This design and field review may be done by the specialty professional retained to design that element or piece of equipment. When a specialty professional is retained to design the support and restraint of an element or piece of equipment, the registered professional of record who is responsible for

Responsibilities for Engineering Services for Building Projects

v1.0

specifying that element or piece of equipment shall review, for completeness, the design details prepared by the specialty professional.

The registered professional of record who is responsible for specifying that element or piece of equipment shall provide the support and restraint information to the structural registered professional of record to permit coordination with the building structural system.

3.7.6.2 Commissioning

The commissioning of construction projects is a managed process that shares responsibility for tasks between the owner, coordinating registered professional, registered professionals of record, the constructor and specialty testing firms. The responsibilities vary among projects and must be clearly defined, coordinated and integrated into the normal project development process.

The commissioning procedures must be planned well in advance of the completion of construction and implemented throughout the construction, start-up and post-construction phases of the project. The commissioning process is closely associated with the overall construction of the project and, in fact, is driven by the construction schedule.

3.7.6.3 Environmental

Specialty professionals or other qualified consultants should be retained to perform environmental audits where deemed necessary by a regulatory jurisdiction, coordinating registered professional, registered professional of record or the owner.

Responsibilities for Engineering Services for Building Projects

v1.0

3.7.7 Professional Engaged to Perform Field Reviews

The respective registered professionals of record of a building project should normally be engaged to perform field reviews to determine conformance to the design. Where the professional engaged to perform field reviews of the particular discipline is not the registered professional of record for the discipline in question, the professional engaged must satisfy himself or herself that he or she understands the intent of the design, including any special features or construction sequences.

He or she must not accept or approve any changes in the design without notifying and resolving any concerns with, the registered professional of record.

Where necessary, a specialty professional responsible for the design of specific aspects of the project should also be required to review the construction. If this is not done, then special care should be taken to obtain involvement of a specialty professional (for example, for pre-manufactured building components). This allows the professional engaged to perform field reviews to become familiar with the important elements of the design and any special procedures during erection or installation.

3.7.8 Constructor

The constructor has a contract with the owner. This contract usually specifies that the constructor is responsible for the labour, materials and equipment for the work and that the constructor is responsible, as set out in the contract documents, for the construction methods, techniques, sequences, procedures, safety precautions and programs associated with the construction work.

The constructor should meet the following criteria.

- a) Coordinate the work of the sub-constructors.
- b) Check that the constructors and sub-constructors work is ready for field review prior to field review by the registered professionals of record.
- c) Provide reasonable notice to the registered professionals of record when components are ready for field review.
- d) Satisfy the professional engaged to perform field reviews that the constructor understands the intent of the design, including any special features or construction sequences.
- e) Direct and supervise construction personnel so that construction complies with the drawings and specifications, and the work is conducted in a safe manner.

Responsibilities for Engineering Services for Building Projects

v1.0

-
- f) Notify the professional engaged to perform field reviews of errors, omissions and discrepancies discovered in the drawings and specifications.
 - g) Ensure that construction personnel comply with reasonable instructions and interpretations made by the professional engaged to perform field reviews.
 - h) Start up and test, in a timely manner, all systems incorporated in the design.
 - i) Deliver operating manuals and record drawings to the owner in accordance with requirements specified in the contract documents.
 - j) If requested, submit declarations during construction and at completion, stating conformity to drawings and specifications.
 - k) Establish, in accordance with builders' lien legislation, when substantial completion is achieved.

Where the constructor is responsible for designing and constructing a building project, contractual responsibilities of the constructor include all items listed for the coordinating registered professional, registered professionals of record and other design professionals. The responsibilities include review during construction.

3.7.9 Authority Having Jurisdiction

The authority should meet the following criteria.

- a) Review submitted contract documents for compliance with the *Alberta Building Code*.
- b) Verify that the drawings are stamped by a registered professional authorized to practice in Alberta.
- c) Interpret the intent of the *Alberta Building Code* when requested.
- d) Inform the owner that the professional engaged to perform field reviews will be required to submit a construction completion certificate (Schedule C in the *Alberta Building Code*).
- e) Inform the owner that an occupancy permit or permission in writing to occupy will be required before permission will be granted to occupy the building.
- f) Ensure that the registered professionals of record or another registered professional has been engaged to perform field reviews.
- g) Issue building permits.

Responsibilities for Engineering Services for Building Projects

v1.0

-
- h) Issue remedial orders if it is determined that:
 - The frequency or quality of field reviews are not adequate; and
 - Construction does not conform to the *Alberta Building Code*.
 - i) Issue stop-work orders on project under construction if it is determined that:
 - The professional engaged to perform field reviews is not performing that function;
 - The building permit is invalid;
 - Construction is unsafe;
 - Site conditions are unsafe.
 - j) Inform APEGGA of any concerns regarding unskilled practice or unprofessional conduct by professional engineers.
 - k) Issue occupancy permits or permission in writing to occupy.

3.7.10 Manufacturer

In some cases, the manufacturer designs and constructs a component of a building. If so, the manufacturer undertakes the responsibilities of a specialty professional and should meet the following criteria.

- a) Design the manufactured building component in conformance with the design criteria supplied by the design professional (registered professionals of record or specialty professional), the *Alberta Building Code*, other standards and good engineering practice.
- b) Prior to construction, supply shop drawings. This should include all necessary details and other information that may be required for the registered professionals of record or specialty professional to undertake his or her work. The manufacturer should stamp these drawings when requested by the registered professionals of record or specialty professional.
- c) Supply, prior to construction, when requested by the registered professionals of record or specialty professionals, a letter of certification (See Appendix D.) stamped and signed by a registered professional. The letter of certification should state:
 - The requirements specified by the registered professionals of record or specialty professionals, such as strength or performance, have been accommodated in the design; and
 - The process used in the fabrication of the components being supplied

**Responsibilities for Engineering Services
for Building Projects**v1.0

conforms to the *Alberta Building Code*.

3.7.11 Distributor

The distributor should:

- a) Represent the manufacturer as an extension to the latter's sales organization;
- b) Maintain current technical information on the manufacturer's products; and
- c) Facilitate communications between the registered professionals of record or specialty professionals and the manufacturer.

Responsibilities for Engineering Services for Building Projects

4. GUIDELINES FOR PROFESSIONAL PRACTICE

4.1 General

The following are outlines of the services that a coordinating registered professional and the registered professionals of record should provide as part of good engineering practice. The outlines may assist a coordinating registered professional and the registered professionals of record explain their services to an owner. These outlines are not intended to be exhaustive, and should not be interpreted as detracting from the previous provisions of this guideline.

4.2 Basic Engineering Services

This section outlines services that would generally be considered basic services under typical contractual agreements for professional services.

The usual phases of the basic services are generally organized in an agreement according to the sequential phases of a typical project. Each phase of the basic services generally contains those items that pertain most typically to the progress of work for that phase. However, a specific project may require that certain basic services be performed in phases that differ from those indicated below.

Dividing the work on a project into specific phases offers the advantage of establishing a set of distinct checkpoints or milestones for the work.

A building design assignment is commonly carried out in seven distinct phases covering:

- Pre-design;
- Schematic design;
- Design development;
- Contract documents;
- Tender;
- Construction; and
- Post-construction.

Activities in each phase will vary somewhat depending on the size and complexity of the assignment and on the project delivery method (e.g. design-build). However, all assignments require that consideration be given to specific questions and decisions in each of the phases.

Responsibilities for Engineering Services for Building Projects

v1.0

4.2.1 Pre-Design Phase

During pre-design, the coordinating registered professional should meet with the owner to determine his or her needs, expectations and any constraints to be taken into account in the design. Key decisions at these meetings, including design criteria, should be recorded and a pre-design report prepared by the coordinating registered professional following completion of any resulting investigations.

In the pre-design phase, the coordinating registered professional should:

- a) Define the scope of the project based on the owner's program;
- b) Investigate the site and aspects of the location that may affect the design;
- c) Initiate legal, utilities and topography surveys, geotechnical and soil contamination investigations and other testing;
- d) Consider conceptual alternatives for structural, mechanical and electrical systems; and
- e) Prepare a pre-design report covering conceptual sketches and specification notes. (A construction-cost estimate and schedule typically would be included in the pre-design report but would normally be provided as a supplemental service.)

At the completion of the pre-design phase, the owner considers the pre-design report and authorizes the coordinating registered professional to proceed based on specific instructions on all items that will affect the development of the schematic design phase.

4.2.2 Schematic-Design Phase

During schematic design, the design team investigates the proposed site and develops the conceptual alternatives, including any conditions or concerns highlighted in the pre-design report. Each of the design disciplines submits a report describing its respective investigations and recommendations to the coordinating registered professional.

Based on the submission of each of the disciplines, a schematic-design report should be prepared by the coordinating registered professional.

At the completion of the schematic-design phase, the owner considers the schematic-design report and authorizes the coordinating registered professional to proceed with the design-development phase.

4.2.2.1 Coordinating Registered Professional

In the schematic-design phase, the coordinating registered professional should:

**Responsibilities for Engineering Services
for Building Projects**

v1.0

-
- a) Finalize the owner/sub-consultant agreements that reflect the owner's authorization to proceed to the schematic-design phase.
 - b) Prepare the schematic-design report based on the submission by each of the disciplines and submit it to the owner.
 - c) Explain in writing to the owner all new construction materials or new techniques the coordinating registered professional and registered professionals of record proposes for use in the project and the alternatives, including the short and long-term risks, advantages and disadvantages. This will allow the owner to weigh the choices and make an informed decision before the design team proceeds any further.
 - d) Determine the number and timing of project-team meetings during each phase of the project.
 - e) Determine and maintain channels of communication.
 - f) Develop or review the project schedule, including any milestone dates.
 - g) Establish dates by when information affecting the individual discipline design will be needed from other disciplines.
 - h) Determine drawing standards and specifications format.
 - i) Define the responsibility for showing overall and detail dimensions on the drawings.
 - j) Establish procedures for quality control for the assignment.
 - k) Co-operate with others preparing cost estimates and schedules.
 - l) Review conformance with the requirements of the environmental impact assessment or environmental report on which designs are based.

