PROFESSIONAL ENGINEERS & GEOSCIENTISTS NEWFOUNDLAND & LABRADOR
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Guideline for the Provision of Engineering Services for Facilities

Professional Engineers & Geoscientists

Newfoundland and Labrador

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1.0 Introduction

1.1 PEGNL

Professional Engineers and Geoscientists Newfoundland & Labrador (PEGNL) is an organization whose mandate is to regulate the practice of engineering and geoscience in the public interest. PEGNL exists so that there will be competent and ethical practice of engineering and geoscience in Newfoundland and Labrador, and to ensure public confidence in the professions. To practice Engineering or Geoscience in Newfoundland and Labrador you are required to be registered, and in good standing, with PEGNL.

The Newfoundland and Labrador ***Engineers and Geoscientists Act, 2008*** and the associated ***Engineers and Geoscientists Regulations, 2011*** under that Act govern the practice of engineering and geoscience in the Province. PEGNL is the authority that licenses practitioners under the Act and administers all aspects of that legislation and strives to ensure the ethical conduct of all professional members

Under Section 36 of the Regulations PEGNL has the power to produce "statements of policies and standards, and other publications for the purpose of: (a) promoting high standards of professional services and adequate remuneration for those services and for the maintenance and improvement of the competence of members; (b) outlining the scope of professional services which shall define for clients the services to be expected from a consulting engineer or geoscientist; (c) assisting clients in the selection of professional engineers and geoscientists for professional services. PEGNL produces these documents to inform and educate its professional members, and the public, in matters of professional practice and to:

- ensure PEGNL professional members, understand their duties in performing specific components of their professional roles in accordance with the current *Act, Regulations and By-Laws*; and
- help the public, especially clients, contractors and suppliers, understand the role of PEGNL professional members and the responsibilities professional members have when performing professional services.

Professional members adhering to this Guideline will ensure themselves and the public that they are following best practices in conforming to the legislation and ethical practices applicable to this guideline.

This Guideline seeks to advise what is normally expected of a reasonable and prudent Professional Engineer. However, it is not a comprehensive list of what constitutes substantive engineering practice. This is an area of responsibility which will remain fully that of the Professional Engineers.

The intention is not to supersede or replace contractual arrangements designed to satisfy specific situations where good engineering practice might, in certain circumstances, dictate departure from this Guideline.

In addition to items covered in this Guideline each project will have its own discipline-specific requirements for design and quality standards which the professional must respect. This Guideline is intended to be read in conjunction with other applicable PEGNL Guidelines.

Questions or concerns relating to this document should be addressed to the Professional Standards Director at PEGNL.

1.2 Engineering Services Guideline Purpose

This Guideline has been prepared to set out the standards of practice which professional members should meet and follow in providing professional engineering services. It is intended to establish minimum standards which professional members must meet to fulfil their obligations, especially in regard to the primary duty to protect the public, and any failure to meet these standards may give rise to disciplinary proceedings.

It is anticipated that variations in the application of this Guideline may be required and a professional member must always exercise professional judgement in providing services. It is not intended that this Guideline be used as a legal document or to alter contracts between professional members and others.

This Guideline applies to the practice of providing any discipline of Engineering Services in the design, construction and modification of facilities and infrastructure. The Professional Member who is in responsible charge of any discipline of engineering works in either an investigative or a regulatory capacity, should fulfill the requirements of this guideline. This guideline outlines the extent of the services to be provided and the general method to be followed, the types of reports and the normal range of the recommendations which may be included by the Professional Member who originates the work. Professional Members operating in a regulatory capacity should be familiar with these procedures in initiating an investigation and in making an objective appraisal of submitted reports.

1.3 Definitions

Act
The Newfoundland and Labrador Engineers and Geoscientists Act, 2008
Additional Services
Services, as set out in Appendix B, which the EOR may provide in addition to the Basic Services.
As-built Drawings
A document reflecting the actual installed, fabricated, constructed or commissioned condition of an item or project based on information provided by another party or by the professional member using information furnished by a third party and not necessarily verified by a professional member. As-builts reflect all field changes and modifications made to the original design during the construction process. Some of the information provided on as-built drawings might be changes authorized by the professional member during construction. Other information might reflect changes initiated by other parties due to site conditions or other causes**.**
Authority Having Jurisdiction

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

Basic Services

The services provided by the EOR as set out in section 3.3.

Client

The party given the mandate from the Owner to establish and engage others to bring the project to conclusion. In many cases the Client will be the Owner.

Commissioning

the documentation, testing and verification necessary so that the system will function to meet design intent and tuning of the systems necessary to meet the Owner's operational requirements.

Connections

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

Contract Documents

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

Discipline

A specific field of practice within the professions governed by the Act (e.g., civil engineering, electrical engineering, geology, environmental geoscience, etc.).

Engineer of Record

The Engineer of Record (EOR) is the discipline-specific professional member responsible for the integrity of the engineering design of the discipline-specific systems shown on all documents prepared by the EOR. Where a discipline specific EOR is referred to in this document they are referred to as “xxx…” EOR where “xxx…” can be Mechanical, Electrical, Geotechnical, Municipal or Structural.

Engineering Services

or the “practice of engineering" means reporting on, advising on, evaluating, designing, preparing plans and specifications for or directing the construction, technical inspection, maintenance or operation of a structure, work or process" in this guideline as it applies to commercial and institutional facilities.

Fabricator

The contractor responsible for the fabrication of components to satisfy a specific contract.

Falsework

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

Fast Track

Fast-track scheduling is an approach used to shorten the overall project delivery timeline. It involves producing design work in “packages” to allow construction to commence before the entire design complete. Phases of work overlap such that the EOR’s and contractor can work simultaneously on a condensed schedule.

Field Observation Services

The services provided by the EOR as set out in Section 3.3.5 to ascertain if the work is generally in accordance with the Contract Documents.

General Contractor

The firm that is responsible for the construction of all or a portion of the project.

Non-Structural Elements

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

Owner

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

Member in Responsible Charge (MIRC)

An employee of an organization who is a practicing licensed professional member of PEGNL and who undertakes to provide responsible direction and personal oversight in a specific discipline of professional practice in which the licensee is personally competent. The MIRC is specifically named on the Permit to Practice as taking responsibility for a specific discipline of practice.

Permit Holder

A corporation or association of persons that holds a permit to practice under the Act. A permit holder has a permit number issued by PEGNL allowing the permit holder to offer and provide engineering or geoscience services to the public.

Person

An individual, as well as a corporation, company, association, firm, partnership, society or other organization.

Primary Structural Element

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

Primary Structural System

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

Prime Consultant

The individual who or firm which has the responsibility to coordinate the design and field reviews of the various design professionals (such as electrical, structural, mechanical, geotechnical, architectural, etc.) for the project. For single discipline projects, the EOR is often the Prime Consultant.

Professional Document

A document in any medium (e.g., paper, electronic or other) that contains or presents engineering or geoscience work as defined under the Act.

Professional Member

An engineer, geoscientist, limited licensee (engineering), or limited licensee (geoscience) entitled to engage in the practice of engineering or geoscience under the Act.

Record Drawings

Drawings which represent the final drawings issued and which normally incorporate such items as addenda, change orders and significant modifications made during construction. Site measurements need not be incorporated onto these drawings unless significant differences from the specified dimensions occur. Variations from the Contract Documents

may be noted, where appropriate, with remarks or comments. Record Drawings shall contain the engineering seal of the engineer responsible for the content as well as the Permit to Practice seal.

Regulations

The Engineers and Geoscientists Regulations, 2011

Request for Proposals (RFP)

A process for defining submission and pricing requirements for certain project types and can be applied to both engineering services and construction.

Request for Qualifications (RFQ)

A process for selecting entities to bid on a project where the entities provide details of how their organization meets the criteria developed by the owner and the owner selects only those entities that best meet the owners specified needs.

Secondary Structural Elements:

Elements which are structurally significant for the function they serve but do not contribute to the overall strength or stability of the Primary Structural System. Examples of Secondary Structural Elements are elevator support rails and beams, wall systems, cladding, and seismic restraints for architectural, mechanical and electrical elements.

Shop Drawings

These are drawings produced by the Fabricator or Vendor to provide all information necessary for shop personnel to fabricate and assemble the items. The drawings shall be sealed, signed and dated in accordance with PEGNL's Practice Guideline for Authentication when incorporating design by the other Professional Members.

Subcontractor

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

Submittal(s)

Items required by the Contract Documents to be submitted such as requests for payment, progress reports, shop drawings and manufacturer's literature. Submittals are normally used by the EOR to aid in determining if the work and work products conform with the intent of the Contract Documents.

Supplementary Structural Elements

Structural elements which are designed by the Supplementary Structural Engineer. These elements, normally fabricated off-site, may require specialized fabrication equipment or a proprietary fabrication process not usually available at the job site (for example open web steel joists, wood trusses, combination wood and metal or plywood joists, precast concrete elements, and prefabricated wood or metal buildings). Supplementary Structural elements may form part of the Primary Structural System.

Supplementary Structural Engineer

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

Tests/Testing

Tests/Testing refers to field and laboratory procedures carried out on construction materials, as per the applicable standards, to determine conformance with the project specifications.

