



**GUIDELINES FOR
ELECTRICAL
ENGINEERING SERVICES
AUGUST 1995**

PUBLISHED BY:

**PROFESSIONAL ENGINEERS AND GEOSCIENTISTS OF NEWFOUNDLAND & LABRADOR (PEGNL)
P.O. Box 21207, St. John's, NL A1A 5B2
Telephone: (709) 753-7714
Fax:(709) 753-6131**

ACKNOWLEDGEMENT

The support and assistance of Professional Engineers and Geoscientists of British Columbia (APEGBC) is gratefully acknowledged. APEGBC's "Guidelines for Electrical Services for Building Projects" was used extensively in the preparation of this document.

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	PURPOSE OF GUIDELINES	1
1.2	SCOPE OF GUIDELINES	2
1.3	QUALIFICATION	2
2.0	DEFINITIONS	2
3.0	PROJECT ORGANIZATION AND RESPONSIBILITIES	5
3.1	COMMON FORMS OF PROJECT ORGANIZATION	5
3.2	RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS	5
3.2.1	Owner	5
3.2.2	Prime Consultant	6
3.2.3	Electrical Engineer of Record	7
3.2.4	General Contractor	8
3.3	SELECTION OF CONSULTANTS	9
4.0	GUIDELINES FOR PROFESSIONAL PRACTICE	9
4.1	SOLE USE OF DOCUMENTS	9
4.2	SCOPE OF SERVICES	9
4.3	BASIC ELECTRICAL ENGINEERING SERVICES	10
4.3.1	"Conceptual" or "Schematic" Design Stage	10
4.3.2	Design Development Stage	12
4.3.3	Contract Document Stage	13
4.3.4	Tendering Stage	16
4.3.5	Construction Stage	17
4.4	ADDITIONAL ELECTRICAL ENGINEERING SERVICES	21
4.5	FABRICATION DRAWINGS AND DOCUMENTS	25
4.5.1	Shop Drawings	25
	APPENDIX A - COMMON ORGANIZATIONAL CHARTS	26

GUIDELINES FOR ELECTRICAL ENGINEERING SERVICES

1.0 INTRODUCTION

1.1 PURPOSE OF GUIDELINES

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

The Guidelines have been prepared to set out the standards of practice which *Members* should meet and follow in providing professional engineering services. PEGNL and its Council have a commitment to maintain the quality of the services *Members* provide to *Clients* and the public, and have published these Guidelines for that purpose.

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

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

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

1.2 SCOPE OF GUIDELINES

These Guidelines apply to the practice of Electrical Engineering.

The Guidelines outline the professional services which should generally be provided by the *Electrical Engineer of Record (EER)*. They specify tasks which should be performed by the *EER* to achieve designs which are in the best interest of the *Client* and the public and which are properly coordinated with the work of other design, fabrication and construction team participants. These Guidelines should assist in maintaining the integrity of the overall and detailed designs.

1.3 QUALIFICATION

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

2.0 DEFINITIONS

Additional Services:

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

As-Built Drawings:

Drawings which are prepared from measurements taken on site to depict accurately the actual size and location of existing elements.

Association:

Professional Engineers and Geoscientists of Newfoundland & Labrador (PEGNL).

Authority Having Jurisdiction:

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

Basic Services:

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

Client:

The party who engages the *EER* to provide professional electrical engineering services.

Commissioning:

Commissioning is defined as the documentation 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. Generally the post-commissioning phase would include monitoring through the first year of seasonal operations.

Contract Documents:

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

Due Care:

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

EER:

The *Electrical Engineer of Record*.

Electrical Engineer of Record:

The *Member* with general responsibility for the design integrity of the electrical systems as provided by section 3.0 of the Guidelines.

Fabricator:

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

Field Services:

The services provided by the *EER* as set out in Section 4.3.5 to ascertain if the electrical construction work is generally in accordance with the Electrical Contract Documents.

General Contractor:

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

project.

Maintenance Manual:

A binder containing all the necessary technical information on electrical systems for the *Owner* to carry out maintenance and operation of the equipment installed under the contract.

Member:

A *Member* in good standing with PEGNL.

Owner:

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

Prime Consultant:

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

Professional Engineer:

The person who holds a certificate of registration to engage in the practice of engineering under the Engineers and Geoscientists 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.