4.2.2.2 All Registered Professionals of Record

In the schematic-design phase, all registered professionals of record should

- a) Establish the scope of professional service required to meet the needs of the project during design, fabrication and construction, and advise the owner and the coordinating registered professional accordingly.
- b) Define the need for any specialty professionals who may be required for the project in areas, such as material testing, vibration analysis, wind-tunnel testing,

Responsibilities for Engineering Services for Building Projects

v1.0

-
- acoustics, fire protection, fire code, systems verification and testing, commissioning and environmental impact assessment.
- c) Establish criteria, as required, for specialty professionals, such as geotechnical, environmental and vibration, acoustical and other consultants. Comment on reports presented.
 - d) Attend, as required, periodic meetings with the coordinating registered professional to obtain the owner's instructions regarding the owner's functional, aesthetic, cost and scheduling requirements, to prepare a preliminary design concept, and to report on their specific design.
 - e) Check applicable codes, regulations and restrictions, environmental issues and other factors affecting the design of the project.
 - f) Prepare preliminary sketches and outline specifications illustrating and defining the proposed design concept.
 - g) Prepare their portion of the schematic-design report and submit it to the coordinating registered professional.
 - h) Provide, if required, brief outline specifications for proposed materials.
 - i) Develop alternate design schemes where appropriate.
 - j) Prepare a description of alternatives considered.
 - k) Consider materials and systems suitable to the project requirements. Evaluate systems considering economy, performance, capital cost, compatibility with other design elements and requirements of relevant codes and authorities.
 - l) Consider the requirements of the other design professionals and provide the information they require.
 - m) Identify deviations from and potential impact on owner's program.
 - n) Conduct site visits and review existing drawings where appropriate.
 - o) Co-operate with others responsible for preparing the cost estimate.

4.2.2.3 Structural, Mechanical and Electrical Engineers of Record

In the schematic-design phase, the structural, mechanical and electrical engineers of record should:

Responsibilities for Engineering Services for Building Projects

v1.0

-
- a) Establish design criteria and limitations for specific structural, mechanical and electrical systems; and
 - b) Prepare preliminary calculations and establish base requirements for the structural, electrical, HVAC, plumbing and fire-protection systems.

4.2.2.4 Mechanical and Electrical Engineers of Record

In the schematic-design phase, the mechanical and electrical engineers of record should:

- a) Review, with the commissioning specialty professional, the design concept for conditions that affect the commissioning function. The results of the review are recorded in a written report to the coordinating registered professional.
- b) Determine the allocation of suitable space for mechanical rooms and other major mechanical installations and electrical vaults, electrical rooms, telephone rooms, generator rooms and other major items of electrical installation.
- c) Determine equipment weights, size and other physical characteristics that are to be considered in the building's structural, mechanical and electrical design.

4.2.2.5 Structural Engineer of Record

In the schematic-design phase, the structural engineer of record should:

- a) Develop the structural scheme for the primary structural system, together with alternate schemes where appropriate; and
- b) Consider the requirements of the other design professionals and provide the information relating to the primary structural system that they require.

4.2.2.6 Geotechnical Engineer of Record

In the schematic-design phase, the geotechnical engineer of record should:

- a) Develop recommendations as to the appropriate types of foundation systems for permanent building loads;
- b) Develop recommendations as to the appropriate types of foundation and shoring systems for temporary construction loads;
- c) Develop recommendations on the appropriate types of permanent and temporary systems for controlling groundwater conditions; and
- d) Submit the first draft of the geotechnical investigation report.

Responsibilities for Engineering Services for Building Projects

v1.0

4.2.3 Design-Development Phase

During the design-development phase, the selected scheme is developed in sufficient detail to enable commencement of the contract-document phase by all participants of the design team.

The coordinating registered professional confirms the owner's authorization to proceed to the design-development phase by providing a comprehensive summary of the basis on which the authorization was given.

At the completion of the design-development phase, the owner considers the design-development report and authorizes the coordinating registered professional to proceed with the contract document phase.

4.2.3.1 Coordinating Registered Professional

In the design-development phase, the coordinating registered professional should:

- a) Schedule, coordinate and attend meetings with the owner and design team.
- b) Prepare the design-development report and drawings for review and approval by the owner.
- c) Coordinate structural design criteria with deflection and lateral movement requirements of the other design-team participants.
- d) Coordinate structural, mechanical and electrical designs, including space and servicing requirements. In particular, the coordinating registered professional should notify the registered professionals of record of all interfaces between the disciplines and participate in their resolution.
- e) Co-operate with others responsible for preparing the cost estimates.

4.2.3.2 All Registered Professionals of Record

In the design-development phase, all registered professionals of record should:

- a) Continue development and expansion of schematic design documents to establish – through plans, sections, typical details, and equipment layouts, as appropriate – the final scope, relationships, forms, size and appearance of the project.
- b) Assist any specialty professionals retained for the project.
- c) Attend, as required, periodic meetings with the coordinating registered professional.

Responsibilities for Engineering Services for Building Projects

v1.0

-
- d) Prepare their portion of the design development report and submit it to the coordinating registered professional.
 - e) Finalize materials and systems for the project.
 - f) Consider the requirements of the other design professionals and provide the information they require.
 - g) Identify deviations from and potential impact on owner's program.
 - h) Establish procedures for quality control for the project.
 - i) Explain in writing to the owner all new construction materials or new techniques the coordinating registered professional and registered professionals of record proposed for use in the project. The alternatives, including the short and long-term risks, advantages and disadvantages should be explained. This will allow the owner to weigh the choices and make an informed decision before the design team proceeds any further.
 - j) Co-operate with others responsible for preparing the cost estimate.

4.2.3.3 Structural, Mechanical and Electrical Engineers of Record

In the design-development phase, the structural, mechanical and electrical engineers of record should refine preliminary calculations and establish base requirements for the structural, electrical, HVAC, plumbing and fire-protection systems selected.

4.2.3.4 Mechanical and Electrical Engineers of Record

In the design-development phase, the mechanical and electrical engineers of record should:

- a) Confirm conditions that affect the commissioning function with the commissioning specialty professional. The results of the review are recorded in a written report to the coordinating registered professional.
- b) Refine the allocation of suitable space for mechanical rooms and other major mechanical installations and electrical vaults, electrical rooms, telephone rooms, generator rooms and other major items of electrical installation.
- c) Update equipment weights, size and other physical characteristics that are to be considered in the building's structural, mechanical and electrical design.
- d) Determine the impact of noise and vibration from the mechanical and electrical systems and recommend solutions or recommend involvement of specialty professionals, if necessary.

Responsibilities for Engineering Services for Building Projects

v1.0

4.2.3.5 Structural Engineer of Record

In the design-development phase, the structural engineer of record should:

- a) Finalize the choice of structural systems based on the desired standards of quality and the effect of such standards on serviceability requirements such as:
 - Deflection of slabs and beams and the effect of deflection on non-structural items such as curtain walls and glazing;
 - Control of potential vibration induced by footfall or machinery
 - Lateral drift of the structure.
 - Crack control in concrete and masonry elements;
 - Foundation settlement;
 - Soil-structure interaction; and
 - Seismic deformations (permanent) and movements.
- b) Prepare preliminary foundation drawings based on recommendations by the geotechnical engineer of record and taking into consideration the mechanical and electrical underground services.


4.2.3.6 Geotechnical Engineer of Record

In the design-development phase, the geotechnical engineer of record should:

- a) Finalize recommendations for foundation systems for permanent building loads;
- b) Finalize recommendations for foundation and shoring systems for temporary construction loads;
- c) Finalize recommendations for permanent and temporary systems for controlling groundwater conditions; and
- d) Submit the final geotechnical investigation report.

4.2.4 Contract-Documents Phase

The coordinating registered professional confirms the owner's authorization to proceed to the contract-document phase. During the contract-document phase, the coordinating registered professional should have regular meetings, as necessary, with members of the design team and with the owner to maintain communication or to seek authorization respecting special areas that may be of concern. Minutes of meetings and letters confirming decisions must be maintained.

When the contract-document phase has been completed, the drawings, specifications and design notes are stamped by the registered professional  record in accordance

Responsibilities for Engineering Services for Building Projects

v1.0

with the APEGGA publication *Professional Designations, Professional Stamps and Permit Stamps*. Contract documents are submitted to the owner along with a report covering estimated cost, proposed construction schedule and requirements for professional services during construction.

At the completion of the contract-documents phase, the owner considers the contract documents and authorizes the coordinating registered professional to proceed to the tender phase.

Design notes are not normally submitted to the owner unless specifically requested. They must be available for review, however, and should therefore be prepared in appropriate form and clarity.

4.2.4.1 Coordinating Registered Professional

In the contract-document phase, the coordinating registered professional should meet the following criteria:

- a) Direct the preparation of the drawings, specifications and contract documents in accordance with his or her agreements with the various registered professionals of record.
- b) Ensure that all documents are appropriately stamped by the professional members who supervised their preparation and by the professional members assuming responsibility for the respective permit holders.
- c) Establish insurance and bonding requirements.
- d) Ensure contract documents include all information necessary for the constructor to establish a contract price, including a description of the requirements for professional engineering involvement in the design of components assigned to the constructor.
- e) Meet with the owner to determine the latter's needs, expectations and any constraints to be taken into account during the tendering and negotiation period through to signing of a contract.