1.4 Responsibilities of Professional Members and Permit Holders

Professional members and permit holders are responsible for practicing in accordance with the Act, Regulations and By-laws (which include the PEGNL Code of Ethics).

A permit holder is corporately responsible for the integrity of its work. A permit holder is responsible to put in place a quality management system enabling engineering or geoscience practice to be carried out competently and ethically by the professionals with training and experience in specific disciplines of practice, which includes facilitating their compliance with this guideline.

Regardless of project organization is chosen for the work, certain professional principles apply:

1. All Engineering Services, as defined, wherever they may occur in the project organization, are to be performed by Professional Members;
2. The Professional Member must ensure that, in the provision of Engineering Services the interests of public safety and welfare come before the interests of the client, contractor, suppliers and Professional Members; and
3. The responsibility for overall functional design and discipline specific design rests with the Prime Consultant and the Engineers of Record.

1.5 Liability

Liability is defined as a legal responsibility for some harm or loss caused to another person. PEGNL has no authority to determine legal liability; jurisdiction to resolve disputes concerning liability rests with the courts. However, PEGNL does have jurisdiction and responsibility to administer the Act, Regulations and By-Laws. Not following this guideline without providing documented, sound professional judgement may contravene the requirements of the Act, Regulations and By-Laws and could lead to discipline proceedings.

2.0 Project Organization and Responsibilities

2.1 Project Organization

There are several ways engineering projects for commercial and institutional facilities are organized outside the traditional design, bid build process. These include, among others, design build, design build finance and design build finance maintain. This guideline focuses on the provision of engineering services regardless of the process but addresses the different reporting and responsibility structures an EOR may be involved in.

2.1.1 Design-Bid-Build

The Design Bid Build process is the traditional form of project organization, where the owner hires a prime consultant to: (i) understand the owner's needs; (ii) hire other consultants as required; (iii) provide a completed design and cost estimate; (iv) tender and award the project to a general contractor; and (v) administer a completed project. In this form the prime consultant is directly responsible to the owner.

Variations in this form of project organization include where the owner may use employee engineers or other engineering consultants to help define its needs and manage its relationship with the prime consultant. Further, the owner may decide to undertake some or all the project management responsibilities itself. Typical roles for a design bid build project are:

Owner Client
This includes not only the owner / client but also those who may provide some engineering services to the owner which may include high level project definition, selection of the engineering consultants, consultant management and some or all elements of project management. If so, these engineering services are provided by employee engineers or other engineering consultants who are not otherwise engaged in the project.

Prime Consultant / Engineers of Record
The Prime consultant may include all the discipline specific Engineers within its organization, or it may engage other permit holders to provide discipline specific engineering design services as part of the project. Typically the Owner / Client delegates the contractor selection (in consultation with the Owner/Client) and project management to the prime consultant and its associates. However, it may undertake some or all the project management itself.

General Contractor
This includes not only the contractor, but also those providing engineering services to the contractor or its suppliers. Among the engineering services that may be provided to contractors by employee engineers or other engineering consultants are those providing designs for special engineered work methods, falseworks, non-standard or difficult lifts and those providing nonstandard products.

2.1.2 Design-Build

The Design Build process is where the owner defines its high levels needs and issues an RFP to Design Builders requesting bids that include both the design and supply of the finished facility. In addition, the owner may further define the project through an RFQ to select the best qualified Design Builders to bid on the project. In this form the prime consultant and the EOR's are directly responsible to the consortium. However, the professional members remain professionally responsible to the owner and the public for their professional work.

Variations in this form is the degree to which the owner engages engineers to define its needs and manage both the bidding process and the execution. Typical roles for a design build project are:

Owner Client

This includes not only the owner / client but also those who may provide some engineering services to the owner which may include high level project definition, selection of the engineering consultants, consultant management and some or all elements of project management. If so, these engineering services are provided by employee engineers or engineering consultants who are not otherwise engaged in the project.

Design Builder

This usually includes a consortium of organizations, including a general contractor, prime consultant and engineers of record, with a lead organization. While the prime consultant may be the lead organization, in most cases it is not. In most cases it is the general contractor or investor that is the lead organization.

2.1.3 Integrated Project Delivery

Integrated Project Delivery method is an approach that integrates all people, suppliers and service providers into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, and maximize efficiency through all phases of design, fabrication, and construction. In this method, the Design and Construction is included in one single contract between the Owner, Primary Designer, Design Sub Consultant, Primary Contractor, and Subcontractors. Typical roles for a design build project are:

Owner Client

This includes not only the owner / client but also those who may provide some engineering services to the owner which may include high level project definition, selection of the integrated project team, collaboration in the design, and some or all elements of project management. If so, these engineering services are provided by employee engineers or engineering consultants who are not otherwise engaged in the project.

Prime Consultant / Engineers of Record

The Prime consultant may include all the discipline specific Engineers within the integrated project team, or it may engage other permit holders to provide discipline specific engineering design services as part of the project.

General Contractor / Subcontractors

This includes not only the contractor, but also those providing engineering services to the contractor, subcontractor or its suppliers. Among the engineering services that may be provided to contractors as employee engineers or engineering consultants are those providing designs for special engineered work methods, specialty products, falseworks, non-standard or difficult lifts and those providing nonstandard products.

2.2 Responsibilities of Participants

2.2.1 Owner

F To ensure that appropriate standards of public safety and the requirements of applicable regulations are met, the Owner should:

- Where the Owner requires engineering support in the selection of a Prime Consultant, in high level definition of its needs or to provide any other engineering service that is not part of the Prime Consultant or Engineer of Record category, the Owner must use employee Professional Member or Engineering Consultants to perform these tasks;

- Retain or cause to be retained qualified professional members including a Prime Consultant and EORs with responsibility for providing the necessary discipline specific design;
- Cooperate with the EOR to set out a written description of the scope of the EOR services as referred to in paragraph 3.2, and an adequate written description of the project;
- Before the commencement of the EOR's services, finalize or cause to be finalized a written agreement with the EOR (directly with the Owner or with the Prime Consultant or with another appropriate party);
- Cooperate with the Prime Consultant and the EOR in establishing a realistic schedule for the provision of design services;
- Authorize in writing any Additional Services that may be required beyond the scope of the EOR's contract;
- Ensure that all required approvals, licenses and permits from the Authorities Having Jurisdiction are obtained prior to proceeding with construction;
- Recognize that drawings, specifications and other documents prepared by the EOR are for the project and that such documents shall not be used or copied for other projects without the agreement of the EOR and without advice from a qualified design professional;
- Recognize that unanticipated site conditions may be encountered and that code interpretations may differ and, accordingly, include a reasonable contingency in the Owner's budget; and
- As with all the laws of the province, ensure that it complies with the Engineers and Geoscientists Act.

2.2.2 Prime Consultant

To enable the EOR to perform their duties properly, the Prime Consultant should:

- Interpret and define the needs of the Owner and in so doing define the Owner's intended functions and needs. The Prime Consultant should identify any special design criteria such as equipment and other requirements and should advise the EOR accordingly;
- Outline the scope of assignment to each design professional for design, preparation of Contract Documents, review of work during construction and contract administration;
- Negotiate a fee with the Owner with input from each design professional before finalizing same;
- Provide timely information in sufficient detail as required by the EOR to adequately perform their duties;
- Coordinate and review the designs, drawings and other Contract Documents produced by all participants of the design team;
- Coordinate communication of information between the Owner, the contractor and the design professionals, including the EOR, so that the work proceeds in a manner that complies with applicable codes and regulations and meets the Owner's needs and budget; and

- Ensure all appropriate parties are aware of tender call results and have a complete set of Contract Documents

2.2.3 Engineer of Record

- The Engineer of Record (EOR) for each specific discipline is responsible for provision of design parameters to allow for the safe design of systems and related components by the design team for their discipline.
- The EOR may rely on other professional Members in their discipline to be responsible for the design of elements of the project but the EOR has the overall responsibility to see that all design is undertaken as is necessary to achieve a project that meets acceptable engineering standards. In this event the EOR must require the other professional members to sign and seal the documents for such elements.
- The EOR, together with the Prime Consultant and the Owner/Client, is responsible for setting out a written description of the scope of the EOR's services to enable and permit the EOR to meet the design and field review requirements of these Guidelines and applicable codes and regulations. These professional members are responsible for the integrity of their design;.
- The EOR must review and identifying code/standard changes that may be applicable to a project. The EOR should advise the Owner/Client on how to proceed, prepare change proposal including cost/schedule impact, and submit for Owner/Client approval.
- Additional Requirements for Structural EORs:
    - The structural EOR is responsible for the integrity of the design of the Primary Structural System shown on Contract Documents prepared by the structural EOR. The structural EOR is not assumed to be responsible for the Secondary Structural Systems unless agreed with the Prime Consultant and/or Owner in the scope of services. For each Primary Structural System there can only be one structural EOR. For example, there should not be one structural EOR for the foundations and another for the main structure;
    - Unless otherwise noted and agreed with the Prime Consultant and/or Owner, the structural EOR is not responsible for the design of any Supplementary Structural Elements or Non-Structural Elements. However, the structural EOR remains responsible for designing the Primary Structural System to accommodate these elements and for allowing for their effects on the Primary Structural System. For this purpose, the structural EOR is responsible to review these elements;
    - The structural EOR should clearly define the scope of work to be performed by the Supplementary Structural Engineer. The Supplementary Structural Engineers are responsible for the integrity of their designs; and
    - While a structural EOR can provide the field reviews during construction, the owner may elect to use an alternative firm. Unless specified in the agreement with the Owner/Prime Consultant, the

structural EOR is then not responsible for field review of construction.