Subcontractor:

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

Submittal(s):

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

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

3.1 COMMON FORMS OF PROJECT ORGANIZATION

Project organizations vary according to the needs of the project and the parties. The following organizational charts are included in Appendix A:

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

3.2 RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS

3.2.1 OWNER

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

- 3.2.1.1 Retain or cause to be retained qualified *Professional Engineers* including a *Prime Consultant* and an *EER* with responsibility for the design of the electrical systems;
- 3.2.1.2 Cooperate with the *Prime Consultant* to set out a written description of the scope of the *EER's* services as referred to in paragraph 3.2.3.3, and an adequate written description of the project;
- 3.2.1.3 Before the commencement of the *EER's* services, finalize or cause to be finalized a written agreement with the *EER* (directly with the *Owner* or with the *Prime Consultant* or with another appropriate party);

- 3.2.1.4 Cooperate with the *Prime Consultant* and the *EER* in establishing a realistic schedule for the provision of design services;
- 3.2.1.5 Authorize in writing any *Additional Services* that may be required beyond the scope of the *EER's* contract;
- 3.2.1.6 Ensure that all required approvals, licences and permits from the *Authorities Having Jurisdiction* are obtained prior to proceeding with construction;
- 3.2.1.7 Recognize that drawings, Specifications and other documents prepared by the *EER* are for the project and that such documents shall not be used or copied for other projects without the agreement of the *EER* and without advice from that of a qualified design professional;
- 3.2.1.8 Recognize that, because code interpretation of the *Authority Having Jurisdiction* may differ from that of the *EER*, some changes may occur;
- 3.2.1.9 Recognize that, even with a well-qualified design team and with a design, meeting reasonable criteria and standards, some unforeseen changes may occur and that accordingly a reasonable contingency should be included in the *Owner's* budget.

3.2.2 PRIME CONSULTANT

To enable the *EER* to perform his/her duties properly, the *Prime Consultant* should:

- 3.2.2.1 Interpret and define the needs of the *Owner* and in so doing define the *Owner's* intended functions and needs. The *Prime Consultant* should identify any special design criteria such as equipment and other requirements and should advise the *EER* accordingly;
- 3.2.2.2 Outline the scope of assignment to each design professional for design, preparation of *Contract Documents*, review of work during construction and contract administration;
- 3.2.2.3 Negotiate a fee with the *Owner* that is in accordance with the PEGNL fee schedules and shall seek input from each design professional before finalizing same;

- 3.2.2.4 Provide timely information in sufficient detail as required by the *EER* to adequately perform his/her duties;
- 3.2.2.5 Coordinate and review the designs, drawings and other *Contract Documents* produced by all participants of the design team;
- 3.2.2.6 Coordinate communication of information between the *Owner*, the contractor and the design professionals, including the *EER*, so that the work proceeds in a manner that complies with applicable codes and regulations and meets the *Owner's* needs;
- 3.2.2.7 Inform the *EER* of tender call results;
- 3.2.2.8 Provide the *EER* with one (1) complete set of *Contract Documents*.

3.2.3 ELECTRICAL ENGINEER OF RECORD

- 3.2.3.1 The *Electrical Engineer of Record (EER)* is responsible for the integrity of the design of the electrical systems shown on contract documents prepared by the *EER*.
- 3.2.3.2 The *EER* may rely on other *Members* to be responsible for elements of the electrical and related systems but the *EER* has the overall responsibility to see that all design is undertaken as is necessary to achieve an electrical system that meets acceptable engineering standards. In this event the *EER* must require the other *Members* to sign and seal the documents for such elements. These *Members* are responsible for the integrity of their design.
- 3.2.3.3 The *EER* together with the *Client* is responsible for setting out a written description of the scope of the *EER's* services to enable and permit the *EER* to meet the design and field review requirements of these Guidelines and applicable codes and regulations.
- 3.2.3.4 If the *Owner* or *Prime Consultant* fails or refuses to carry out the obligations as set out in Section 3.2.1 and 3.2.2, the *EER* should:
 - (a) consider giving written notice to the *Owner* advising the *Owner* of the *EER's* recommendations;
 - (b) consider whether the *EER* can continue with the project,

because in any event the *EER* must comply with the minimum requirements of these Guidelines.

3.2.4 GENERAL CONTRACTOR

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

- 3.2.4.1 The *General Contractor* is responsible for all labour, materials, equipment, and plant required to complete the work;
- 3.2.4.2 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*;
- 3.2.4.3 The *General Contractor* is responsible for coordinating the work of the *Sub-Contractors* and for checking the *Sub-Contractor's* work;
- 3.2.4.4 The *General Contractor* is responsible for verifying that the work is complete prior to requesting a field review by the *EER*;
- 3.2.4.5 The *General Contractor* is responsible for providing reasonable written notice to the *EER* when components are ready for field review;
- 3.2.4.6 The *EER's* field review does not relieve the *General Contractor* from his responsibilities to complete the work in conformance with the *Contract Documents*;
- 3.2.4.7 All potential *General Contractors* and *Subcontractors* submitting bids are advised to visit the site prior to the tender closing.