4.2.4.2 All Registered Professionals of Record

In the contract-document phase, all registered professionals of record should meet the following criteria:

- a) Determine and specify in the contract documents which structural, mechanical and electrical elements, such as connection details and proprietary products, are to be designed by specialty professionals. The registered professional of record

Responsibilities for Engineering Services for Building Projects

v1.0

should specify the loads and design criteria for use by the specialty professionals in their design.

- b) Attend periodic coordination meetings.
- c) Coordinate with the authority having jurisdiction.
- d) Establish testing and inspection requirements.
- e) Comply with fire-resistance requirements as determined by the coordinating registered professional or specialty professionals.
- f) Seal the contract documents in accordance with the requirements of the Engineering, Geological and Geophysical Professions Act and Regulations.
- g) Specify special construction procedures when required to meet the intent of the design.

4.2.4.3 Structural, Mechanical and Electrical Engineers of Record

In the contract-document phase, the structural, mechanical and electrical engineers of record should:

- a) Prepare contract drawings;
- b) Prepare specifications.

Specifications are written descriptions of all elements that are best described rather than delineated. They include requirements related to the manufacture, methods of installation, design, performance criteria and workmanship of materials and equipment.

4.2.4.4 Mechanical and Electrical Engineers of Record

In the contract-document phase, the mechanical and electrical engineers of record should:

- a) Prepare mechanical and electrical calculations to support all mechanical and electrical designs;
- b) Retain a permanent record of input and output of any computer analyses along with a description of the software used.

4.2.4.5 Structural Engineer of Record

In the contract-document phase, the structural engineer of record should meet the following criteria:

Responsibilities for Engineering Services for Building Projects

v1.0

-
- a) Prepare structural calculations to support all structural designs. A hard copy of input and output of any computer analyses should be included along with a description of the software used.
 - b) Review the effect of non-structural elements attached to the 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.
 - c) 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 constructor familiar with the techniques of construction for the specified materials.
 - d) Framing plans may refer to architectural drawings for dimensions where appropriate and mutually agreed to by the structural engineer of record and the architect. Elevations, sections, and details should be of appropriate scale, number and extent to portray the relationship of members to each other and their interconnections. Care should be taken to determine that details noted "typical" are applicable to the condition being portrayed and that their location and extent are made explicit.

4.2.4.6 Geotechnical Engineer of Record

In the contract-document phase, the geotechnical engineer of record should:

- a) Prepare calculations to support all geotechnical parameters used in the geotechnical (design and construction) aspects of the project; and
- b) Review the contract documents prepared by the structural, mechanical, and electrical engineers of record to reasonably determine if the respective parties understood and complied with the geotechnical provisions provided for the design and construction of the project.

4.2.5 Tender Phase

The tender phase begins when bid documents are issued for the call for tenders. The tender phase ends at the completion of negotiations and allows the signing of a contract.

The coordinating registered professional confirms the owner's authorization to tender the project.

At the completion of the tender phase, the owner considers the tender report and authorizes the coordinating registered professional to proceed based on specific instructions on all items that will affect the awarding of the contract.

Responsibilities for Engineering Services for Building Projects

v1.0

4.2.5.1 Coordinating Registered Professional

In the tender phase, the coordinating registered professional should meet the following criteria.

- a) Respond to and record as addenda commercial and technical clarifications made during the tender phase.
- b) Explain in writing to the owner the impacts of the commercial and technical decisions made by the coordinating registered professional and registered professionals of record during the preparation of addenda.
- c) Review the tender-price breakdown submitted by the constructor to determine if it appears to be reasonable.
- d) Prepare a tender report comparing estimated costs with tender costs.
- e) Review alternatives proposed by bidders so the owner can weigh the choices and make an informed decision before signing a construction contract.
- f) Review the bidders qualifications with the various registered professionals of record. This revision should include the verification of qualifications required for submission as part of the tender process.
- g) After discussing with the various registered professionals of record and the owner, make formal recommendations with respect to the awarding of contract. If the owner overrules the recommendations, the consequences of that decision should be communicated to the owner in writing.
- h) Prepare Schedules A-1, B-1 and B-2, as required by the *Alberta Building Code* and documents required by the authority having jurisdiction for the overall project. Assemble all copies of schedules B-1 and B-2 prepared by the registered professionals of record.

4.2.5.2 All Registered Professionals of Record

In the tender phase, all registered professionals of record, for their respective disciplines, should:

- a) Provide addenda and clarification of documents;
- b) Assist in reviewing bidder's qualifications;
- c) Assist in analysis and evaluation of tenders submitted; and

Responsibilities for Engineering Services for Building Projects

v1.0

-
- d) Prepare Schedules A-2, B-1 and B-2 as required by the *Alberta Building Code* and any other documents required by the authority having jurisdiction.

4.2.6 Construction Phase

The construction phase begins with the signing of the contract for construction and ends with the issuance of Schedules C-1 and C-2 of the *Alberta Building Code* and certificate of final acceptance.

The coordinating registered professional confirms the owner's authorization to proceed with the construction phase.

4.2.6.1 Coordinating Registered Professional

In the construction phase, the coordinating registered professional should meet the following criteria:

- a) Direct, coordinate and administer the field review during construction process for the total project.
- b) Confirm communication channels and procedures, including circulation of field review reports.
- c) Establish with the constructor the general frequency and schedule of field review, including the notice required.
- d) Establish the routing of submittals. Normally, drawings and documents flow from fabricator to constructor, to coordinating professional of record, to registered professional of record and back via the same route.
- e) Confirm that the submittals have been reviewed by the constructor before review by the registered professionals of record.
- f) Review submittals for general compliance with the contract documents. Generally, the review does not include matters such as checking dimensions, quantities, or the review of the constructor's safety measures or methods of construction.
- g) Confirm that the submittals bear the signature and seal of the responsible specialty professional when required by the contract documents.
- h) Conduct periodic field reviews appropriate for the project and attend construction meetings.
- i) Administer the contract, including issuing of change orders and progress payments.

Responsibilities for Engineering Services for Building Projects

v1.0

-
- j) Review record drawings prepared and submitted by the constructor. The owner should be advised that these drawings are prepared by the constructor and have been reviewed only for general conformity to the drawing standards and the intent of the design.
 - k) Arrange for the constructor to submit and review operating and maintenance manuals for the equipment and systems supplied. The data submitted should include the manufacturer's recommendations for maintenance of each piece of equipment and other such information that will enable the owner to assume operation of the building.
 - l) Conduct substantial and total performance inspections, noting deficiencies observed and inspect completed corrections.
 - m) Issue a certificate of final acceptance to the constructor with a copy to the owner when all deficiencies have been corrected.
 - n) Initiate an inspection of the project prior to expiry of the warranty period. The coordinating registered professional, registered professionals of record, constructor and owner are present at this inspection.
 - o) Prepare a warranty-deficiency list as applicable and submit it to the constructor with a copy to the owner.
 - p) Prepare Schedule C-1, and assemble all copies of Schedule C-2 prepared by registered professionals of record.

4.2.6.2 All Registered Professionals of Record

In the construction phase, the registered professionals of record or the professional engaged to perform field reviews should meet the following criteria.

- a) Advise the owner and coordinating registered professional or registered professional on *Alberta Building Code* requirements with respect to field reviews.
- b) Determine if the intent of the design is understood by the constructor, particularly any special features or construction sequences intended in the design.
- c) Establish the type and frequency of field reviews appropriate for the project and provide those services.
- d) Withdraw field review services where the type and frequency of field reviews is limited to a level that is not adequate for the project. The owner, the authority, the coordinating registered professional and the registered professional of record should be notified.

**Responsibilities for Engineering Services
for Building Projects**

v1.0

-
- e) Interpret, as necessary, the intent of the drawings and specifications during construction, including obtaining clarification by the designer.
 - f) Confirm, when required by the contract documents, that the submittals bear the signature and seal of the responsible specialty professional.
 - g) Assist in confirming, reporting and scheduling procedures for testing and inspections.
 - h) Advise the coordinating registered professional of the requirement for testing, such as welding, concrete properties, and sub-grade and back-fill placement and compaction.
 - i) Review the qualifications of sub-contractors selected during the construction phase for conformance to the requirements specified in the contract documents and then make recommendations on sub-contractor selection. If the recommendations are overruled with respect to specified requirements, the consequences of that decision must be communicated in writing to the coordinating registered professional and the owner.
 - j) Review erection drawings and any other manufacturer-supplied drawings and specifications. The registered professionals of record should be satisfied that the intent of the design is met and that the drawings and specifications have been prepared under the supervision of qualified professionals.
 - k) Advise the coordinating registered professional and the constructor on the interpretation of the drawings and specifications, and issue supplementary details and instructions during the construction period as required.
 - l) Advise the coordinating registered professional on the validity of charges for additions or deletions from the contract and on the issuing of change orders.
 - m) Review, and comment on, the constructor's applications for progress payments. Estimate completed work and materials on site for payment according to the terms of the contract.
 - n) Review reports from the testing and inspection agencies to determine if the agency has verified compliance of the reported item of work with the contract.
 - o) Advise the coordinating registered professional and constructor of specific activities and/or construction stages that will require field review.
 - p) Conduct field reviews to observe the quality and the progress of the construction of those elements designed by the registered professionals of record.