- If the Owner or Prime Consultant fails or refuses to carry out the obligations as set out in Section 2.2.1. or 2.2.2 respectively, the EOR should:
  - consider giving written notice to the Owner advising the Owner of the EOR's recommendations; and
  - consider whether the EOR can continue with the project, because in any event the EOR must comply with the minimum requirements of these Guidelines.

2.2.4 General Contractor

The EOR shall ensure that the Contract Documents clearly state that:

- The General Contractor is responsible for all labour, materials, equipment, and plant required to complete the work;
- The General Contractor is responsible for the construction methods, techniques, sequences, procedures, safety precautions and programs associated with the construction work, all as set out in the Contract Documents. Were through construction, the General Contractor requires engineering work to be performed, such as specialized formwork, and heavy lifts, the General Contractor will utilize either employee Professional Members or Engineering Consultants to perform this work;
- The General Contractor is responsible for coordinating the work of the Sub-Contractors and for checking the Sub-Contractor's work;
- The General Contractor is responsible for providing reasonable notice to the EOR when the work is ready for field inspection and Testing;
- The EOR's field inspection and Testing does not relieve the General Contractor from their responsibilities to complete the work in conformance with the Contract Documents;
- The Contractor and all applicable Subcontractors must visit the site prior to tender closing; and
- As with all the laws of the province, ensure that it complies with the Engineers and Geoscientists Act.

2.3 Selection of Consultants

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

3.0 Guidelines for Professional Practice

The following are guidelines for the services which the EOR should consider providing as part of good practice. They may assist the EOR in explaining their services to a Client. These guidelines deal in an advisory way with matters of practice and procedure rather than with matters of substantive engineering. The limitations imposed upon EOR by practical considerations in the determination of

existing conditions should be recognized by the Owner, the Client and other professional members of the design team.

3.1 Sole use of Documents

The following clause (or similar) should appear on all drawings and specifications:

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

3.2 Scope of Services

Before commencement of design services, the EOR shall consult with the Client to:

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

3.3 Basic Engineering Services

The usual stages of Basic Engineering Services apply to all disciplines in a general sense. For additional specific basic services for Geotechnical, Structural and Municipal Basic Services refer to Appendix A of this Guideline. Basic services discussed below, are generally organized in an agreement according to the sequential stages of a typical project. Because of the requirements of the specific project, certain Basic Services activities may be required to be performed out of the normal sequence or in different stages than indicated below. For design bid build projects, additional guidance may be obtained by referring to the Association of Engineering Consulting Companies Canada (ACEC) document ACEC-31.

3.3.1 Concept, Schematic or Pre-Design Stager

In the Conceptual or Schematic Stage, the EOR may:

- Attend as required, periodic meetings with the Client and design team to obtain the Client's instructions regarding the Client's functional, aesthetic, cost and scheduling requirements to prepare a concept design and to report on the required systems considering economy, performance, capital cost, compatibility with other design elements and requirements of relevant codes and authorities;
- If required, assist the Prime Consultant and/or Owner in:

  - Defining the need for any specialty consulting services which may be required for the project, e.g., acoustical, fire protection, etc.;
  - Developing or reviewing the project schedule including any milestone dates;
  - Determining channels of communication;
  - Determining drawing standards and Specifications format; and
  - Determining the number and timing of project team meetings during each stage of the project;
- Establish dates by which information affecting the project will be needed from other engineering disciplines;
- Conduct field reviews and review existing drawings where appropriate;
- Establish criteria for sub-consultants to the EOR as required. Comment on reports presented;
- Identify design criteria, prepare preliminary calculations and establish base load requirements for all systems. In the case of building projects, determine the mode of heating in consultation with the Client and other applicable engineering disciplines;
- Develop the scheme for the systems. Develop alternate schemes where appropriate and as agreed with the owner/client. Consider materials and systems suitable to the project requirements. Consider the requirements of the other design professionals and provide the information they require;
- Check applicable codes, standards, regulations and restrictions, insurance requirements and other factors affecting the design of the project and establish and obtain agreement with the Client and/or Prime Consultant on the applicable codes and standards to be followed;
- Prepare a conceptual cost estimate or cooperate appropriately with others responsible for reporting the estimate, if required;
- Determine the allocation of suitable space for discipline-specific rooms, if required, and other major equipment installations;
- Identify equipment parameters such as weight, size, noise, vibration, and other physical characteristics that are to be considered in the design. Determine the impact of noise and vibration from applicable systems on the Client's operational requirements and recommend solutions using a specialist, if necessary;
- Establish, where appropriate, comparative information to be used in selection of systems for the project;
- Describe the major system(s) and each significant component and material;
- Inform the Client of all new construction materials or new techniques proposed for use in the project and their alternatives, including the risks, advantages and disadvantages over both the short and long term, so that the Client can weigh the choices and make an informed decision before the EOR proceeds further;
- If required by the contract, prepare a concept design report which defines the systems selected for the project and outlines the reasons for the selection; and

- A Client may assume responsibility for all or some of the foregoing Conceptual or Schematic Design Stage activities provided:
  - the EOR's ability to satisfy the requirements of the subsequent stages of these Guidelines is unimpaired;
  - the responsibility for such preliminary design activities is clearly defined in writing; and

the Client, in writing, waives the EOR's responsibility for such preliminary design activities and their effect on the selection of the systems

3.3.2 Design Development Stage

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

- Attend meetings with the Client and design team as agreed;
- Review results of studies by specialist consultants, such as geotechnical, fire protection, etc.;
- Prepare preliminary analysis and design calculations for typical elements of the systems. Select appropriate equipment and materials;
- Prepare preliminary design drawings, as required, depending on the complexity of the design, based on information coordinated with other consultants, showing layouts of critical areas;
- Prepare or edit discipline-specific "outline Specifications" as required;
- Coordinate discipline-specific design with space and servicing criteria to meet the requirements of the other design team participants. Mechanical and Electrical disciplines must identify all points of interface between the two disciplines and determine in the preliminary stages the electrical characteristics and electrical requirements of all mechanical loads and potential conflicts between the mechanical and electrical riser locations;
- Prepare a preliminary cost estimate or co-operate appropriately with others responsible for reporting the estimate; and
- Submit a design development report for review and approval by the Client

3.3.3 Contract Document Stage

- General:
  - Complete the design and drafting of the discipline specific systems;
  - Determine and specify in the Contract Documents which elements are to be designed by other professional members. Attend periodic coordination meetings, as agreed;
  - Coordinate with the Authority Having Jurisdiction, as required;
  - Establish testing and inspection requirements;
  - Comply with fire resistance and life safety requirements as determined by the Prime Consultant or other professional members; and
  - Seal documents per the *Act*.
- Calculations:

- The EOR must prepare calculations to support all designs. Calculations should be prepared legibly and presentably and filed for record purposes. All input and output of any computer analysis should be included as well as description of the software used. In general, calculations include but are not limited to:
  - Design criteria:
    - Discussion and description of design basis including assumptions;
    - Codes or standards used with edition dates; and
    - List of design parameters and provisions that exceed or vary from code and standard requirements as requested by the Client or otherwise used by the EOR;
  - Location diagrams for discipline-specific system elements;
  - Computer analysis and design results, if applicable or agreed;
  - Special studies and analysis where required by Code or agreed on in the contract;
  - For electrical engineers include:
    - Equipment and cable sizing calculations;
    - Fault calculations, as required; and
    - Protection coordination and arc flash studies, as required;
  - For critical design elements and where required by Code, work done by an engineer with limited experience shall be checked by an independent qualified engineer, not necessarily from a separate company;
  - The names of the design engineer(s) and design check engineer; and
  - Table of contents for, or index to, all calculations.

- Drawings:
  - Prepare contract drawings. Scale should be appropriate to convey information properly, be standard scale ratios, and be in accordance with client/authority requirements;
  - Where the scale of drawings or complexity of the work make drawings difficult to read and interpret, separate drawings should be provided for such areas of the work including but not limited to:
    - plumbing and drainage;
    - heating, ventilating and air conditioning;
    - fire protection;
    - process piping and equipment;
    - piping isometrics;
    - power and communications;
    - lighting and photometrics;
    - fire alarm system;
    - security systems;
    - single line diagrams and risers;
    - process and instrumentation; and/or
    - other special systems as necessary;

- Schematics and diagrams should be provided as required for all major systems with notes to describe the function of control, flow and operation;
- Plot plans and/or site plans showing sanitary and drainage arrangements and connections to public utility services as required;
- Symbol lists and typical details should be included, where required, for all equipment, connections, accessories and systems;
- Floor plan layouts for all systems should be provided, Sizing should be shown on these documents as necessary. Sizes, types, locations and capacities of all supply and exhaust air terminals together with type and location of valves should be shown;
- To avoid conflicts, supplementary details should be provided for major pieces of equipment, equipment rooms and congested areas;
- Systems can be shown in single line except where necessary to show arrangements and clearance between disciplines for services in ceiling spaces, shafts, header trenches, chases and for tight or close-coupled equipment. Systems in these areas should be shown in double-line detail with appropriate fittings and accessories;
- Schedules should be included to provide capacities and details of all equipment; and
- All drawings as well as details, elevations and sections should be properly cross-referenced.