3.3 SELECTION OF CONSULTANTS

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

4.0 GUIDELINES FOR PROFESSIONAL PRACTICE

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

4.1 SOLE USE OF DOCUMENTS

The following clause should appear on all drawings and specifications.

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

4.2 SCOPE OF SERVICES

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

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

architectural, structural, mechanical and electrical drawings are completed.

4.3 BASIC ELECTRICAL ENGINEERING SERVICES

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. Because of the requirements of the specific project, certain *Basic Services* activities may be required to be performed out of the normal sequence or in different stages than indicated in the scope of services.

4.3.1 CONCEPTUAL OR SCHEMATIC DESIGN STAGE

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

- 4.3.1.1 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 electrical systems considering economy, performance, capital cost, compatibility with other design elements and requirements of relevant codes and authorities;
- 4.3.1.2 If required, assist the *Prime Consultant* and/or *Owner* in:
 - (a) Defining the need for any specialty consulting services which may be required for the project, e.g., acoustical, fire protection, etc.;
 - (b) Developing or reviewing the project schedule including any milestone dates;
 - (c) Determining channels of communication;
 - (d) Determining drawing standards and Specifications format;
 - (e) Determining the number and timing of project team meetings during each stage of the project;
- 4.3.1.3 Establish dates by which information affecting the electrical design will be needed from other disciplines, such as structural and mechanical;
- 4.3.1.4 Conduct field reviews and review existing drawings where appropriate;

- 4.3.1.5 Establish criteria for other consultants as required. Comment on reports presented;
- 4.3.1.6 Establish electrical design criteria and, in the case of building projects, determine the mode of heating in consultation with the Mechanical Engineer of Record and *Client*;
- 4.3.1.7 Develop the electrical scheme for the electrical systems. Develop alternate schemes where appropriate. Consider materials and systems suitable to the project requirements. Consider the requirements of the other design professionals and provide the information they require;
- 4.3.1.8 Check applicable codes, 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;
- 4.3.1.9 Prepare a conceptual cost estimate or cooperate appropriately with others responsible for reporting the estimate, if required;
- 4.3.1.10 Determine the allocation of suitable space for electrical vaults, electrical room, telephone/data rooms, generator rooms and other major electrical installations;
- 4.3.1.11 Identify equipment parameters such as weights, size, noise, vibration, and other physical characteristics that are to be considered in the electrical design. Determine the impact of noise and vibration from the electrical systems on the *Client's* operational requirements and recommend solutions through the use of a specialist if necessary;
- 4.3.1.12 Establish, where appropriate, comparative information to be used in selection of electrical systems for the project;
- 4.3.1.13 Describe the major electrical system(s) and each significant component and material;
- 4.3.1.14 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 *EER* proceeds further;

- 4.3.1.15 If required, prepare a concept design report which defines the electrical systems selected for the project and outlines the reasons involved in the selection.
- 4.3.1.16 A *Client* may assume responsibility for all or some of the foregoing Conceptual or Schematic Design Stage activities provided:
- (a) the *EER's* ability to satisfy the requirements of the subsequent stages of these Guidelines is unimpaired;
 - (b) the responsibility for such preliminary design activities is clearly defined in writing;
 - (c) the *Client*, in writing, waives the *EER's* responsibility for such preliminary design activities and their effect on the selection of the electrical systems.

4.3.2 DESIGN DEVELOPMENT STAGE

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

- 4.3.2.1 Attend, if required, meetings with the *Client* and design team;
- 4.3.2.2 Review results of studies by specialist consultants, such as geotechnical, fire protection, etc.;
- 4.3.2.3 Prepare preliminary electrical analysis and design calculations for typical electrical elements of the electrical systems. Select appropriate equipment;
- 4.3.2.4 Prepare preliminary design drawings, as required, depending on the complexity of the design, based on information coordinated with other consultants;
- 4.3.2.5 Prepare preliminary design drawings, as required, depending on the complexity of the design, showing layouts of typical and/or critical areas;
- 4.3.2.6 Prepare or edit the "outline Specifications" for electrical items, as required;

- 4.3.2.7 Coordinate electrical design with space and servicing criteria to meet the requirements of the other design team participants. In particular, notify the Mechanical Engineer of Record of all points of interface between the two disciplines and determine as soon as possible the electrical characteristics and mechanical requirements of all electrical loads and potential conflicts between the mechanical and electrical riser locations;
- 4.3.2.8 Prepare a preliminary cost estimate or co-operate appropriately with others responsible for reporting the estimate;
- 4.3.2.9 Submit a design development report for review and approval by the *Client*.