**Responsibilities for Engineering Services
for Building Projects**

v1.0

-
- q) Prepare field review reports outlining observations and deficiencies in the work and bring them to the attention of the constructor's site representative.
 - r) Distribute field review reports to the constructor and the coordinating registered professional. Where the owner directly retains the services of the registered professionals of record, it is recommended that the owner also be sent copies of the reports.
 - s) At the discretion of the registered professionals of record, proprietary products, connections and other elements that have been designed by specialty professionals should be inspected by those specialty professionals at the appropriate stage of construction and reported in writing to the registered professionals of record.
 - t) Conduct substantial and total performance inspections for the applicable components noting deficiencies observed.
 - u) Review the record drawings and operating manuals for conformance to the contract documents.
 - v) Submit a complete Schedule C-2 of the *Alberta Building Code*.
 - w) Conduct an inspection of the project prior to expiry of the warranty period.
 - x) Prepare a warranty deficiency list as applicable and submit it to the constructor with a copy to the coordinating registered professional.
 - y) Report to the authority any circumstances involving refusal to conform to code or safety requirements.
 - z) Report to the owner and the authority when construction review services are withdrawn for any reason.

Responsibilities for Engineering Services for Building Projects

v1.0

4.2.6.3 Structural Engineer of Record

In the construction phase, the structural engineer of record should review shop drawings and other submittals of pre-engineered or proprietary structural elements. They should be reviewed for type, position, and connection to elements of the primary structural system, and for criteria and loads used for the design.

4.2.6.4 Mechanical and Electrical Engineers of Record

In the construction phase, the mechanical engineer of record and electrical engineer of record should:

- a) Witness system-specific testing as required by the authority or contract documents; and
- b) Interpret and clarify the requirements for the mechanical and electrical-system interfaces.

4.2.6.5 Geotechnical Engineer of Record

In the construction phase, the geotechnical engineer of record should conduct the following field reviews.

- a) Witness and test engineered fill materials, as required to assess compliance with design.
- b) Witness shoring or excavation design to determine if stability and geotechnical parameters are consistent with those used in the designs.
- c) Witness shallow foundation-bearing surfaces to determine if they are consistent with the geotechnical parameters assumed in design.
- d) Witness deep-foundation soil-stratigraphy to determine if subsurface conditions are consistent with the geotechnical parameter assumed in the design.

The *Alberta Building Code* requires continuous inspection during:

- installation of deep foundation units, and
- installation and removal of shoring structures, and related backfilling operations.

4.2.6.6 Specialty Professional

In the construction phase, the specialty professional should:

- a) Be responsible for the design of the elements and connections on the drawings where the specialty professional's seal and signature appear;

Responsibilities for Engineering Services for Building Projects

v1.0

- b) Define the extent of work that has been designed by the specialty professional; and
- c) Be responsible for the design of the elements and connections shown on the submittals, in the absence of a signature and professional seal by a specialty professional.

4.2.7 Post-Construction Phase

The extent to which post-construction services are included within the basic engineering services can vary widely depending on contractual relationships and circumstances.

4.2.7.1 Coordinating Registered Professional

In the post-construction phase, the coordinating registered professional should:

- a) Coordinate all post-construction activities of the design team;
- b) Encourage the timely resolution of all post-construction issues related to the original design; and
- c) Perform inspections related to warranties.

4.2.7.2 All Registered Professionals of Record

In the post-construction phase, all registered professionals of record should:

- a) Respond in a timely and professional manner to all post-construction design issues; and
- b) Perform inspections related to warranties.

4.3 Supplemental services

In addition to the basic services, the coordinating registered professional and the registered professionals of record may provide the following supplemental services if the coordinating registered professional and the registered professionals of record and the owner reach appropriate mutual agreements. They are generally not considered intrinsic parts of the basic design services, as discussed in Section 4.2.

4.3.1 Coordinating Registered Professional

Supplemental services might include:

- a) Reviewing items designed by others to confirm compatibility with the design of

Responsibilities for Engineering Services for Building Projects

v1.0

-
- the various systems;
 - b) Project management;
 - c) Construction management.
 - d) Filing applications for and obtaining permits;
 - e) Preparing cost estimates;
 - f) Revising – for reasons over which the registered professional of record has no control – reports, estimates, preliminary studies, design development studies provided by the registered professional of record;
 - g) Providing post-construction inspection services, if not specifically included in basic services; and
 - h) Resolving issues other than those relating to the original design, arising during post-construction inspections.


4.3.2 Registered Professionals of Record

Supplemental services might include the following.

- a) Preparing reports relating to the owner's long-range or other plans not included in Section 4.2.
- b) Performing engineering analysis, design and calculations required to evaluate alternatives proposed by bidders.
- c) Preparing an alternative building design or systems design not included in Section 4.2
- d) Preparing project construction cost, operating cost or lifecycle-cost estimates.
- e) Revising – for reasons over which the registered professional of record has no control – reports, estimates, preliminary studies, design-development studies provided by the registered professional of record.
- f) Revising – for reasons over which the registered professional of record has no control – designs, drawings, plans, specifications or any of the contract documents after their initial completion. The revisions could also incorporate alternatives proposed by bidders.
- g) Preparing designs not included in the contract documents.

Responsibilities for Engineering Services for Building Projects

v1.0


-
- h) Providing special analyses of the owner's needs, such as operational analyses, and preparation of operating or maintenance manuals, operating drawings or charts.
 - i) Preparing for special inspections and testing.
 - j) Preparing bills of materials, measuring quantities of work performed and preparing shop drawings.
 - k) Performing scheduling and expediting services during construction.
 - l)  Additional services arising out of separate contracts, cost-plus contracts and pre-considered contracts.
 - m) Providing advice and instructions to the owner beyond the scope of advice and instructions referred to in Section 4.2.
 - n) Preparing record drawings.
 - o) Providing furnishing drawings.
 - p) Assisting in litigation, arbitration, negotiation or other legal or administrative proceedings on behalf of the coordinating registered professional and/or the owner, and all necessary preparation.
 - q) Preparing applications and supporting documents for government grants, loans or advances.
 - r) Preparing or reviewing environmental assessments and impact studies, and assisting in obtaining approvals of authorities having jurisdiction over the environmental aspect of the project.
 - s) Providing renderings or models for use by the owner and the coordinating registered professional.
 - t) Obtaining on the coordinating registered professional's or owner's behalf, required approvals, licences and permits from municipal and governmental authorities having jurisdiction over the project.
 - u) Performing analyses involving the use of computer programs to simulate building energy use.
 - v) Commissioning of architectural, structural, mechanical and electrical systems, including training and maintenance assistance.
 - w) Providing post-construction inspection services, if not specifically included in

**Responsibilities for Engineering Services
for Building Projects**v1.0

basic services.

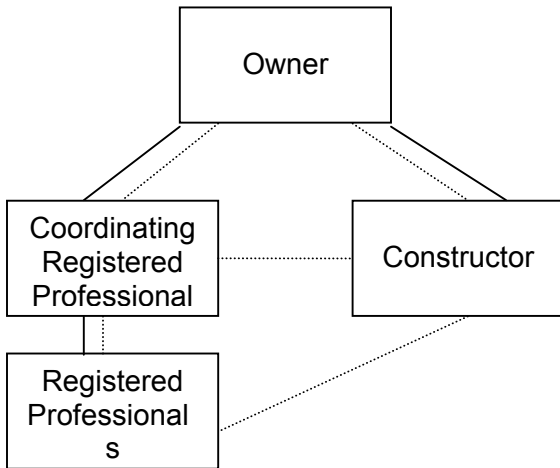
- x) Resolving issues, other than those relating to the original design, arising during post-construction inspections.

Supplemental services might entail providing additional or extended services made necessary by:

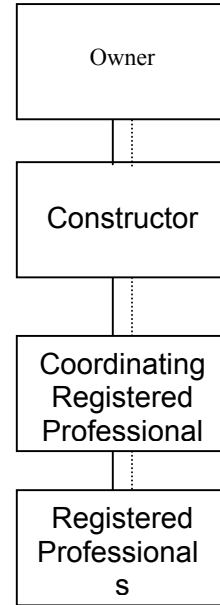
- Work damaged by fire or other causes during the term of the contract;
- Defective work of the constructor;
- Unreasonable prolongation of the contract time due to strikes and other reasons beyond the control of the registered professional of record;
- The constructor's default under the contract arising from his or her delinquency or insolvency, or the delinquency or insolvency of those employed by the constructor;
- Incorrect information or defective work provided by the owner or by the coordinating registered professional;
- Emergencies on site; 
- Non-performance of work covered by warranty.