- Specifications:
  - Prepare Specifications using a format suitable for inclusion with the Contract Documents;
  - The Specifications should include information on:
    - standards, codes, by-laws governing work;
    - submittals required;
    - quality control requirements;
    - materials;
    - workmanship and fabrication;
    - tolerances;
    - information for temporary works and erection information, where necessary, to ensure the intent and integrity of the design;
    - construction inspection and testing;
    - notification by the contractor before significant segments of the work are begun;
    - warranties and close out documentation; and
    - performance criteria for design and detailing by other professional members;
  - Where appropriate, the Specifications may be abbreviated and become part of the drawings; and
  - The Specifications generally set out that the EOR's review of Submittals and inspection of work as well as any testing by

independent agencies reporting to the Client are undertaken to inform the Client of the quality of the contractor's performance and that this review and testing are not for the benefit of the contractor. The contractor must provide their own independent quality control program.

- Other Contract Documents:
  - In addition to drawings and specifications, contract document should include the provision of forms of bonds, a form of tender, schedule of quantities (as applicable), articles of agreement, general conditions of the contact and special conditions that may be required by the client or other public agency.
- Pre-Tender Cost Estimate:
  - Provide the Owner with a pre-tender cost estimate based on the final design

3.3.4 Tendering Stage

- Assist in the preparation of pre-qualification documents, if required;
- Assist in reviewing bidder's qualifications, if required;
- Assist the Client in obtaining required approvals, licenses and permits;
- Aid the Client in answering queries raised by the bidding contractors and issue discipline-specific addenda and clarification of documents, as required;
- Assist in analysis and evaluation of tenders submitted, as required; and
- Assist in the preparation of the contract, if required

3.3.5 Construction Stage

It is essential that Field Observation Services be provided for all systems for which the EOR is responsible to ascertain whether the work is generally in accordance with the Contract Documents. It is preferable that the Field Observation Services be provided by the EOR; however, where practical the EOR may delegate these duties to others.

Field Observation Services by the EOR should not be construed to relieve the contractor of the contractor's responsibility for completing the project in accordance with the Contract Documents, controlling the progress, providing safe working conditions, and correcting any deviations from the project requirements. Some items reviewed by the EOR may also require review by other professional members of the design team or by testing and inspection agencies. Such work may include proprietary products and elements designed by others.

- General Services during construction should include, but not necessarily be limited to, the following and may vary depending on the complexity of the job:
  - Attend construction meetings, as required;
  - Confirm communication channels and procedures;
  - Assist in confirming, reporting and scheduling procedures for testing and inspections;
  - Assist in confirming procedures for shop drawings and other Submittals;

- Confirm that manufacturers and fabricators are complying with the Specifications;
- Advise the contractor and the Prime Consultant on the interpretation of the discipline-specific drawings and specifications and issue supplementary details and instructions during the construction period as required;
- If agreed on in the project scope of work:
  - advise the Client on the validity of charges for additions to or deletions from the contract and on the issue of change orders;
  - assist Client in the development of an acceptable format and price breakdown structure to facilitate certification of construction progress payments;
  - review and comment on the contractor's applications for progress payments. Estimate completed work and materials on site for payment according to the terms of the construction contract;
- Review reports from the testing and inspection agencies to determine if the agency has verified compliance of the reported item of work with the Contract Documents. Initiate any necessary action;
- Conduct substantial performance field reviews of the discipline-specific components of the project, note deficiencies and inspect completed corrections;
- Attend the start-up of the mechanical systems and respond as required to any design-related operational difficulties. Arrange and perform field review when the contractor has applied for substantial completion of the project; and
- Prepare a list of deficiencies (workmanship, completeness and function) and, when these have been rectified, issue the final report.

- Submittals should be reviewed for general compliance with the Contract Documents and would not necessarily include checking dimensions or quantities or the review of the contractor's safety measures or methods of construction. The EOR shall:
  - Confirm that the Submittals have been reviewed by the General Contractor and relevant Subcontractors before review by the EOR;
  - Review the shop drawings and other submittals for general conformance with the Contract Documents and the intent of the design;
  - When required by the Contract Documents, confirm that the shop drawings bear the signature and professional seal of the other professional members responsible for the design of specialty systems. Responsibility for the detail design remains with the other professional members whose seals and signatures appear on the drawings;
  - Review As-Built Drawings prepared and submitted by the contractor in a format acceptable to the Client to reflect the "as-built" condition

of the project as turned over to the Client. The Client shall be advised that these drawings are prepared by the contractor and have been reviewed only for general conformity to the drawing standards and the intent of the design and that the EOR cannot accept responsibility for their accuracy;

- If applicable to the project, arrange for the contractor to submit and review operating and maintenance manuals for the equipment/systems supplied. The data submitted should include manufacturer's recommendations for maintenance of each piece of equipment and other such information which will enable the Client to assume operation of the systems; and
- The following is the recommended stamp affixed to all Submittals signed and dated by the EOR;

ABC ENGINEERING LIMITED Shop Drawing review is solely for purpose of determining adherence to general design concept. Contractor shall remain responsible for any detail design inherent in the shop drawings and for all errors and omissions. Contractor shall remain responsible for confirmation and correlation of all dimensions for fabricated components at the job site. REVIEWED (Proceed with work) ( ) REVIEWED & MODIFIED (Proceed as noted) ( ) REVISE & RESUBMIT (Do not proceed with work) ( )	
Reviewed By:	Shop Drawing #:
Date:	Project #:

- Field Review:
  - Visit the site at intervals appropriate to the stage of construction, and as agreed upon in the contract documents, to observe the quality and the progress of the construction of those elements designed by the EOR. At the discretion of the EOR, components which have been designed by other professional members should be inspected by those other professional members at the appropriate stage of construction and reported in writing to the EOR;
  - Prepare site visit reports outlining observations and deficiencies in the work in consultation with the contractor's site representative;
  - Distribute site visit reports to the Prime Consultant and other parties such as the General Contractor and Owner, as required. Where the

Owner directly retains the services of the EOR, it is recommended that the Owner also be sent copies of the reports;

- Conduct a final project review with the owner's and contractor's site representatives and advise the Client of all observed defects or deficiencies whether they have been previously reported. Include in this report any action recommended for correction or resolution of these defects or deficiencies; and
- Conduct warranty inspection, if required.

3.3.6 Fabrication Drawings and Documents

Following a review of the drawings, specifications and contract documents supplied by the EOR and the resolution of any errors or requested changes, the Fabricator or Vendor shall produce all necessary drawings and documents to represent the work covered by their contract with the contractor. They usually include Shop Drawings. Where Engineering Services have been provided as part of producing these drawings or documents, they must be done so in accordance with the Engineers and Geoscientists Act.

APPENDIX A – BASIC, DISCIPLINE SPECIFIC, ENGINEERING SERVICES

Appendix A1 – Basic Geotechnical

Geotechnical engineering embraces the knowledge of soil, rock, and other earth materials as applied to foundations, the behaviour of engineering structures, the engineering assessment of natural landforms and the stability of natural and man-made slopes. It includes aspects of soil mechanics, rock mechanics, hydrogeology, foundation engineering, and construction techniques as applied to building foundations, excavation methods, earth dams, and embankments, foundations for pavements, floor slabs and other relevant aspects of construction works.

In addition to the basic engineering services outlined in Section 3.3, the following additional basic services shall apply to all geotechnical EORs. The usual stages of the Basic Services, as discussed below, are generally organized in an agreement according to the sequential stages of a typical project for geotechnical EORs:

Preliminary Investigation Stage

During the conceptual planning of a project, a preliminary geotechnical investigation may be carried out. The Geotechnical EOR may attend, as required, periodic meetings with the Client and design team to obtain the Client's instructions regarding project requirements. In the preliminary investigation stage, the Geotechnical EOR may provide the following:

- **Air Photo Interpretation**
  Where air photographs are available, the site and surrounding area terrain may be mapped to indicate some or all of the following:
  - general drainage patterns
  - general slopes and ranges of gradient
  - bedrock outcrops, where present
  - general surficial soil types
  - poorly drained or bog areas (peat or muskeg)
  - erosion features
  - old or potential slope failure areas
  - indications of prior land development, disturbance, landfilling or waste disposal.
- **Literature Search**
  The geology of the area may be reviewed from known data, either to supplement the air photo interpretation, or to replace it where air photos are not available. All available physiographical data may be searched, and previous site investigation data reviewed along with any available well, standpipe, or piezometer installation details and associated water level records;
- **Site Reconnaissance**
  Following air photo interpretation and/or literature search, a preliminary site reconnaissance may be made to physically examine landforms, drainage, erosion features, indications of prior land development or disturbance, etc. In addition, hand

auger holes or rod soundings may be put down, or shallow test pits excavated to confirm the general surficial soil, bedrock and groundwater conditions;

- **Preliminary Investigation Report**
  The findings of the work will be presented in the preliminary investigation report. The data should be presented in a form that enables the Client to assess the economic effect which the soil, bedrock and groundwater may have on the viability of the project.