4.3.3 CONTRACT DOCUMENT STAGE

4.3.3.1 General:

- (a) Design the electrical systems;
- (b) Determine and specify in the *Contract Documents* which electrical elements are to be designed by other *Members*;
- (c) Attend periodic coordination meetings, as required;
- (d) Coordinate with the *Authority Having Jurisdiction*, power utility company, telephone company, cable TV company, as required;
- (e) Establish testing and inspection requirements;
- (f) Comply with fire resistance requirements as determined by the *Prime Consultant* or other *Members*.
- (g) Seal documents per Engineers and Geoscientists Act.

4.3.3.2 Electrical Calculations

The *EER* must prepare electrical calculations to support all electrical designs. The electrical calculations should be prepared legibly and presentably and filed by the *EER* for record purposes. Hard copy of input and output of any computer analysis should be included as well as description of the software used.

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

- (a) Design criteria:
 - Discussion and description of design basis including assumptions;
 - Codes and standards used with edition dates;
 - List of electrical design parameters and provisions that exceed or vary from code and standard requirements as requested by the *Client* or otherwise used by the *EER*;
- (b) Location diagrams for electrical elements;
- (c) Computer analysis and design results, if applicable;
- (d) Special studies and analysis where required by Code;
- (e) Equipment and cable sizing calculations;
- (f) Fault calculations, as required;
- (g) Protection coordination studies, as required;
- (h) 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;
- (i) The names of the electrical design engineer(s) and design check engineer;
- (j) Table of contents for, or index to, the electrical calculations.

4.3.3.3 Electrical Drawings

Prepare contract drawings. In the case of buildings, these drawings should be made, where possible, to the same scale as that of the building layout drawings and should define the work:

- (a) Where scale of drawings or complexity of work make drawing difficult to be read and interpreted, separate drawings should be provided for such areas of the work as:
 - lighting and power
 - HVAC electrical services
 - communication and alarm system requirements
 - one line diagram and risers

- other special systems as necessary;
- (b) Schematics and riser diagrams should be provided as required for all major systems with notes to describe the function of distribution power systems and functioning of communication systems;
- (c) Plot plans and/or site plans showing electrical power and communications arrangements, connections to public utility services and cross sections and profiles, should be included;
- (d) Symbol lists and typical details should be included, where required, for all equipment, accessories, devices;
- (e) In the case of buildings, floor plan layouts for all electrical systems should be provided. Complete electrical feeder sizing together with sizes, type, locations and capacities of all panelboards should be shown on these documents;
- (f) To avoid conflicts, supplementary details should be provided in congested areas of electrical rooms and communication equipment rooms. For clarity, such details should be drawn in plan and elevation views at an appropriate scale;
- (g) Power distribution can be shown in single line diagram;
- (h) Schedules should be included to provide type and capacities of lighting fixtures, panelboards, motor equipment, devices, and electrical heating equipment;
- (i) All drawings as well as details, elevations and sections should be properly cross-referenced.

4.3.3.4 Specifications

- (a) Prepare Specifications using a format suitable for inclusion with the *Contract Documents*;
- (b) The Specifications should include information on:
 - standards, codes, by-laws governing work;
 - *Submittals* required;
 - quality control requirements;
 - materials and the procedure for substitution other than specified

- material;
 - 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;
 - performance criteria for design and detailing by other *Members*.
- (c) Where appropriate, the Specifications may be abbreviated and become part of the drawings;
- (d) The Specifications generally set out that the *EER'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 his own independent quality control program.

4.3.4 TENDERING STAGE

- 4.3.4.1 Assist in the preparation of pre-qualification documents, if required;
- 4.3.4.2 Assist in reviewing bidder's qualifications, if required;
- 4.3.4.3 Assist the *Client* in obtaining required approvals, licences and permits by submitting required drawings and documentation to utility companies such as power, telephone and communications;
- 4.3.4.4 Provide assistance to the *Client* in answering queries raised by the bidding contractors and issue electrical addenda and clarification of electrical documents, as required;
- 4.3.4.5 Assist in analysis and evaluation of tenders submitted;
- 4.3.4.6 Assist in the preparation of the contract, if required.

4.3.5 CONSTRUCTION STAGE

It is essential that *Field Services* be provided for all systems for which the *EER* is

responsible to ascertain whether or not the work is generally in accordance with the electrical Contract Documents.

It is preferable that the *Field Services* be provided by the *EER*; however, where practical the *EER* may delegate these duties to others.

Field Services by the *EER* should not be construed to relieve the contractor of the contractor's responsibility for building 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 *EER* may also require review by other members of the design team or by testing and inspection agencies. Such work may include proprietary products and electrical elements designed by others.