**Responsibilities for Engineering Services
for Building Projects**

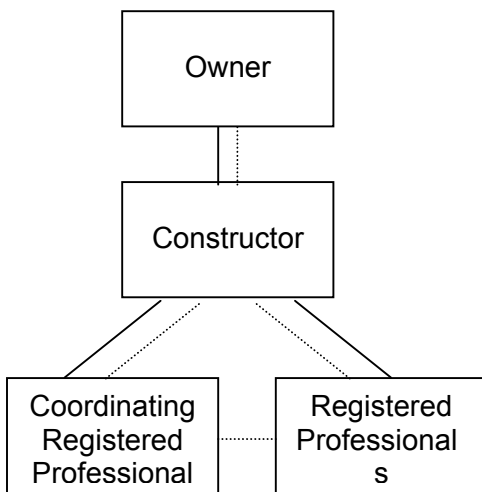
APPENDIX A - TYPICAL ORGANIZATION RELATIONSHIPS



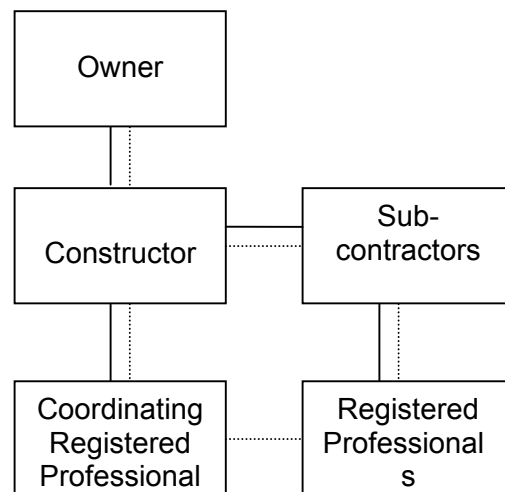
Option 1: Traditional Design-Bid Build 1



Option 2: Design



Option 3: Design Build 2



Option 4: Design Build 3

——— Communications
 Contracts

**Responsibilities for Engineering Services
for Building Projects**

APPENDIX B - STRUCTURAL ENGINEERING CALCULATIONS AND DRAWINGS

B-1 General

The structural engineer of record must prepare structural calculations to support all structural designs. The structural calculations should be prepared legibly and presentably, and be filed by the structural engineer of record for record purposes. A hard copy of input and output of any computer analyses should be included and so should a description of the software used.

B-2 Structural Calculations

In general, structural calculations and supporting documentation should include, but, not necessarily be limited to:

- a) Design criteria, covering;
 - Discussion and description of the design basis, including assumptions,
 - Latest building codes with edition dates,
 - Listing of all applicable live loads (They include, but are not limited to snow loads, seismic factors and wind-load criteria and any special loads and provisions greater than building code requirements as requested by the client or otherwise used by the structural engineer of record.),
 - Structural material specifications for concrete, reinforcing steel, masonry, structural steel, wood and other materials used,
 - Geotechnical report information and design criteria, and
 - Deflection limitations of structural elements and systems;
- b) Description of location for structural elements;
- c) Vertical load analysis and design of (including but not limited to):
roof structures floor structures, frames or trusses, columns, walls and foundations;
- d) Lateral-load analysis, including, but not limited to, design for seismic, wind and unbalanced-lateral earth forces;

Responsibilities for Engineering Services for Building Projects

v1.0

-
- e) Computer analyses and design input and output, and software identification, if applicable;
 - f) Special studies and analyses (dynamic, vibration, etc.), where used;
 - g) Independent check of the final structural design and documents to confirm the adequacy and appropriateness of the design (The independent check shall be performed by an engineer other than the original design engineer but the engineer conducting the independent check need not necessarily be from a separate company.);
 - h) The names of the structural design engineer(s) and design-check engineer; and
 - i) Project name and date.

B-3 Structural Drawings

Structural drawings should 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 constructor familiar with the techniques of construction for the specified materials. Drawings should indicate the project name and date.

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

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

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

a) Structural notes should include:

- 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, or, in the absence of a geotechnical report, the assumed design criteria;

Responsibilities for Engineering Services for Building Projects

v1.0

-
- Brief material specifications, including any fabrication criteria;
 - Absolute or relative deflection and vibration criteria for structural members;
 - Where forces are shown, they should be clearly identified as factored or unfactored.
 - Building codes and edition dates;
 - Pertinent design standards;
 - Reference to drawings and specifications prepared by other participants of the design team; and
 - Reference to submittals and field-review requirements.

b) Typical details

c) Foundation plans and schedules should include:

- General gridline dimensions and overall building dimensions;
- Allowable soil-bearing capacity, pile capacities and lateral earth pressures for retaining structures if not otherwise specified;
- Sizes, locations, dimensions, orientation and details of all foundations;
- Estimated pile length(s) or source of this information;
- Location of known existing services and existing foundations that conflict with structural foundations, or the source where this information can be found should be referenced; and
- If underpinning or temporary shoring is specified to be designed by others, there should be indication on the drawings of the areas designated to be shored or underpinned. If shoring or underpinning is designed by the structural engineer of record, there should be indication of all details and construction sequences.

d) Floor and roof framing plans and details should include:

- General gridline dimensions and overall building dimensions;
- Sizes, locations, dimensions and details of all structural elements;

Responsibilities for Engineering Services for Building Projects

v1.0

-
- 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 placing criteria;
 - Locations and details of control, construction, contraction and expansion joints;
 - Locations, sizes and reinforcing of significant openings; and
 - Provision for future extensions.

e) Schedules and details for columns, beams and walls should include:

- Element sizes;
- Anchorage to supporting elements;
- 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 members.

f) Connections

Where connections are specified to be designed by specialty structural engineers, the contract drawings should indicate all required information and governing forces. In such cases, the specialty structural engineer shall seal, sign and date the fabrication drawings. Where connections are designed by the structural engineer of record, they should show all dimensions and comprehensive connection details requiring no further engineering input. Under these circumstances, the structural engineer of record retains responsibility for these connections.

The structural engineer of record shall consider the design of the connections when sizing the structural members, e.g. HSS truss joints, post-tensioned anchorages.

**Responsibilities for Engineering Services
for Building Projects**

v1.0

General arrangement and details at intersections of different structural materials should be shown.

g) Sequence of construction should be included if this is critical to the functioning of the finished structure.

See also Appendix F.

APPENDIX C - MECHANICAL ENGINEERING CALCULATIONS AND DRAWINGS**C-1 General**

C-1.1 Each mechanical drawing should include the following items:

- name of the project
- north arrow
- scale of the plan
- consultant's name

C-1.2 A set of mechanical drawings should include a summary of all symbols indicated on the drawings.

C-1.3 All drawings, as well as details, elevations and sections should be properly cross-referenced.

C-1.4 All equipment and devices that require connection to the electrical system must be coordinated with the electrical engineer of record. At a minimum, the power, control and interlock requirement for each load should be indicated. Trade responsibilities and trade definition rules for the project should be established prior to passing information to the electrical engineer of record.

C-1.5 The structural engineer of record should be provided with drawings and information indicating concrete bases, curbs, roof openings, floor openings, wall openings, structural member penetrations and equipment weights/dimensions. The structural engineer of record also should be provided with details on the force imparted onto structural members due to piping expansion and anchorage.

C-2 Site

C-2.1 For clarity, the mechanical site plan should be superimposed on a landscape/architectural site plan.

C-2.2 The municipal address should be clearly indicated on the plan.

C-2.3 All mechanical utilities should be referenced to buildings, property line or other utilities. All features and dimensional information affecting routing, placement and function of the mechanical services should be indicated.

C-2.4 All invert information should be provided in metres (Geodetic).

C-2.5 Utility connection information should be provided for all services and information should include, but not be limited to, the following:

Responsibilities for Engineering Services for Building Projects

v1.0

1) Water supply, including:

- Pipe size and routing;
- Water meter/backflow preventor location and detail, if not shown on plumbing drawings, and
- Fire-protection demand where applicable.

2) Gas supply, including:

- Pipe routing;
- Meter location; and
- Gas load.

3) Sanitary drainage, including:

- Pipe size and routing;
- Invert and rim elevations; and
- Total fixture unit load.

4) Storm drainage, including:

- Pipe size and routing;
- Invert and rim elevation; and
- Storm-retention requirements if applicable.

C-3 Plumbing and drainage

C-3.1 Drainage Design

Floor plans and riser diagrams must indicate the installation arrangement of the drainage system. The following information should be included:

- Pipe sizes;
- Direction of slope; and
- Fixtures or devices served.

C-3.2 Roof Drainage

Roof drainage should:

- Indicate area served and roof drain locations;
- Show flow rates and retention data for control-flow roof drains if applicable;
- Indicate shallowest invert on lowest level and leaving invert (building connection) for both sanitary and storm-sewer mains; and

Responsibilities for Engineering Services for Building Projects

v1.0

- Detail and dimension all drainage sumps and lift stations, including incoming and outgoing inverts.

C-3.3 Water Systems

Floor plans should indicate at minimum:

- Location and type of fixtures and equipment;
- Complete details of water-entry piping, including water meter, pressure reducing devices and back-flow devices;
- System layouts showing connection to fixtures complete with pipe sizes;
- On multi-story buildings, indicate risers on floor plans and provide riser diagrams where appropriate; and
- For clarity, provide larger-scale plans (1:50) for areas with a high density of fixtures.

Schematics and diagrams should be provided to fully describe the operation of all major systems. Direction of flow and control points should be clearly indicated. The sequence of operation should be provided on the schematics or included in the control-system specifications.

C-3.4 Specialty Systems

Plans, schematics and diagrams should be provided to fully describe the operation of all specialty systems. Direction of flow and control points should be clearly indicated. The sequence of operation should be provided on the schematics or included in the control-system specifications.

C-3.5 Heating, Ventilating, Air Conditioning, and Refrigeration (HVAC&R)/Controls

C-3.6 Piping and Duct System Floor Plan Layouts

Floor plan layouts for the piping and duct systems should include:

- Duct and pipe sizes;
- Sizes, types, locations and capacities of all supply, return and exhaust-air terminals;
- Type and location of main valves. (Individual equipment valving can be shown on details); and
- All fire-damper locations.

Responsibilities for Engineering Services for Building Projects

v1.0

C-3.7 Operation of Major Systems

Schematics and diagrams should be provided to fully describe the operation of all major systems. Direction of flow and control points should be clearly indicated. The sequence of operation should be provided on the schematics or included in the control system specifications.

C-3.8 Supplementary Details

To avoid conflicts, supplementary details should be provided for boiler equipment, fan rooms and congested areas. For clarity, such details should be drawn in plan and elevation views at a scale of 1:50 or larger.