Detailed Geotechnical Investigation

Upon completion of the preliminary investigation the Geotechnical EOR may attend, if required, meetings with the Client and design team to review other relevant planning information. The detailed geotechnical investigation shall include;

- **Field Exploration**
  The pattern of borehole drilling and/or test pit excavation should be agreed between the Geotechnical EOR and the Client or Client's consulting design engineer. The nature of the project to be designed and the known subsurface conditions of the area usually dictate the location, spacing and depth of the test holes. The drilling of boreholes should be carried out by an experienced drill crew using the type of equipment best suited for the terrain and anticipated soil conditions. Boreholes may be advanced by wash boring, with or without driven casing, solid stem augers or hollow stem augers. Test pits may be hand or mechanically excavated. In all cases, the method by which the test hole has been made must be clearly stated as part of the field procedure. Such work should be performed under the direction of the Geotechnical EOR;
- **Field Sampling**
  Exploration and field sampling work must be carried out in accordance with recognized practice, such as recommended in the Canadian Foundation Engineering Manual and by A.S.T.M. The frequency and type of sampling may be varied by the requirements of the project but should be under the control of the Geotechnical EOR. Normally, standard sampling is carried out at 0.75 m intervals initially, with a spacing often increased to 1.5 m intervals below the 4.5 m or 6 m depth if conditions warrant such increase. Types of samples normally used include split spoons and thin wall Shelby tubes. Other types of samplers which may be required in certain types of soil are piston and Oesterberg samplers and foil samplers. In test pit excavations, representative bulk samples may be recovered from the different stratigraphic units as necessary;
- **Field Testing**
  Field Testing must be carried out in accordance with recognized practice such as recommended in the Canadian Foundation Engineering Manual and by A.S.T.M. or in accordance with special instructions set out by the equipment manufacturers. Types of Tests normally done include in-situ vane, standard penetration, dynamic cone penetration, pressure meter and pumping Tests. Other Tests depending on soil conditions may include static cone penetrometer, flat dilatometer, plate load Tests, etc. Such Tests must be utilized correctly and at the appropriate place to define the in-situ soils or bedrock parameters;

- **Groundwater Records**
  Fluctuations in the elevation of the groundwater occur over a period of time. It is considered good practice that the existing groundwater level should be monitored by piezometers or other methods as a routine part of any investigation. The installation of such equipment should be in accordance with recognized standards and as directed by the qualified Geotechnical EOR or other suitably qualified professional. Such installations usually require additional visits to the site to make field observations until conditions have reached equilibrium. It is also essential that all observations of the encountering of seepage water or initial water percolation into test pits be recorded as part of the field records. Further, the rate of inflow and rise of water levels should be recorded at the time of the initial observations in order to assess correctly the apparent influence which the water condition may have on the design project as well as on construction procedures
- **Laboratory Testing of Samples**
  It is normally a requirement that representative samples from the detailed site investigation be tested in the laboratory for the determination of soil properties essential to the preparation of the geotechnical report. It is normally essential that the natural moisture content of samples be determined at the time of the investigation as a routine measure. After the completion of the laboratory Testing program, the report and recommendations should be made based on the results obtained;
- **Classification Tests**
  Classification Testing of samples is frequently carried out to identify soil type. Such classification Tests include grain size analysis, Atterberg limits, moisture content determinations and must be carried out in accordance with recognized practice such as recommended by A.S.T.M.;
- **Strength Tests**
  Strength and consolidation Tests should be carried out on undisturbed samples if conditions warrant such Testing. Such Tests may be carried out in a variety of ways, depending upon the parameters required and the soil type being examined, but all such Tests must be carried out in accordance with recognized practice, such as recommended in Canadian Standards, the National Building Code of Canada, and by A.S.T.M. Laboratory Testing will be performed by trained and qualified technicians working under the control of an experienced Geotechnical EOR. Only such Testing as is required to provide the data for proper analysis of the geotechnical problem should be carried out;
- **Report and Recommendations**
  The Geotechnical Report should outline the terms of reference of the investigation, should summarize the findings of the field investigation and the supplementary laboratory Testing and should then present the conclusions and recommendations based on these findings. When construction proceeds, it is recommended that the Geotechnical EOR be retained to provide services during construction;
  - **Factual Data**
    The factual data comprises the terms of reference, the details of the field investigation procedures, the results of the field investigation, the results of

the field Testing, records of groundwater observations, laboratory Test results, site plan and inferred soil stratigraphy, etc. This portion of the report should not include any conclusions derived from the factual data;

- **Report Recommendations**
  The report recommendations and geotechnical conclusions should be presented separately, so that these recommendations may be excluded from the tendering documents if the user so desires. Such recommendations may cover a variety of activities, such as alternative founding depths/elevations with recommended design bearing values, pile design considerations, estimates of potential settlements, recommended safe slopes of banks or excavation walls, earth pressures for shoring design, dewatering requirements, soil stabilization, etc. The recommendation should be made with due consideration to the construction proposed by the user, to provide the most economic viable alternatives available for consideration. Only in this way can the user obtain the true benefits available from a competently performed geotechnical report. The report embodying the findings of the Geotechnical EOR should be a necessary tool for the planner, designer and for those contractors who specialize in dewatering, excavating and foundations. It is thus recommended that the part of the report containing this information be incorporated in the tendering documents.

Services During Construction

Further to the carrying out of a geotechnical investigation and report, various supplementary activities can be provided as part of the Geotechnical EOR's work during the construction phase. The supplementary services which should be arranged include the following:

- **Foundation Subgrade Inspection**
  Site inspection of the foundation bearing material during construction should be carried out under the supervision and control of the Geotechnical EOR who prepared the original site investigation report. The geotechnical engineer should be given the opportunity to verify the conditions at the bottom of the excavated site as were anticipated and that no part of the excavation shows soil conditions which are substantially different than those which were anticipated. It is normally a requirement by the foundation designer or structural engineer that such inspection verify that the specified bearing values have been achieved at the foundation level.
- **Pile Driving Inspection**
  During the driving of piles for the foundations, it is normally a requirement that an independent inspection be carried out by an inspector or technician under the supervision of the Geotechnical EOR who carried out the site investigation report to ensure that the piles have been driven to adequate penetration and set, as required for the load design capacity of the pile. The pile driving records should include the final set, the founding elevation of the tip of the pile and the length of the pile in place, as well as the cut-off elevation of the pile. Geotechnical supervision should also be provided in the case of compacted concrete piles, drilled caissons and vibroflotation and dynamic compaction operations to ensure installations, are in accordance with specifications.

- **Load Test Supervision**
  It is occasionally necessary that load tests of piles or foundations must be carried out as decided by the Geotechnical EOR and the Structural Engineer of Record. Such load testing should be carried out under the supervision of a technician working for the Geotechnical EOR. The details of the load application and settlement under each increment of load must be recorded as the work proceeds. All such load tests should be carried out in accordance with recognized practice such as recommended by A.S.T.M. Details of the tests should be presented in graphical form representing the Load/Time/Settlement curves for the pile or footing tested; a report should be submitted providing details of the work and the results obtained.
- **Fill Compaction Testing**
  Where fill placement is a requirement of the contract, inspection and testing for approval of soils (site borrow material or granular fills) should be carried out by a qualified experienced soils technician under supervision of the Geotechnical EOR. Where standards of compaction are a requirement for these fills, the physical testing of the fill material should be carried out also by a qualified and experienced soils technician under the supervision of the Geotechnical EOR. As such testing is carried out, a report should be submitted to the user indicating acceptance or rejection of the work as it is performed.
- **Pavement Subgrade Testing**
  Road subgrades should be tested for design recommendations for the eventual pavement design, which should be based upon the nature and condition of the subgrade at the time of construction of the roadway. Such tests may involve laboratory testing of samples recovered from the site or may involve in-situ testing of the subgrade in its prepared condition.
- **Slope Stability Monitoring**
  The installation of, and the monitoring of, slope indicators prior to, during and following construction of civil engineering works may be essential to the safety of the facility. Such work should only be carried out by qualified and experienced engineering technicians under the supervision of a Geotechnical EOR.
- **Field Instrumentation-Settlement**
  The monitoring of instrumentation established during construction to evaluate settlement and deformation, and changes in stress or pore water pressures is sometimes a requirement of the Geotechnical EOR's services. Such work should only be carried out by qualified, experienced technicians acting under the supervision of a Geotechnical EOR.

Appendix A2 – Basic Structural

In addition to the basic engineering services outlined in Section 3.3, the following additional basic services shall apply to all structural EORs at the stages noted:

Design Development Stage

- Identify desired structural 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 or advise of potential vibration induced by footfall or machinery;
  - Lateral drift of the structure;
  - Crack control in concrete and masonry structural elements;
  - Foundation settlement;
  - Soil-structure interaction;
  - Seismic deformations (permanent) and movements.

