



Ministry of
Transportation
and Infrastructure

ELECTRICAL AND TRAFFIC ENGINEERING MANUAL

Section 200

Design Process and Quality Management

Electrical and ITS Engineering

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Electronic versions of this manual and appendices available at:

http://www.th.gov.bc.ca/publications/eng_publications/electrical/electrical_and_traffic_eng/Electrical_Signing_Design_Manual/tableofcontents.htm

201 INTRODUCTION TO DESIGN PROCESS

201.1 ABOUT SECTION 200

- .1 Section 200 provides guidelines for maintaining a consistent approach to preparing and submitting designs and supporting documentation. All pre-requisite steps and procedures for ministry reviews and acceptance are also defined.

201.2 BEFORE YOU BEGIN

- .1 Designers shall be familiar with the requirements of this Manual, as well as all associated engineering publications prior to preparing a design.
- .2 This document references several engineering disciplines including electrical, traffic, civil, structural, and others. Designers must be competent in all engineering disciplines applicable to a project. Professional Engineers are required to sign and seal all drawings, specifications, and reports submitted to the ministry in accordance with the Engineers and Geoscientists Act.
- .3 All design submissions and revisions shall be in accordance with this section unless otherwise indicated by the ministry representative.
- .4 Design agencies shall have an in-house Quality Management program in place prior to preparing any designs or supporting documentation. Failure to maintain an effective in-house Quality Management Plan shall result in lower performance ratings in the consultant performance evaluation process and may affect the awarding of subsequent work to the design agency.

201.3 MINISTRY REFERENCE STAFF

- .1 Designers shall determine the following key ministry project team members prior to proceeding with the design:
 - .1 Ministry Representative (Project Manager)
 - .2 Ministry Electrical Representative (Electrical Engineering)
 - .3 Senior Traffic Operations Engineer
 - .4 Manager, Electrical Services
 - .5 Electrical Consultant Liaison Technician

201.4 TYPE OF DESIGNS

- .1 The intention of this manual is to document the design process for the different types of projects. The types of projects and a brief description of each are as follows:
 - .1 Ministry Projects
 - .1 Ministry projects are initiated and managed by the ministry or, alternately, an engineering consultant on behalf of the ministry. Typically, the types of work include, traffic engineering, electrical design, sign design, traffic signal design, lighting design, contract document preparation, construction engineering services, and record drawings.
 - .2 Developer Initiated Projects
 - .1 Developer projects are initiated by a Developer or by another government agency such as a Municipality. For these projects the Developer will identify the scope of the work with input from the ministry or the designated engineering consultant. The Developer is responsible for all engineering applicable to the project.
- .2 The ministry will conduct reviews at various stages of the process, as described later in this section.

201.5 GENERAL DESIGN PROCESS

- .1 Ministry Projects
 - .1 The ministry will prepare scope of work and may engage an engineering consultant to undertake the assignment.
 - .2 The Designer shall obtain a TE - Drawing Series number from the Electrical Consultant Liaison Technician.
 - .3 The Designer shall prepare or obtain a *Traffic Engineering Check Sheet* (TEC) and Signal Timing Sheet (STS) in accordance with 202.4 Traffic Engineering Check Sheet Submittal.
 - .4 After the ministry has accepted and signed-off the TEC, the Designer shall prepare the electrical design and supporting documentation as defined in Section 202.5 Electrical Design Submittal.
 - .5 The Electrical Consultant Liaison Technician will distribute the following:

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- .1 A complete set of signed and sealed drawings, special provisions, and construction cost estimate in electronic format to the ministry Project Manager;
 - .2 A copy of drawings to the Manager, Electrical Service, Senior Traffic Operations Engineer, and Traffic Controller Technician;
 - .6 When construction is complete the Designer shall request the mark-up drawings from the ministry Representative. Within 30 days of construction completion the Designer must submit signed and sealed record drawings to the ministry Electrical Design Liaison Technician.
 - .7 Upon completion of the project the ministry may evaluate the performance of the engineering consultant.
- .2 Developer Initiated Projects
 - .1 The process for roadway lighting or traffic signal projects by the Developer is defined in information sheets in Appendix 200.3 & Appendix 200.4.
 - .2 For all developer initiated projects the Developer must contact the District Development Approvals Technician.