4.3.5.1 General Services During Construction

General Services should include, but not necessarily be limited to, the following and may vary depending on the complexity of the job:

- (a) Attend construction meetings, if required;
- (b) Confirm communication channels and procedures;
- (c) Assist in confirming, reporting and scheduling procedures for testing and inspections;
- (d) Assist in confirming procedures for shop drawings and other *Submittals*;
- (e) Confirm that the qualifications of manufacturers meet the Specifications;
- (f) Advise the contractor and the *Prime Consultant* on the interpretation of the electrical drawings and Specifications and issue supplementary details and instructions during the construction period as required;
- (g) If requested, advise the *Client* on the validity of charges for additions to or deletions from the contract and on the issue of change orders;
- (h) Assist *Client* in the development of an acceptable format and price breakdown structure to facilitate certification of construction

progress payments;

- (i) Review and comment on, if requested by the *Client*, the contractor's applications for progress payments. Estimate, if required, completed work and materials on site for payment according to the terms of the construction contract;
- (j) Review reports from the testing and inspection agencies to determine if the agency has verified compliance of the reported item of work with the electrical Contract Documents. Initiate any necessary action;
- (k) Conduct substantial performance field reviews of the electrical components of the project, note deficiencies and inspect completed corrections;
- (l) Attend the start-up of the electrical 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; prepare a list of deficiencies (workmanship, completeness and function) and, when these have been rectified, issue the final report.

4.3.5.2 Review of *Submittals*

Submittals should be reviewed for general compliance with the electrical Contract Documents and do not include: checking dimensions or quantities or the review of the contractor's safety measures or methods of construction.

The *EER* shall:

- (a) Confirm that the *Submittals* have been reviewed and stamped by the *General Contractor* and relevant *Subcontractors* before review by the *EER*;
- (b) Review the shop drawings and other *Submittals* for general conformance with the *Contract Documents* and the intent of the design;
- (c) When required by the *Contract Documents*, confirm that the shop drawings bear the signature and professional seal of the other *Members* responsible for the design of such specialty systems. Responsibility for the detail design remains with the other *Members* whose seal and signature appear on the drawings;
- (d) Review *Record Drawings* prepared and submitted by the contractor on white prints or mylar copies to reflect "Record" 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 *EER* cannot accept responsibility for their accuracy;
- (e) Arrange for the contractor to submit and review a *Maintenance Manual* for the equipment/systems supplied on this project. 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.
- (f) The following is the recommended stamp affixed to all *Submittals* signed and dated by the *EER*

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
()

REVIEWED & MODIFIED
()

REVISE & RESUBMIT
()

Date Returned	Shop Drawing No.
Reviewed by	Job No.

4.3.5.3 Field Review

The *EER* should:

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

4.4 ADDITIONAL ELECTRICAL ENGINEERING SERVICES

In addition to the *Basic Services*, the *EER* may provide the following *Additional Services* if the *EER* 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 *EER* should provide under these Guidelines.

Examples of *Additional Services* are:

- 4.4.1 Design work resulting from changes to the project as originally described and agreed to under the contract between the *EER* and *Client*, such as changes in scope, complexity, diversity or magnitude of the project;
- 4.4.2 Preparation of alternate electrical designs and related

documentation after selection of the electrical system made during the conceptual and schematic design stages;

- 4.4.3 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;
- 4.4.4 Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- 4.4.5 Review of alternate designs or products after completion of the *Contract Documents*;
- 4.4.6 Work resulting from changes necessary because of construction cost over-run which is outside the control of the *EER*;
- 4.4.7 Translation of *Contract Documents* into a second language, conversion to other units, special preparation of drawings for reduction;
- 4.4.8 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;
- 4.4.9 Analysis of long range plans as defined by the *Prime Consultant* and attendant preliminary sketches and reports (master planning);
- 4.4.10 Preparation of alternative system designs and attendant documentation when required by the *Prime Consultant* or *Client* either for review or for competitive tender prices;
- 4.4.11 Travelling time outside of normal requirements;
- 4.4.12 Construction or project management services;
- 4.4.13 Value engineering (life cycle costing) analysis including schematics where required by the *Prime Consultant* or *Client*;
- 4.4.14 Preparation of designs and documentation for future implementation not included in construction contract;
- 4.4.15 Preparation of Bills of Material or Schedules of Material at any

time during the project;

- 4.4.16 Resident engineering services during construction. Supply resident staff on the project to determine if the contractor is carrying out his 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;
- 4.4.17 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;
- 4.4.18 Certification inspections and testing of life safety systems where required by the *Authority Having Jurisdiction*;
- 4.4.19 Testing of electrical systems requiring confirmation of conformance with Specifications;
- 4.4.20 Preparation of *Maintenance Manuals*;
- 4.4.21 Preparation of *Record Drawings*. (The *EER* does not guarantee the accuracy of information provided to him/her by the contractor);
- 4.4.22 Providing services after expiry of the period of one (1) year following Certification of Substantial Performance;
- 4.4.23 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*;
- 4.4.24 *Commissioning* of electrical systems including training of personnel and providing operating and maintenance assistance;
- 4.4.25 Advisory services which include: testimony; consultation and advice; appraisals; valuations; research; other services leading to specialized conclusions and recommendations;