Contract Document Stage

- Determine and specify in the Contract Documents which elements are to be designed by other professional members including:
  - which structural elements, such as connection details and proprietary products, are to be designed by Supplementary Structural Engineers. Specify the type of element, its position within the structure and the method of connecting to the Primary Structural System. Specify the loads and design criteria for use by the Supplementary Structural Engineer in their design;
  - reviewing the effect of Non-Structural Elements attached to the Primary Structural System and design the structure to accept and support such items. Provide information regarding the supporting capability and physical attachment limitations of the Primary Structural System if requested;
- Structural Calculations
  The Structural EOR shall prepare structural calculations to support all structural designs. The structural calculations shall be prepared legibly and presentably and filed by the Structural EOR for record purposes. Hard copy of input and output of any computer analysis, if applicable, shall be included as well as description of the software used.

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

  - Design criteria:
    - List of dead loads, live loads, snow loads, seismic factors and wind load criteria and any special loads and provisions that exceed or vary from code and standard requirements as requested by the Client or otherwise used by the Structural EOR;
    - Structural material specification for concrete, reinforcing steel, masonry, structural steel, wood and other materials used;
    - Geotechnical report information and design criteria;
    - Deflection limitations of structural elements and systems.

- Location drawings for structural elements;
- Vertical load analysis and design of:
  - Roof structures;
  - Floor structures;
  - Frames or trusses;
  - Columns;
  - Walls;
  - Foundations.
- Lateral load analysis and design for seismic and wind forces;
- Computer analysis and design results, if applicable;

- Structural Drawings

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

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

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

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

  - Structural Notes:
    - Design criteria indicating all superimposed vertical and horizontal loads used in the design including live, snow, earthquake, wind and dead loads (such as landscape, partition and equipment loads) not shown on the structural drawings. These loads should be designated as unfactored;
    - Reference to the geotechnical report on which the foundation design is based;
    - Brief material specifications including standards and grades;
    - Absolute or relative deflection criteria for structural members;
    - Where forces are shown, the forces should be clearly identified as factored or unfactored;
    - Pertinent design standards;
    - Reference to drawings and Specifications prepared by other participants of the design team.
  - Typical Details;
  - Foundation Plans and Schedules:
    - Allowable soil-bearing capacity, pile capacities and lateral earth pressures for retaining structures;
    - Sizes, locations, dimensions and details of all foundations;
    - Assumed bearing strata or elevation(s);
    - Estimated pile length(s) or source of this information;

- Location of know existing underground services and/or structures or reference to the source where this information can be found;
- If underpinning or temporary shoring is specified to be designed by others, indication on the drawings of the areas designated to be shored or underpinned. If shoring or underpinning is designed by the Structural EOR, indication of all details and construction sequences.

- Floor and roof framing plans and details:
  - General gridline dimensions and overall building dimensions;
  - Sizes, locations, dimensions and details of all structural elements;
  - Elevations, including slopes and depressions;
  - Lateral load resisting system;
  - Governing forces, moments, shears or torsion required for the preparation of shop and detail drawings;
  - Reinforcing bar sizes and details with fabrication and placing criteria;
  - Locations and details of control, construction, contraction and expansion joints;
  - Locations, sizes and reinforcing of significant openings;
  - provision for future extensions;
  - Location and magnitude of any additional superimposed loads, which are not part of the normal dead and/or live load.
- Schedules and Details for Columns, Beams and Walls:
  - Element sizes;
  - Elevation of bottom of columns;
  - Reinforcing steel and splice details for concrete columns;
  - Type and location of splices for structural steel columns;
  - Details of structural masonry or reinforced concrete walls including lintels, details and reinforcing of significant openings;
  - Stiffeners, lateral bracing and local reinforcement.
- Connections:
  - The Structural EOR shall either: (1) Design all connections or (2) specify which connections are to be designed by the Supplementary Structural Engineer;
  - For structural steel projects wherein CSA W47.1 certified fabricators are specified, the Structural EOR shall clearly state who is responsible to do connection design;
  - Where connections are specified to be designed by Supplementary Structural Engineers, indicate on the contract drawings all required information and governing forces. In such cases the Supplementary Structural Engineer shall seal, sign and date the fabrication and erection drawings that show connection design information;
  - Where connections are designed by the Structural EOR, show all dimensions and comprehensive connection details requiring no further engineering input. Under these circumstances, the Structural EOR retains responsibility for these connections;
  - The Structural EOR shall consider the design of the connections when sizing the structural members, e.g. HSS truss joints, post-tensioned anchorages;
  - Show general arrangement and details at intersections of different structural materials.
- Sequence of construction, if this is critical to the functioning of the finished structure.
- General
  - Engineers seal, signature and date of issue

- Purpose of each issue
- Applicable design and constructions codes and standards
- Sequence of work, if required for function of finished structure
- Expansion, construction and control of joint locations and details

Construction Stage

- General Services
  Recommendations to the Client on the timing and number of Structural EOR site visits. Consideration should be given to full time inspection for those elements which will no longer be available for inspection due to cover up;

- Review of Submittals
  Review shop drawings and other Submittals of pre-engineered or proprietary structural elements for type, position, and connection to elements of the Primary Structural System and for criteria and loads used for the design. Pre-engineered or proprietary structural elements shall bear the seal of a Professional Engineer

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

  - Structural Element/Connection Drawings
    The drawings for proprietary structural elements, such as open web steel joists, shall be sealed, signed and dated by the Supplementary Structural Engineer who designed these items;
  - Erection Drawings
    These drawings shall specifically show the location of structural members, connections and components to be supplied by the fabricator. When these drawings incorporate design by the Supplementary Structural Engineer, the drawings shall be sealed, signed and dated by the Supplementary Structural Engineer. To clarify responsibility, the Supplementary Structural Engineers may qualify the extent of work which has been designed by them;
  - Shop Fabrication
    These drawings produced by the fabricator shall provide all information necessary for shop personnel to fabricate and assemble the items. The drawings shall be sealed, signed and dated when incorporating design by a Supplementary Structural Engineer;
  - Construction Engineering Drawings

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

Appendix A3 – Basic Municipal

In addition to the basic engineering services outlined in Section 3.3, the following additional basic services shall apply to all Municipal EORs:

Design Development Stage

- Carry out an investigation and analysis to determine the user requirements and subsequently the system design criteria for materials and performance;

Contract Document Stage

- Contract Drawings
  A general plan should show a summary of all proposed facilities and services at an appropriate scale. For large projects, a location plan at a convenient scale should be provided showing the geographic location of the project.

  Engineers should endeavour to standardize plan sizes and scales in the best interests of their Clients. The drawings for municipal projects will be of two basic types: a) those relating to work within road and right of way allowances, either for roads or for services therein, and b) those relating to treatment plants, pumping stations, bridges and other structures:

  - Works within Road and Right of Way Allowances
    - These drawings should generally show plan and profile, augmented with cross sections and detailed drawings as required.
    - Plans and profiles should normally be drawn to a horizontal 1:500 scale and a vertical scale of 1:100, subject to the requirements of the municipality. The north point should be shown on each plan, together with the names of the streets, lot numbers, property lines and frontage dimensions obtained from existing municipal plans.
    - Design details of standard units of construction, such as road sections, maintenance holes, catch-basins, valve chambers, hydrants, streetlight standards, guiderails and pipe bedding, should be presented on standard drawings at appropriate scales. Plans should show the location of all known existing utilities both underground and on the surface, all existing topographic features including embankments, buildings, mature trees, entrances, signs, fences, etc., within the road allowance or in proximity to the work.
    - Profiles shall show the existing surface profile, the approximate location and elevation of known existing utilities which will be intersected by the new work and any available soils information.
    - For roadwork, the profile should indicate the finished road surface giving the length and grade of each tangent section of vertical curve.
    - For sewers and watermains, the profile should show an invert and obvert profile of the pipe. For sewers, invert and basement elevations should be shown and for watermains, minimum depths of cover, as required. The length, grade and class of pipe and type of bedding or encasement for each section should be indicated.
  - Treatment Plants, Pumping Stations, Bridges and Other Structures

- Design of pumping stations and plants shall be such that competitive bidding is encouraged for the supply of equipment and structures unless special conditions require the supply of specific equipment or structures.
- These drawings should be grouped according to the type of work to which they relate and, where applicable, should comply with the APEGN Guidelines in the structural, mechanical and electrical fields.
- The manner of presentation of the work in the plan form, the rendering of detail in line diagrams, the dimensioning and lettering and all other drafting work should be carried out in a professional and skilled manner to ensure that the work is presented in an orderly fashion, the facilities and structures are shown in a recognizable manner and that the wording on the plans is simple, concise, grammatically correct and completely legible.

- Approvals
  Engineers should become familiar with all Authorities Having Jurisdiction over any component of the Work. They should submit plans, specifications, schedules, and applications for approval to Clients and to appropriate authorities, as required. They should attend meetings at the offices of these public authorities to discuss designs and to provide explanations for the purpose of furthering the applications towards approval.

  In addition, the Engineer may be required to prepare special applications or reports to assist the municipality in obtaining subsidy payments, grants or special financing from senior levels of government.

Construction Stage

The services to be provided by the Engineer during construction of a Project fall into two (2) categories, namely, General Review Services and Resident Staff Services During Construction.