C-3.9 Piping and Ductwork

Piping and ductwork can be shown in single line except where necessary to show arrangement and clearance for piping or ductwork in ceiling spaces, shafts, header trenches and pipe chases.

C-3.10 Schedules

Schedules should be included to provide capacities and details for the performance of fans, air-handling units, pumps, etc. Alternatively, these schedules may be included in the specifications.

C-3.11 Fire Protection

1) Fire Extinguishers

The design responsibility for the fire extinguishers should be confirmed with the coordinating registered professional.

2) Standpipe and Sprinkler Systems

The following section assumes that a detailed set of sprinkler drawings will be provided by a fire-protection specialty consultant. If the mechanical engineer of record's scope of services includes engineered fire-protection drawings, they shall be provided in compliance with NFPA and the authority having jurisdiction. At a minimum, the mechanical engineering drawings should include the following:

- Specification of the zoning and hazard for each zone;
- Calculations determining water demand and pressure requirements. (These calculations should be used to determine if a fire pump is required);
- Main service location and risers;

Responsibilities for Engineering Services for Building Projects

v1.0

- Details of main fire-protection components, including fire-pump information; and
- Location, number and detail for interconnecting system devices to the fire or sprinkler monitoring system.

3) Specialty Fire-Protection Systems

Plans, schematics and diagrams should be provided to fully describe the operation of all specialty fire-protection systems. Direction of flow, control points and sequence of operation should be clearly indicated by:

- Calculations determining demand and pressure requirements;
- Specifying the zoning and hazard for each zone;
- Providing location, number and detail for interconnecting system devices to the fire or sprinkler-monitoring system; and
- Performance specification.

C-4 Heating, Ventilating, Air Conditioning, and Refrigeration (HVAC&R)/Controls

C- 4.1 Floor Plan Layouts

Floor-plan layouts for piping and duct systems should include:

- Duct and pipe sizes;
- Sizes, types, locations and capacities of all supply, return and exhaust air terminals;
- Type and location of main valves (Individual equipment valving can be shown on details); and
- All fire-damper locations.

C-4.2 Schematics and Diagrams

Schematics and diagrams should be provided as required for all major systems with notes to describe the function of control, flow and sequence of operation.

C-4.3 Supplementary Details

To avoid conflicts, supplementary details should be provided for boiler equipment, fan rooms and congested areas. For clarity, such details should be drawn in plan and elevation views at a scale of 1:50 or larger.

Responsibilities for Engineering Services for Building Projects

C-4.4 Piping and Ductwork

Piping and ductwork can be shown in single line except where necessary to show arrangement and clearance for piping or ductwork in ceiling spaces, shafts, header trenches, and pipe chases.

C4.5 Schedules

Schedules should be included to provide capacities and details for the performance of fans, air-handling units, pumps, etc. Alternatively, these schedules may be included in the specifications.

C-5 Fire Protection

C-5.1 Fire Extinguishers

The design responsibility for the fire extinguishers should be confirmed with coordinating registered professional.

C-5.2 Standpipe and Sprinkler Systems

The following section assumes that a detailed set of sprinkler drawings will be provided by a fire-protection specialty consultant. If the mechanical engineer of record's scope of services includes engineered fire-protection drawings, they shall be provided in compliance with NFPA and the authority having jurisdiction. At a minimum, the mechanical engineering drawings should include the following:

- Specification of the zoning and hazard for each zone;
- Calculations determining water demand and pressure requirements. (These calculations should be used to determine if a fire pump is required.);
- Main service location and risers;
- Details of main fire-protection components, including fire pump information; and
- Location, number and detail for interconnecting system devices to the fire or sprinkler-monitoring system.

C-5.3 Specialty Fire-Protection Systems

**Responsibilities for Engineering Services
for Building Projects**v1.0

Plans, schematics and diagrams should be provided, as required, for all specialty fire-protection systems with notes to describe the function, flow and operation. At a minimum, the following is required:

- Calculations determining demand and pressure requirements;
- Specification of the zoning and hazard for each zone;
- Location, number and detail for interconnecting system devices to the fire or sprinkler-monitoring system; and
- Performance specification.

**Responsibilities for Engineering Services
for Building Projects**

APPENDIX D - ELECTRICAL ENGINEERING CALCULATIONS AND DRAWINGS**D-1 General**

Each electrical drawing should include the symbol schedule, the name of the project, a north arrow and the scale of the plan. A set of electrical drawings should include a summary of all symbols indicated on the drawings. All drawings as well as details, elevations and sections should be properly cross-referenced.

D-2 Site**D-2.1 Equipment**

Locations of service points, power poles, transformers, grounding, lighting standards, luminaries, distribution panels, parking outlets and other equipment should be shown.

D-2.2 Wiring

Location and routing of all wiring including services, feeders branch wiring and empty conduit should be shown.

D-2.3 Details

The following should be provided:

- Details, as required, for equipment pads and bases, vaults, grounding, duct banks, manholes, parking lot distribution system and outlets, luminaries, and control circuits; and
- Information necessary for coordination of site services with utilities.

D-3 Power**D-3.1 Service**

Location and general arrangement of service equipment should be shown.

D-3.2 Distribution

The following should be shown:

- Location and general arrangement of service and service equipment;

Responsibilities for Engineering Services for Building Projects

v1.0

-
- Location and general routing of bus duct, cable tray, under-floor raceway and feeders; and
 - Equipment elevations and details where required by project size and complexity.

D-3.3 Equipment

Location, identification, type, rating, load, and circuiting for power receptacles, equipment connections, convenience receptacles, motors, loose motor control, disconnects and special outlets should be shown.

Outlet symbols should be properly identified and the applicable CSA designations shown.

Feeder sizes on either floor plans, single-line or on schedules should be indicated.

D-3.4 Branch Wiring

Home runs to panels, runs with multiple circuits, junction and outlet boxes should be shown.

Special mounting and installation provisions, where required, should be shown.

D-3.5 Electrical Heat

Location, layout and mounting of electric heaters and heating cables should be shown.

D-4 Lighting

D-4.1 Luminaries

Location, identification, type, circuiting, and switching should be shown. Luminaries should be coordinated with ceiling and finished to ensure proper application and accessibility for maintenance.

D-4.2 Switches and Controls

Location, circuiting, and control method should be shown.

D-4.3 Branch Wiring

Home runs to panels, runs with multiple circuits, junction and outlet boxes should be shown. Special mounting and installation provisions, where required, should be shown.

D-4.4 Low-Voltage Switching and Dimming

Locations of switches, dimmers, and control panels should be shown.

Responsibilities for Engineering Services for Building Projects

v1.0

D-5 Life Safety Systems

D-5.1 Emergency Generators, Transfer Switches, and Distribution

Location, identification, general arrangement and approximate sizes should be shown. Either a schematic diagram or operational description and control sequence should be included in the documentation. Fire-rated feeders should be included.

D-5.2 Emergency Lighting (Luminaries and Power Supplies)

Location, identification, type, ratings, and circuiting should be shown.

D-5.3 Exit Signs

Location, type, mounting, circuiting, and directional arrows should be shown.

D-5.4 Equipment

Location, connection, and circuiting for emergency equipment, such as fire pumps, should be shown.

D-5.5 Branch Wiring

Feeders, home runs, runs with multiple circuits, outlet and junction boxes should be shown.

D-5.6 Fire-Alarm Equipment

Location, identification, and approximate sizes of control panels, annunciators, power supplies, and amplifiers should be shown.

D-5.7 Devices

Location, type, and zoning for manual stations, automatic detectors, signals, door holders, door locks, flow switches, microphones, handsets, and speakers should be shown.

D-5.8 Interface

Location of connections to other equipment such as fire dampers, air-handling units, smoke doors, sprinkler pumps, elevators, etc. should be shown.

D-5.9 Branch Wiring

Responsibilities for Engineering Services for Building Projects

v1.0

Home runs, runs with more than one zone, outlet and junction boxes should be shown.

D-6 Communications

D-6.1 Raceways and Wiring

The following should be shown:

- Location, routing and sizes of risers, cable tray and distribution conduits; and
- Wiring for home runs, runs with more than one zone, outlets and junction boxes.

D-6.2 Telephone Equipment

The following should be shown:

- Location, identification, type and approximate sizes of telephone switches, panels, path panels and closets; and
- Telephone line protection and grounding.

D-6.3 Telephone Outlets

Location and identification of switchboards, zone and junction boxes should be shown.

D-6.4 Public Address (PA), Sound Masking, Sound Reinforcement, and Intercom Equipment

Location, identification, type and approximate sizes of amplifiers, signal sources, processors, switches, master stations and patch panels should be shown.

D-6.5 PA Outlets

Location, type, and zoning of speakers, microphones, jacks and outlets should be shown.

D-6.6 Closed-Circuit TV Equipment

Location, identification, type and zoning for cameras, switchers, processors, recorders, and monitors should be shown.

D-6.7 Master Antenna Systems

Location and type of antennae, amplifiers, splitters, and outlets should be shown, as well as detail mounting requirements for antennae.

D-6.8 Intrusion Alarm and Door Security

Responsibilities for Engineering Services for Building Projects

v1.0

Location, identification, type and zoning for control panels, door switches, motion detectors, detection equipment, control stations and signals should be shown.

D-6.9 Data System

Location, identification, type and approximate sizes of antennae, central equipment and panels should be shown.

D-6.10 Radio, Mobile Radios and Pagers

Location, identifications, type, mounting, and approximate sizes of antennae, central equipment panels should be shown.

D-6.11 Nurse Call

The following should be shown:

- Location, identification, type and approximate sizes of control panels, annunciators, master stations, indicators and outlets; and
- Location, type and zoning of stations, indicators and outlets.