- 4.4.26 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;
- 4.4.27 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;
- 4.4.28 Factory witness testing of major electrical components to verify performance before shipment from the factory;
- 4.4.29 Fast-track construction. To facilitate an earlier-than-normal construction start, the *Prime Consultant* or project manager may request the *EER* 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 *EER* is required for each bid package;
- 4.4.30 Site work elements beyond the property line;
- 4.4.31 Specific elements or systems normally designed by other *Members*;
- 4.4.32 Preparing or assisting with the development of detailed cost estimates. The *EER* 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;
- 4.4.33 Filing application for and obtaining permits that are normally the responsibility of others;
- 4.4.34 Preparation of *As Built Drawings* and/or demolition documents;
- 4.4.35 Tenant-related design services;
- 4.4.36 Design or review of the effects of the contractor's methods, procedures or construction equipment on the structure;
- 4.4.37 Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor;

- 4.4.38 Work due to extended time schedules for design or construction beyond the control of the *Prime Consultant* or *EER*;
- 4.4.39 Services as an expert witness in connection with any public hearing, arbitration or court proceedings concerning the project, including attendant preparation of same;
- 4.4.40 Work resulting from damage as the result of fire, man-made disasters, or natural disasters;
- 4.4.41 Authorized overtime work requiring premium pay.

4.5 FABRICATION DRAWINGS AND DOCUMENTS

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

4.5.1 Shop Drawings

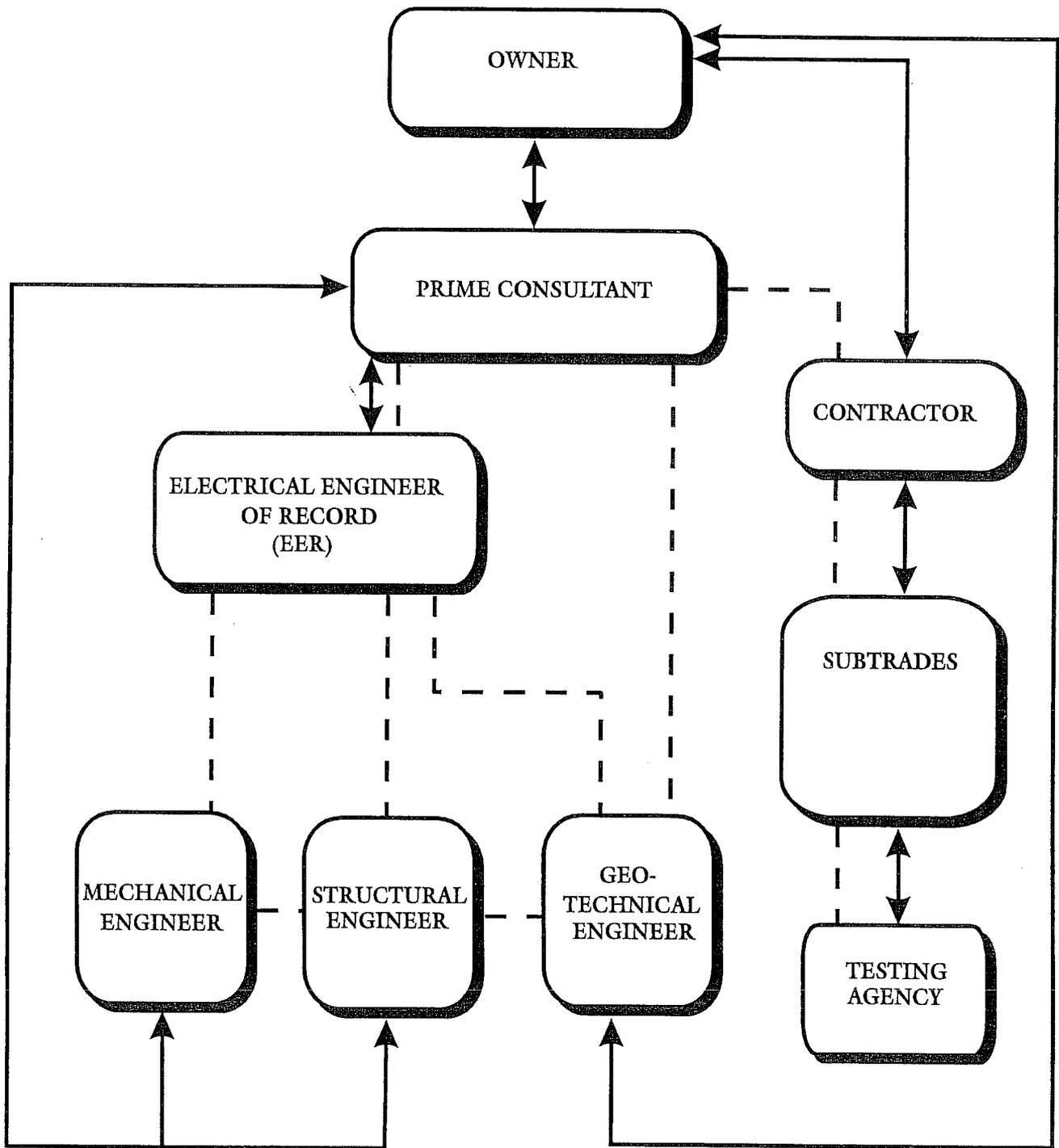
These are drawings produced by the fabricator to provide all information necessary for shop personnel to fabricate and assemble the items. The drawings shall be sealed, signed and dated when incorporating design by the other *Members*.