When, in the opinion of the Engineer, a resident engineer and staff are required, the Engineer should so advise the Client. This service may be provided by an authorized representative of the Engineer, or by a sub-consultant reporting to the Engineer. If the Client agrees to the services, the following should be included:

- General Review Services
  - advise the contractor on the interpretation of the Contract Documents and issue supplementary details and instructions during the construction period as required;
  - review the construction schedule proposed by the contractor;
  - consider and advise on alternative equipment and materials proposed by the Contractor;
  - maintain adequate records related to the Contract;
- Resident Staff Services During Construction
  If agreed with the client, resident staff services will be provided by the Engineer or representative on a full-time or part-time basis. This service may be provided by an authorized representative of the Engineer, or by a sub-consultant reporting to the Engineer. Such services should include the following:
  - provide reference line and elevation to the Contractor at the beginning of the Contract and, where necessary, check the Contractor's line and grade;
  - determine if the Contractor is carrying out the Work in accordance with the Contract Documents and communicate with the Contractor, the Engineer's authorized

representatives, and the Client regarding deficiencies in the Work, and other matters of direct interest or concern;

- arrange for or carry out all necessary field testing and inspection of materials and equipment installed;
- On unit price-based contracts, measure and record all work and material quantities in a form consistent with schedule of quantities for the Work;
- investigate, report and advise on unusual circumstances which may arise during construction;
- carry out final inspection at the conclusion of the construction contract, as part of the acceptance program of the Client;
- obtain and record field information of construction details for the modification of contract drawings;
- maintain sufficient data to determine periodic progress of the Work, and;

prepare recommendations to the Client regarding payments to the Contractor, considering progress of work, materials and equipment delivered to site, and contractual and statutory holdbacks.

APPENDIX B – ADDITIONAL, DISCIPLINE SPECIFIC, ENGINEERING SERVICES

Appendix B1 – Additional Geotechnical

In addition to the Basic Services, the Geotechnical EOR may provide the following Additional Services if the Geotechnical EOR and the Client reach appropriate mutual agreements. They are not considered intrinsic parts of the basic geotechnical design services as discussed in Section 3.3, and are not part of the minimum services which the Geotechnical EOR should provide under these guidelines.
Examples of Additional Geotechnical Services can include:

- Geotechnical engineering work resulting from changes to the project as originally described and agreed to under the contract between the Geotechnical EOR and Client, such as changes in scope, complexity, diversity or magnitude of the project;
- Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- Review of alternative designs or products after completion of the Contract Documents;
- Review of design drawings or Specifications prepared by others to determine suitability;
- Blast monitoring during excavation and/or seismic risk analysis;
- Special dynamic analysis beyond that required by codes such as ground-foundation response;
- Special physical soil model analysis such as centrifuge testing;
- Field investigation of existing buildings and structures including surveys of existing construction;
- Design review or field observations of shoring or bracing for excavations and building or underpinning of adjacent structures;
- Review of the contractor's methods, procedures and construction equipment with respect to the effect on the project;
- Work resulting from corrections or revisions required because of errors or omissions in
- construction by the contractor;
- Extra work arising from disputes due to problems outside the control of the Geotechnical EOR;
- Work due to extended time schedules for design or construction, beyond the control of the Prime Consultant or Geotechnical EOR;
- Services as an expert witness in connection with any public hearing, arbitration, or court proceedings concerning the project, including attendant preparation for same;
- Work resulting from damage as the result of fires, man-made disasters, or natural disasters;
- Overtime work requiring premium pay when authorized;
- Travelling time outside of normal requirements;
- Provision of special clauses to be included in the specifications where unusual soil, bedrock or groundwater conditions exist and where special expertise is required;
- Provision of special sketches for drainage, special foundation measures, safe slopes and
- shoring requirements;
- Attendance at special site meetings to review problems of an unforeseen nature that have arisen during foundation or earthworks construction.
- Performance of specialized field testing, surveys, or assessments conducted by geotechnical engineering specialists, geological engineers, engineering geologists, geophysicists and

hydrogeologists is sometimes required as part of a geotechnical engineering study. These should be regarded as additional services to be coordinated by the Geotechnical EOR.

Appendix B2 – Additional Mechanical

In addition to the *Basic Services*, the mechanical *EOR* may provide the following *Additional Services*, if the mechanical *EOR* and the *Client* reach appropriate mutual agreements. They are not generally considered intrinsic parts of the basic mechanical design services, as discussed in section 3.3, and are not part of the minimum services which the mechanical *EOR* should provide under these Guidelines.

Examples of *Additional Mechanical Services* can include:

- Design work resulting from changes to the project as originally described and agreed to under the contract between the *Mechanical EOR* and *Client*, such as changes in scope, complexity, diversity or magnitude of the project;
- Preparation of alternate mechanical designs and related documentation after selection of the mechanical system made during the conceptual and schematic design stage;
- Review, design and documentation of alternate systems, if requested by the *Prime Consultant*, the *Client* or the contractor, for tendering to obtain competitive bids for items such as proprietary products;
- Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- Review of alternate designs or products after completion of the *Contract Documents*;
- Work resulting from changes necessary because of construction cost over-run which is outside the control of the *Mechanical EOR*;
- Translation of *Contract Documents* into a second language or conversion to other units;
- Investigation, analysis and/or studies to determine the user requirements of a special nature and subsequently the mechanical system design criteria for materials and performance;
- Analysis of long-range plans as defined by the *Prime Consultant* and attendant preliminary sketches and reports (master planning);
- Preparation of alternative system designs and attendant documentation when required by the *Prime Consultant* or *Client* either for review or for competitive tender prices;
- Travelling time outside of normal requirements;
- Construction or project management services;
- Value engineering (life cycle costing) analysis including schematics where required by the *Prime Consultant* or *Client*;
- Preparation of designs and documentation for future implementation not included in construction contract;
- Preparation of Bills of Material or Schedules of Material at any time during the project;
- Resident engineering services during construction. Supply resident staff on the project to determine if the contractor is carrying out their work in accordance with the *Contract Documents*. If required by the *Prime Consultant* resident services may include the recording of all details of construction for final revision of the plans or drawings to show the work on *Record Drawings*. "Services" as described do not include the direction of persons or the selection, direction or approval of methods and equipment employed by the contractor in any phase of the construction or the placing in operation of any plant or equipment;

- Preparation of drawings, Specifications and change orders and administration of contract additions and/or deletions which are initiated by the *Client* but either have not been implemented or result in a reduction in the contract price;
- Certification inspections and testing of life safety systems where required by the *Authority Having Jurisdiction*;
- Testing of mechanical systems requiring confirmation of conformance with Specifications;
- Preparation of *Maintenance Manuals*;
- Preparation of *Record Drawings*;
- Providing services after expiry of the period of one (1) year following Certification of Substantial Performance;
- Complete or partial revision of design documents previously approved by the *Client* or in keeping with written instruction or drawings previously received from the *Client*;
- *Commissioning* of mechanical systems including training of personnel and providing operating and maintenance assistance;
- Advisory services which include testimony; consultation and advice; appraisals; valuations; research; other services leading to specialized conclusions and recommendations;
- Surveys of existing mechanical equipment which includes elaborate surveys or measurements and evaluation of existing mechanical equipment, i.e., securing of information on special existing loadings such as unusual equipment requirements or unusual construction;
- Balancing of air and water/liquid systems which involves the actual detailed balancing and adjustment of air and water/liquid systems including adjustment of heating, air conditioning, ventilation systems, and piping networks as installed (typically included in Contract Specifications);
- Computerized energy analysis involving the use of computer programs to simulate the amount of energy used. The program optimizes the effects of varying architectural features, mechanical systems and electrical systems;
- Fast-track construction. To facilitate an earlier-than-normal construction start, the *Prime consultant* or project manager may request the *Mechanical EOR* to prepare several separate bid packages instead of the normal one. In this case, complete tender documentation necessitating extra work on the part of the *Mechanical EOR* is required for each bid package;
- Site work elements beyond the property line;
- Specific elements or systems normally designed by other *Professional Members*;
- Review of design drawings or Specifications prepared by others;
- Preparation or assisting with the development of detailed cost estimates. The *Mechanical EOR* shall inform the *Client* of the variables inherent in the estimate and the expected degree of variation from the estimate. Where the degree of variation is critical, the *Owner* should have the estimate independently verified;
- Filing application for and obtaining permits, that are normally the responsibility of others;
- Preparation of *As-Built Drawings* and/or demolition documents;
- Tenant-related design services;
- Design or review of the effects of the contractor's methods, procedures or construction equipment on the structure;
- Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor;
- Work due to extended time schedules for design or construction beyond the control of the *Prime Consultant* or *Mechanical EOR*;

- Services as an expert witness in connection with any public hearing, arbitration or court proceedings concerning the project, including attendant preparation of same;
- Work resulting from damage as the result of fire, man-made disasters, or natural disasters;

Authorized overtime work requiring premium pay.