D-6.12 Clock Systems

The following should be shown:

- Location, identification, type and approximate sizes of control panels, annunciators, master clocks; and
- Location, type and zoning of other clock outlets.

D-7 Building Control Systems

Location, identification, type and approximate sizes of equipment control panels, control devices and outlets for control systems such as building management systems and process controls, etc. should be shown.

Wiring for home runs should be shown. For runs serving more than one device, outlets and junction boxes should be shown. Control schematics should be provided where required.

Responsibilities for Engineering Services for Building Projects

v1.0

D-8 Grounding

The following should be shown:

- Location, type and configuration of all grounding electrodes, mats, etc.;
- Size, type and routing of all grounding conductors;
- Location and connection of all air terminals, interconnections, horizontal and down conductors for lighting protection, including antennae;
- Details of all special grounding means, such as grids, high-impedance grounding, computer floors and outlets, etc.; and
- Details of cathodic protection.

D-9 Special Systems

The following should be shown:

- Location, identification, type and approximate sizes of equipment, panels and outlets;
- Adequate details for power supply systems such as stand-by generators, uninterruptible power-supply systems, motor-generator sets, battery systems, etc.; and
- Wiring for home runs. For runs with more than one device, outlets and junction boxes should be shown.

D-10 Risers and Single Lines

Schematic riser diagrams should be provided showing general configurations for the following.

D-10.1 Power System Single Line

The following should be shown:

- Configuration, type, voltage and amperage ratings for the service and all switchgear, panel boards and motor-control centres;

Responsibilities for Engineering Services for Building Projects

v1.0

- Frame size and trip ratings of all over-current protective devices;
- Available and rated fault current at all switchgear, panel boards and over-current devices, if over 10,000 amps; and
- Metering control and relaying provisions. Unless shown elsewhere on floor-plans or schedules, feeder sizes should be shown.

D-10.2 Fire-Alarm Riser

General system configuration, control panels, annunciators, typical zones and interconnections should be shown.

D-10.3 Other System Risers

General system configuration, control panels, annunciators, typical zones and interconnections should be shown.

D-11 Schedules

D-11.1 Luminaries

The type, description, lamps, voltage, diffusers, and mounting should be shown.

D-11.2 Panels

The type, circuits, voltage, amperage, breakers and space quantities and mounting should be shown.

D-11.3 Motors and Equipment

Designation, horsepower (or kW), and/or full load amperage, disconnect type and protection, starter type, pilot devices, controls and interlocks should be shown. For all motors, kitchen equipment and special loads, requirements should be coordinated with the appropriate consultant. All motor control should be adequately and properly documented.

D-11.4 Electrical Heat

Schedules should properly specify all electrical heat required, such as baseboards, unit heaters and heating cables, etc. All hardware required, such as transformers, contactors and line thermostats, should also be specified.

APPENDIX E – GEOTECHNICAL ENGINEERING SERVICES

E-1 Introduction

This appendix differs from other appendices in this document. Whereas Appendices B, C, & D address the issue of what should be contained or shown within design calculations and drawings, the geotechnical engineering process often involves the subjective appraisal of geological and geomorphological conditions. Moreover, compared to other professions, the design report often contains fewer calculated design values and more qualitative recommendations for construction.

The objective of this appendix is to provide a listing of topics that could be addressed in the design process. Those issues that may require supporting calculations have been marked with an (*). The appendix also includes a listing of services that are commonly provided by the geotechnical engineer of record, as noted below.

E-1.1 Site Work

- Drilling/testpitting program;
- Groundwater monitoring;
- Soil sampling;
- Characterization of subsurface conditions;
- Insitu testing;
- Surveying;
- Load tests;
- Geo-environmental assessments;
- Airphoto interpretation;
- Geophysical investigations;
- Geological studies;
- Pre-construction investigation and survey of existing structure; and
- Corrosion Studies.

E-1.2 Laboratory Work

- Soil classification
- Determination of **index properties and strength/deformation characteristics**

E-1.3 Analysis / Consideration of Issues

- Foundation elements and bearing capacity (*);
- Settlement of foundation elements (*);
- Control of groundwater (temporary and permanent);

Responsibilities for Engineering Services for Building Projects

v1.0

-
- Slabs-on-grade;
 - Structural slabs;
 - Fills (landscape, engineered, structural);
 - Earth pressure coefficients (*);
 - Retaining structure analysis (*) – temporary and permanent;
 - Excavation support and underpinning evaluations and design (*) – global instability and internal stability; and
 - Slope stability (*)

E-2 Reporting

A report, summarizing the results of the site works, laboratory work, and analyses, should be prepared. It should include recommendations for the geotechnical aspects of design and construction of the project. Generally the report includes references to:

- Recommended design parameters for pile and/or footing foundations;
- Recommended design and construction provisions for control of groundwater;
- Recommendations for construction of slabs-on-grade, grade beams, and sub grades;
- Recommendations for design and construction of excavation support system;
- Recommendations backfill material and compaction;
- Recommendations for surface drainage criteria;
- Recommendations for concrete types;
- Recommendations for parking areas and access roadways; and
- Recommendations for roadway design and construction, including surfacing type (granular, concrete, asphalt).

Services beyond those outlined above are sometimes required and may be provided by the geotechnical engineer of record under terms mutually agreed upon between the client and the geotechnical engineer of record. They include:

- Environmental testing to evaluate possible presence of hazardous or toxic materials in soils or groundwater or design of mitigative measures;
- Installation and monitoring of groundwater observation piezometers or slope inclinometers;
- Attending construction progress meetings;
- Estimates or reviews of quantities and construction costs;
- On-site sewage-disposal system studies;

**Responsibilities for Engineering Services
for Building Projects**v1.0

- Routine monitoring of excavations required by occupational health & safety or other regulatory agencies with jurisdiction;
- Quality-control testing, including inspection and testing of engineered fill and backfill;
- Preparation or review of contract documents;
- Design and monitoring of ground modification improvement;
- Permanent dewatering or sub-drainage studies;
- Additional services due to changes in the scope, design, locations or magnitude of the project from that originally envisioned; and
- Service as an expert witness or fact witness in project-related disputes.

APPENDIX F – POTENTIAL RESPONSIBILITY GAPS AND CONFLICTS

F-1 Introduction

This appendix is intended to identify situations where there is a risk that responsibility may fall between disciplines, or where historically there has been controversy as to who should be responsible for an item.

The examples noted in Section 2 below are guidelines. Situations may arise where responsibility should be allocated differently from that described below. The common aspect of all examples is that the coordinating registered professional or the registered professional of record should ensure that the responsibilities are defined and understood.

This appendix also contains “Cautionary Notes” in Section 3.

F-2 Examples of possible responsibility gaps

F-2.1 Subsurface Drainage (Weeping Tile)

Drainage has historically been shown on drawings of various disciplines. The following is a guideline for assigning responsibility.

The geotechnical engineer of record has knowledge of the anticipated groundwater flows and therefore specifies the design parameters for the drainage – the backfill materials, filter materials, slopes, size, spacing, flow rate to be accommodated by sumps, pumps and other downstream plumbing.

The subsystem drainage pipes could be shown on either architectural, structural, or mechanical drawings that also indicate the underground features of the building, such as the outline of the foundation systems and sumps.

From the discharge point of the drainage system (i.e. into a sump) the mechanical engineer of record would design and draw the system based on flow parameters provided by the geotechnical engineer of record.

Field review of the perforated subsurface drainage pipe (i.e. up to but not including the sump) should be done by the geotechnical engineer of record.

F-2.2 Vapour Barriers below Floors on Ground

Several disciplines must provide input and share responsibility. The geotechnical engineer of record should indicate the implications of providing or not providing vapour barriers at the particular site. The structural engineer of record should decide, based on

Responsibilities for Engineering Services for Building Projects

v1.0

information provided by the geotechnical engineer of record, if vapour barrier is needed for structural serviceability (e.g., vapour barrier can enhance resistance to sulphates but requires extra precautions in curing to avoid slab curling). The coordinating registered professional should specify vapour barrier if needed to protect floor finishes.

F-2.3 Responsibilities For Cladding Design

Responsibilities for cladding design have sometimes not been clear. It is essential that design criteria and responsibilities be defined for:

- Resistance to leakage or transmission of air, water, and heat;
- Performance (strength, deflection, cracking) under lateral loads (wind, seismic, and pressure from air handling systems); and
- Accommodation of anticipated movements of the primary structural elements.

Sometimes portions of the system, or, in some cases, the entire system are designed and constructed by a specialist.

Note that in many cases, merely referring to the *Alberta Building Code* does not precisely define the design parameters for the cladding system. Deflections that can be tolerated by the various elements are not specified by the code. Also, there is room for interpretation in determining internal and external pressure coefficients. If further detail is not given, competing alternatives may not be fairly compared or an incorrect assumption may be made by the cladding-system designer. The coordinating registered professional must specify deflection criteria and must ensure that either the structural engineer of record or the specialty professional is designated to determine the design wind loads.

The following is a list of some of the elements of responsibility that need to be assigned and some suggestions or alternatives on how these can be resolved.

Coordinating Registered Professional

The coordinating registered professional has overall responsibility for:

- Design and construction review;
- Specifying the design criteria for various aspects of the system;
- Determining that the various components work together as an entire system; and
- Determining that all of the various areas of responsibility are covered, and delegation of responsibility to specialists as appropriate.

Structural Engineer of Record

The structural engineer of record should:

Responsibilities for Engineering Services for Building Projects

v1.0

-
- Specify anticipated movements of the primary structural system that the cladding system must be designed to accommodate; and
 - Provide guidelines to the coordinating registered professional to allow the latter to specify design parameters for the cladding system.