APPENDIX A

COMMON ORGANIZATIONAL CHART

COMMON ORGANIZATIONAL CHARTS

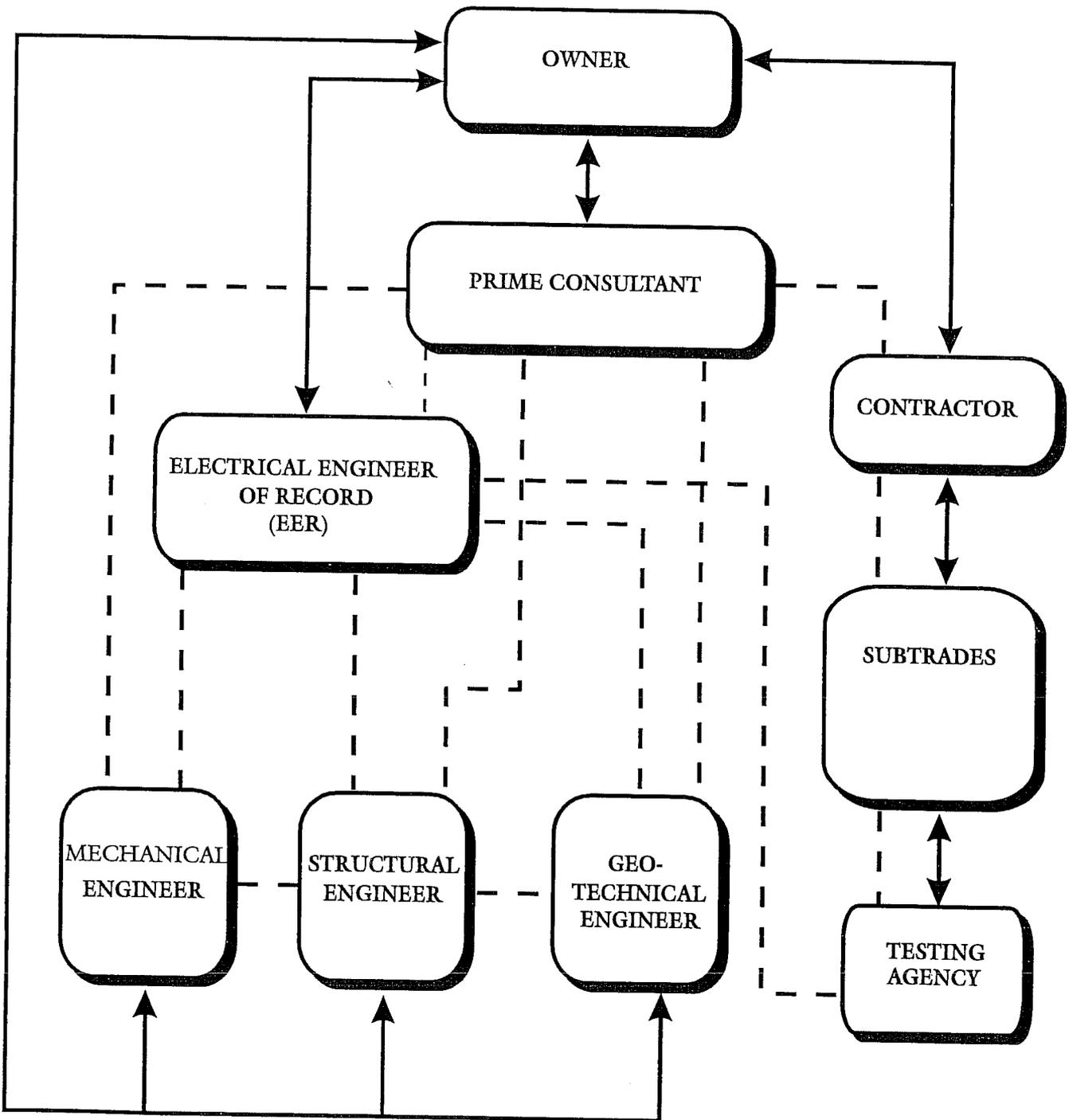
1. ELECTRICAL ENGINEER OF RECORD (EER) / PRIME CONSULTANT CONTRACT



Note: The *Prime Consultant* shall be responsible for coordination of the Subconsultants even though they are hired by the *Owner*.