Appendix B3 – Additional Structural

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

Examples of *Additional Services* are:

- Design work resulting from changes to the project as originally described and agreed to under the contract between the *structural EOR* and *Client*, such as changes in scope, complexity, diversity or magnitude of the project.
- Preparation of alternate structural designs and related documentation after selection of the *Primary Structural System* made during the conceptual and schematic design stage.
- Review, design and preparation of documentation of alternate systems, if requested by the *Prime Consultant*, the *Client* or the contractor.
- Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction.
- Review of alternate designs or products after completion of the *Contract Documents*.
- Work resulting from changes necessary because of construction cost over-run which is outside the control of the *structural EOR*.
- Translation of *Contract Documents* into a second language, conversion to other units, or special preparation of drawings for reduction.
- Work associated with *Non-Structural Elements* beyond those described under *Basic Services*.
- Review of design drawings or Specifications prepared by others to determine adequacy of anchorage of *Non-Structural Elements*.
- Preparing or assisting with detailed cost estimates.
- Quantity take-offs and preparation of bills of materials.
- Seismic risk analysis.
- Special dynamic analysis beyond that required by codes such as spectrum or time-history response to seismic forces or floor-response to vibratory equipment.
- Design of seismic restraints for mechanical or electrical equipment, architectural features and other *Non-Structural Elements*.
- Special physical model analysis such as wind-tunnel tests or shaking table tests.
- Field investigation of existing buildings and structures including surveys of existing construction.
- Filing application for and obtaining permits that are normally the responsibility of others.
- Preparation of demolition documents.
- Determination of structural fire-resistance requirements.
- Tenant-related design services.
- Preparation of shop or fabrication drawings.
- Preparation of reinforcing steel bending schedules or other types of shop drawings.
- Continuous or detailed inspections of construction.
- Design review or field observations of shoring or of bracing for excavations and building or of underpinning of adjacent structures.

- Design or review of the contractor's methods, procedures and construction equipment with respect to the effect on the structure.
- Design or review of the contractor's design of formwork, falsework or construction bracing.
- Review of additional *Submittals* when occasioned by improper or incomplete *Submittals*.
- Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor.
- Extra work arising from disputes due to problems outside the control of the *Structural EOR*.
- Preparation of *Record Drawings* of the structures.
- Work due to extended time schedules for design or construction beyond the control of the *Prime Consultant* or *structural EOR*.
- Services as an expert witness in connection with any public hearing, arbitration, or court proceedings concerning the project, including attendant preparation for same.
- Work resulting from damage as the result of fires, man-made disasters, or natural disasters.
- Overtime work requiring premium pay when authorized.
- Travelling time outside of normal requirements.
- Preparation of *As-Built Drawings*.

Appendix B4 – Additional Municipal

In addition to the Basic Services, the municipal EOR may provide the following Supplementary Services if the municipal EOR and the Client reach appropriate mutual agreement. They are generally not considered intrinsic parts of the basic municipal design services, as set out in Section 3.3, and are not part of the minimum services which the municipal EOR should provide under these Guidelines.
Examples of Supplementary Services are:

- Provide analysis of long-range plans as defined by the Client and attendant preliminary sketches and reports (master planning).
- Design work resulting from changes to the Project as originally described and agreed to under the Agreement between the Engineer and Client such as changes in scope, complexity or magnitude of the Project;
- Preparation of alternate designs and related documentation, as requested by the Client, after selection of the systems made during the predesign stage;
- Review, design and documentation of alternate systems, if requested by the Client or the Contractor, for tendering to obtain competitive bids for items such as proprietary products;
- Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- Review of alternate designs or products after completion of the Contract Documents;
- Work resulting from changes necessary because of construction cost over-run which is outside the control of the Engineer;
- Translation of Contract Documents into a second language, conversion to other units, special preparation of drawings for reduction;
- Travelling time outside of normal requirements;
- Construction management or project management services;
- Value engineering (life cycle costing) analysis including schematics where required by the Client;
- Preparation of designs and documentation for future implementation not included in construction contract;
- Preparation of additional Bills of Material or Schedules of Material at any time during the Project;
- Certification inspections and testing of life safety systems where required by the Authority Having Jurisdiction;
- Testing of systems requiring confirmation of conformance with specifications;
- Preparation of Maintenance Manuals;
- Complete or partial revision of design documents previously approved by the Client or in keeping with written instructions or drawings previously received from the Client;
- Commissioning of systems including training of personnel and providing operating and maintenance assistance as per the Municipal Water, Sewer and Roads Specifications, Government of Newfoundland and Labrador;
- Advisory services which include consultation and advice; appraisals; valuations; research; other services leading to specialized conclusions and recommendations;
- Fast-track construction. To facilitate an earlier-than-normal construction start, the Client may request the Engineer to prepare several separate bid packages instead of the normal one. In this

case, complete tender documentation necessitating extra work on the part of the Engineer is required for each bid package;

- Review of design drawings or specifications prepared by others;
- Filing application for and obtaining permits, that are normally the responsibility of others;
- Preparation of As-Built Drawings as per the Municipal Water, Sewer and Roads Specifications, Government of Newfoundland and Labrador;
- Design or review of the effects of the Contractor's methods, procedures or construction equipment;
- Work resulting from corrections or revisions required because of errors or omissions in construction by the Contractor;
- Work due to extended time schedules for design or construction beyond the control of the Client or Engineer;
- Services as an expert witness in connection with any public hearing, arbitration or court proceedings concerning the Project, including attendant preparation of same;
- Work resulting from damage as the result of fire, man-made disasters, or natural disasters;
- Authorized overtime work requiring premium pay.

Appendix B5 – Additional Electrical

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

Examples of Additional Services are:

- Design work resulting from changes to the project as originally described and agreed to under the contract between the Electrical EOR and Client, such as changes in scope, complexity or magnitude of the project;
- Preparation of alternate electrical designs and related documentation after selection of the electrical system made during the conceptual and schematic design stages;
- Review, design and documentation of alternate or substitute systems if requested by the Prime Consultant, the Client or the contractor, for tendering to obtain competitive bids for items such as proprietary products;
- Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- Review of alternate designs or products after completion of the Contract Documents;
- Work resulting from changes necessary because of construction cost over-run which is outside the control of the Electrical EOR;
- Translation of Contract Documents into a second language, conversion to other units, special preparation of drawings for reduction;
- Investigation, analysis and/or studies to determine the user requirements of a special nature and subsequently the electrical system design criteria for materials and performance;
- Analysis of long-range plans as defined by the Prime Consultant and attendant preliminary sketches and reports (master planning);
- Preparation of alternative system designs and attendant documentation when required by the Prime Consultant or Client either for review or for competitive tender prices;
- Travelling time outside of normal requirements;
- Construction or project management services;
- Value engineering (life cycle costing) analysis including schematics where required by the Prime Consultant or Client;
- Preparation of designs and documentation for future implementation not included in construction contract;
- Preparation of Bills of Material or Schedules of Material at any time during the project;
- Resident engineering services during construction. Supply resident staff on the project to determine if the contractor is carrying out their work in accordance with the Contract Documents. If required by the Prime Consultant resident services may include the recording of all details of construction for final revision of the plans or drawings to show the work on Record Drawings. "Services" as described do not include the direction of persons or the selection, direction or approval of methods and equipment employed by the contractor in any phase of the construction or the placing in operation of any plant or equipment;

- Preparation of drawings, Specifications and change orders and administration of contract additions and/or deletions which are initiated by the Client but either have not been implemented or result in a reduction in the contract price;
- Certification inspections and testing of life safety systems where required by the Authority Having Jurisdiction;
- Testing of electrical systems requiring confirmation of conformance with Specifications;
- Preparation of Maintenance Manuals;
- Preparation of Record Drawings. (Electrical EORs do not guarantee the accuracy of information provided to them by the contractor);
- Providing services after expiry of the period of one (1) year following Certification of Substantial Performance;
- Complete or partial revision of design documents previously approved by the Client or in keeping with written instruction or drawings previously received from the Client;
- Commissioning of electrical systems including training of personnel and providing operating and maintenance assistance;
- Advisory services which include testimony; consultation and advice; appraisals; valuations; research; other services leading to specialized conclusions and recommendations;
- Surveys of existing electrical equipment which includes elaborate surveys or measurements and evaluation of existing electrical equipment, i.e., securing of information on special existing loadings such as unusual equipment requirements or unusual construction;
- Electrical system short circuit analysis and protective device coordination study to ensure a coordinated distribution system; adjustment of the breaker times on site to respond to the coordination study results;
- Factory witness testing of major electrical components to verify performance before shipment from the factory;
- Fast-track construction. To facilitate an earlier-than-normal construction start, the Prime Consultant or project manager may request the Electrical EOR to prepare several separate bid packages instead of the normal one. In this case, complete tender documentation necessitating extra work on the part of the Electrical EOR is required for each bid package;
- Site work elements beyond the property line;
- Specific elements or systems normally designed by other Professional Members;
- Preparing or assisting with the development of detailed cost estimates. The Electrical EOR shall inform the Client of the variables inherent in the estimate and the expected degree of variation from the estimate. Where the degree of variation is critical, the Owner should have the estimate independently verified;
- Filing application for and obtaining permits that are normally the responsibility of others;
- Preparation of As Built Drawings and/or demolition documents;
- Tenant-related design services;
- Design or review of the effects of the contractor's methods, procedures or construction equipment on the structure;
- Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor;
- Work due to extended time schedules for design or construction beyond the control of the Prime Consultant or Electrical EOR;

- Services as an expert witness in connection with any public hearing, arbitration or court proceedings concerning the project, including attendant preparation of same;
- Work resulting from damage as the result of fire, man-made disasters, or natural disasters;
- Authorized overtime work requiring premium pay.