Mechanical Engineer of Record

The mechanical engineer of record is responsible for specification of air pressures resulting from operation of the air-handling systems (stack effect for tall buildings, plenum enclosures in the event that the cladding system forms a wall of the plenum).

Coordinating Registered Professional or Specialty Professional

Typically the following items would be the responsibility of either the coordinating registered professional or a specialty professional. The coordinating registered professional should specify who has responsibility for the design and field review of the following items:

- Design of the various layers (glass, metal, masonry, insulation, vapour barriers, air barriers, sealants, etc.);
- Design of attachments that attract load, e.g. snow guards, antennae, lifeline anchors, window washing equipment;
- Design of secondary structural elements that form part of the cladding system (girts, studs) in some cases the structural engineer of record will take on this role as a supplementary service. (In other cases, the coordinating registered professional will delegate this work to a specialty professional.); and
- Design of attachment of the cladding system to the structural frame. (The division line for responsibility needs to be established for the specific project e.g. ledger angles, their attachment to the face of the structure, elements embedded within the structure.)

F-2.4 Variable Frequency Drives

If the variable frequency drive is provided as an integral part of the mechanical equipment, it should be specified by the mechanical engineer of record. To ensure that the building electrical system can properly accommodate the equipment, the variable frequency drive specification should be reviewed by the electrical consultant.

If the variable frequency drive is not integral to the mechanical equipment, either the mechanical or electrical engineer of record may specify it. Both the mechanical engineer of record and the electrical engineer of record should review the specified equipment to ensure it is compatible with the respective building systems.

Responsibilities for Engineering Services for Building Projects

v1.0

Any technical review of a variable frequency drive by either the mechanical engineer of record or electrical engineer of record should – to ensure compatibility of the equipment and the length of electrical feeds – include the electrical motor that the drive serves.

Field review of the installed equipment should be provided by both the mechanical engineer of record and electrical engineer of record. Specific disciplines should review the equipment based on their area of expertise.

F-2.5 Field Reviews by Specialty Professionals

The specialty professional always comes under the area of one of the registered professionals of record or under the coordinating registered professional. The appropriate registered professional of record or coordinating registered professional should determine whether field reviews are required for the particular aspect of the building, and if so, who should do them.

F-2.6 Wood Trusses

F-2.6.1 Introduction

Problems have arisen in the past due to poor communications, unclear responsibilities or lack of knowledge in the field. It has resulted in improper installation and erection of trusses, or damage to trusses on site.

Experience has shown that there are a number of critical elements in the construction of a building containing wood trusses that require specific attention to detail or adherence to standards.

F-2.6.2 Responsibilities

The structural engineer of record's drawings, specifications, and details should make it clear to the specialty professional how the truss system and load-carrying systems supporting the trusses are coordinated.

The structural engineer of record should:

- Provide a building layout showing truss bearing points, girder truss locations and bearing points, material specifications, special framing details, permanent bracing details, and nailing and framing instructions;

(Temporary locations and bracing or erection sequence required to provide stability of individual members during construction is the responsibility of the constructor). The

Responsibilities for Engineering Services for Building Projects

v1.0

constructor should obtain from the manufacturer any special requirements regarding erection sequence or temporary bracing for the specific project.

- Provide point load values and locations;
- Review load-carrying mechanism taking loads down to the foundations;
- Provide loading diagrams, including built-up loads from snow drifts;
- Outline stamping requirements of the truss drawings;
- Check that the wood-truss design drawings match the site-specific requirements, including the assumed location of supports and the site specific design loads: and
- Review diaphragm and overall building bracing design for compatibility with truss bracing.

F-2.6.3 Training and Certification

A subcommittee of APEGGA's Practice Standards Committee has recommended that training and certification programs be developed for manufacturers and erectors. The structural engineer of record should become familiar with the status of such developments and incorporate appropriate clauses in the project specifications.

F-2.6.3 Role of Specialty Professional

A specialty professional should be responsible for the design and field review of the wood trusses. Where a specialty professional is not involved in the truss design or field review, the structural engineer of record assumes these responsibilities.

The structural engineer of record will rely on the specialty professional's certification that the design and construction of the wood trusses meet the requirements of the relevant codes and good engineering and construction practice.

The specialty professional should:

- Review drawings and specifications provided by the structural engineer of record to determine that the above noted items have been provided for and/or communicated to the specialty professional;
- Provide reasonable assurance to the structural engineer of record that the intent of the truss design will ultimately be manufactured. (Where the specialty professional is not involved in the manufacture of the trusses, the structural engineer of record should satisfy himself or herself that the manufacturing plant supplying the trusses

Responsibilities for Engineering Services for Building Projects

v1.0

has quality-control standards in place that will ensure the finished product meets the designer's intent.); and

- Design wood trusses and certify that they are designed and manufactured to meet their intended use.

F-2.6.4 Field Review

Field review is required, as mentioned elsewhere in this document. If the inspecting individual is not also the specialty professional for truss design, he or she should examine the drawings and specific details of the wood-truss assembly prior to visiting the site. Any uncertainty concerning the design or details must be resolved through discussion with the specialty professional.

F-3 Cautionary Notes

F-3.1 Durability

In the past, design professionals often have not considered durability but recently the cost to owners and to society of premature deterioration has become very apparent. CSA Standards S 478 and S 413 were prepared to address these concerns. CSA 413 deals with the durability aspects of parking structures.

CSA Standard S 478 presents durability as an issue that requires discussion between owners, design professionals and constructors to ensure that the durability issues are understood and that materials (and construction costs) reflect a common understanding of the needs of the project. Guidelines are given for design life of various components of a building. The coordinating registered professional should ensure that the appropriate discussions are held and documented.

F-3.2 Unique Local Requirements

Specific local knowledge is important for many aspects of building design. Registered professionals should make themselves aware of any specific local conditions that would not necessarily be reflected in building codes or trade publications. Examples are climatic data and geotechnical conditions.

Climatic Data

Climatic data given in the code reflects data obtained from specific sites. Local variations can exist. Care should be taken to investigate specific local conditions.

**Responsibilities for Engineering Services
for Building Projects**v1.0

In particular, climatic data, such as rain or snow loads, are statistically based. A recent, exceptionally large rain- or snowfall would provide new data that could make the old design criteria obsolete.

Geotechnical Conditions

Geotechnical conditions are obviously local considerations. Not only are the soil parameters variable with location (bearing capacity, elastic properties) but other serviceability and durability aspects, such as swelling clays and sulphate-containing soils, need to be considered.

**Responsibilities for Engineering Services
for Building Projects**

v1.0

**APPENDIX G – LETTERS OF COMMITMENT, LETTERS OF COMPLIANCE, AND
SCHEDULES****G-1 Applicable Standata**

At the time of writing of this guideline, a Standata Director's Interpretation was being prepared regarding the use of Schedules A-1, A-2, B-1, B-2, C-1 and C-2 in the *Alberta Building Code*. Users of this guideline should obtain a copy of the final version of this director's interpretation. It would not change the requirements of the *Alberta Building Code* or the Safety Codes Act. However, the aim of the Standata would be to clarify the intent of the schedules and it may mention amendments to the wording of the schedules that would be acceptable to the director.

G-2 Letters of Commitment and Compliance from Coordinating Registered Professional, Registered Professional of Record and Specialty Professionals

The coordinating registered professional coordinates all the registered professionals of record providing services on the specific project. The coordinating registered professional does not take responsibility for work that the registered professionals of record are covering.

The coordinating registered professional may also coordinate and rely on the specialty professionals, such as a civil engineer, if they do not come under one of the registered professionals of record.

Similarly, the registered professionals of record do not take responsibility for the work of other registered professionals working in the specific discipline for which he or she is responsible. However, the registered professional of record is responsible for coordination to ensure all areas are covered (in regard to design and site review). Attachment of qualifying letters to the schedules explaining the inter-relationship with other professionals in the specific discipline may be acceptable to the authority.

Often the specialty professional is appointed during the construction phase. In this case, Schedule C and accompanying letters would give closure to the responsibility of the applicable aspects. It would indicate who is the specialty professional, whether field reviews were needed and certify that they were done.

The coordinating registered professional and the registered professional of record should establish with the various specialty professionals a clear written understanding of the respective areas of responsibility. Often this is done through the applicable contract documentation. For example, the responsibility of a specialty professional responsible for design and field review of a pre-engineered building could be specified in contract documents prepared by the structural engineer of record.

Responsibilities for Engineering Services for Building Projects

v1.0

If the coordinating registered professional or registered professional of record is relying on design or field review of a specialty professional, the coordinating registered professional and/or registered professional of record should attach supporting documentation to Schedules C-1 and C-2. This would not only establish the responsibility of the coordinating registered professional and registered professional of record. It also would help to clarify what is expected of the specialty professional and would help ensure that all areas of responsibility are covered.

For example, the coordinating registered professional and registered professionals of record could ask the specialty professional to provide:

- A “Letter of Commitment” addressed to the coordinating registered professional or registered professional of record as appropriate, in a form similar to Schedule B-1 or B-2, to acknowledge responsibility for design by the specialty professional. If required by the coordinating registered professional or registered professional of record, the letter should also confirm that the specialty professional is undertaking responsibility for field review of the applicable aspects of the project.
- A “Letter of Compliance”, addressed to the coordinating registered professional or registered professional of record as appropriate, in a form similar to Schedule C-1 or C-2, to confirm that the specialty professional has performed the necessary field review and that the applicable aspects of the project substantially comply with the specialty professional’s design. (This letter would only be required in cases where the specialty professional is required to perform field review).