COMMON ORGANIZATIONAL CHARTS

2. ELECTRICAL ENGINEER OF RECORD (EER) / OWNER CONTRACT

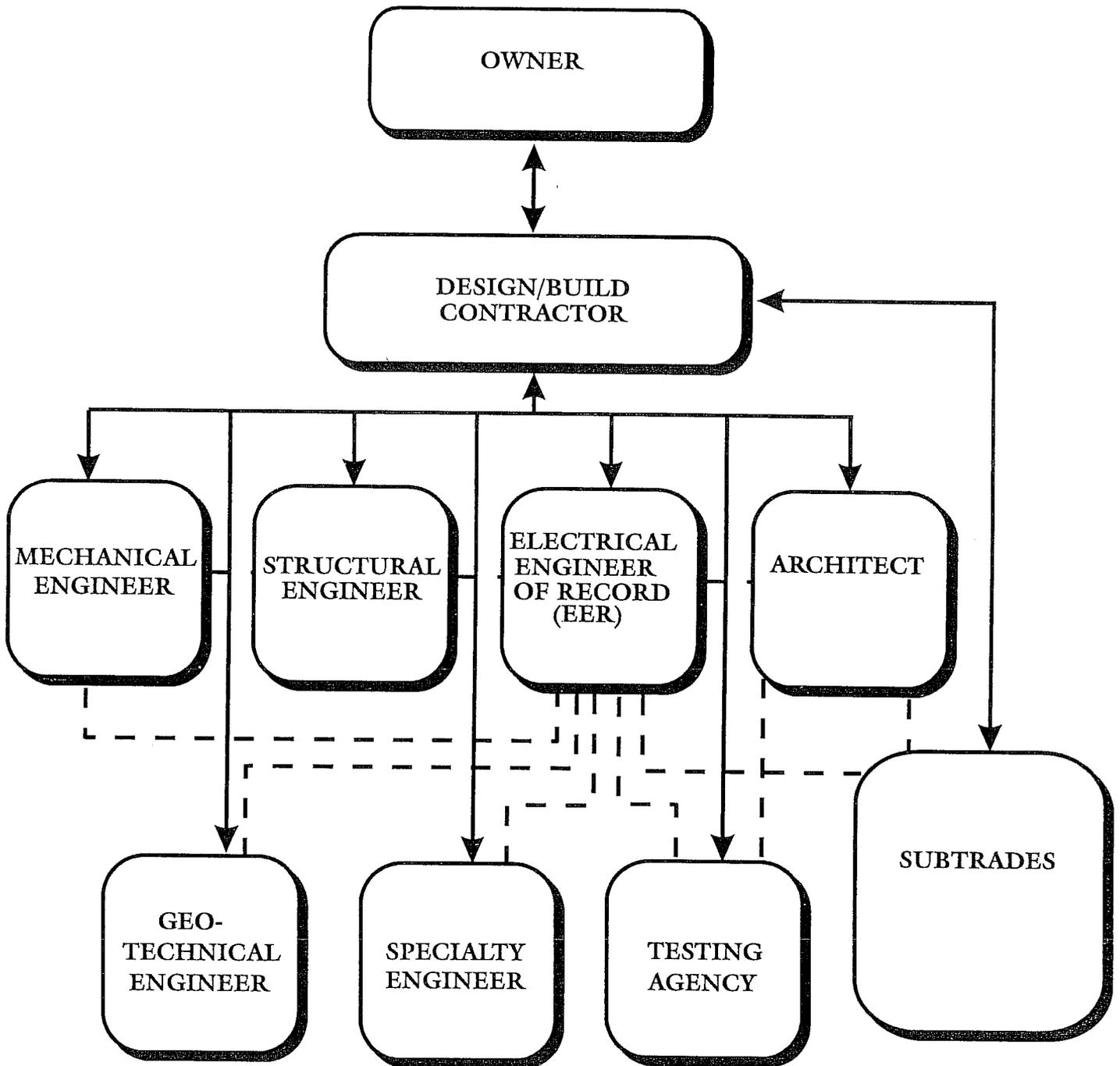


↔ Contractual Relationship
- - - Functional Interface

Note: The *Prime Consultant* shall be responsible for coordination of the subconsultants even though they are hired by the *Owner*.

COMMON ORGANIZATIONAL CHARTS

3. DESIGN/BUILD CONTRACT



Contractual Relationship



Functional Interface