202 TRAFFIC AND ELECTRICAL DESIGNS

202.1 GENERAL

- .1 This chapter covers the general guidelines for traffic and electrical designs.
- .2 The ministry will not accept design submissions that do not meet the requirements listed in this section.
- .3 If the engineering consultant wishes to confirm the scope of work, they shall arrange for a meeting with the ministry. At this meeting, the engineering consultant shall present their questions and the ministry will provide comments. It is the responsibility of the engineering consultant to summarize and record any decisions made at this meeting and include this in the design folder for the project.
- .4 The responsibility for undertaking the traffic and electrical design rests with the engineering consultant. The ministry shall perform the following functions:
 - .1 Review and accept the *Traffic Engineering Check Sheet*, *Signal Timing Sheets*, and drawings.
 - .2 Conduct quality assurance audits.
 - .3 The ministry will provide feedback on all submissions within two weeks provided all appropriate documentation is submitted as a complete package. Submissions found to be incomplete will be rejected and must be re-submitted in complete form.
 - .4 *Traffic Engineering Check Sheets* which have not been signed by a Senior Traffic Operations Engineer; and /or design drawings that have not been accepted and initialled by Electrical and ITS Engineering will not be acceptable for construction.
 - .5 The ministry supplies traffic controllers or arranges to modify existing traffic controllers for all ministry projects. The costs for this work and controller commissioning shall be paid by the Developer. Contact the Sr. Traffic Systems Control Technologist to obtain costs for controller and electrical work defined under Section 500 Signal Commissioning Guidelines of the Ministry of Transportation Traffic Controller Design Manual.
 - .6 In order to provide a new traffic controller or modify an existing traffic controller, the ministry requires:
 - .1 Ministry accepted *Traffic Engineering Check Sheets*.
 - .2 Ministry accepted *Signal Timing Sheets*.
 - .3 Ministry accepted electrical drawings

- .4 Payment for controller modifications and electrical work as defined by the Sr. Traffic Systems Control Technologist.

202.2 DESIGNER QUALIFICATIONS

- .1 Electrical and traffic engineering designs must be prepared under the direction of a qualified professional engineer registered with the Engineers and Geoscientists of British Columbia (EGBC). The engineer signing and sealing the drawings shall be known as the Engineer of Record.
- .2 The Engineer of Record must be able to demonstrate a thorough understanding of ministry standards and requirements.
- .3 The ministry may request the engineering consultant provide documentation detailing their relevant experience in traffic, lighting, electrical and traffic signal design.

202.3 BEFORE PROCEEDING WITH A DESIGN

- .1 Prior to starting a design it is recommended the engineering consultant contact the ministry Electrical and ITS Engineering to review the scope of work and design criteria. This is particularly important for Developer initiated work where the ministry is not directly responsible for engaging the engineering consultant.

202.4 TRAFFIC ENGINEERING CHECKLIST SUBMISSIONS

- .1 If a project involves either modifying an existing traffic signal or installing a new traffic signal, the designer shall submit a completed *Traffic Engineering Check Sheet* and *Signal Timing Sheet* for each signal. These check sheets ensure that all factors associated with traffic signal designs (geometrics, signing, markings, and operations) are considered in the traffic signal design and are used as a reference for resolving operational issues that may arise in the future.
- .2 The traffic engineering submission shall include all items listed in the Traffic Design Folder (refer to 202.6).
- .3 The Traffic Design Folder must be submitted to the Senior Traffic Operations Engineer for acceptance of the *Traffic Engineering Check Sheet*. Where deliverables are submitted as part of the prime consultant's package, additional copies shall be submitted directly to the Senior Traffic Operations Engineer.
- .4 For further information on completing the *Traffic Engineering Check Sheet* refer to the document *Traffic Engineering Checklist- How to Complete the*

Form or Signal Timing Sheets - How to Complete the Form in Appendix 400 - Signal Design.

202.5 ELECTRICAL DESIGN SUBMISSIONS

- .1 Large projects may incorporate preliminary and/or functional designs in the form of a written report defining the scope of work, project design criteria, list of concerns, and a cost estimate. Typically, the prime consultant will incorporate this preliminary or functional design report into a report that includes all the project elements. Where such a report is produced it shall be submitted to the ministry Electrical and ITS Engineering.
- .2 The electrical submission shall be forwarded to ministry Electrical and ITS Engineering when complete. The submission shall include the following:
 - .1 One full size hardcopy set of drawings signed and sealed by the Engineer of Record.
 - .2 One electronic copy of the final design folder (refer to 202.7).
 - .3 One electronic copy (ACAD digital files) of all electrical drawings.
 - .4 One electronic copy of the lighting calculation files (AGi32, Visual 3D).

202.6 TRAFFIC DESIGN FOLDERS

- .1 Traffic Design Folders provide relevant data and information aiding in the design review of the *Traffic Engineering Check Sheet*. The design folder is also used as supporting documentation in cases where legal action is brought against the ministry/engineering consultant as a result of motor vehicle accidents. Traffic design folders are also useful when field changes are required during construction.
- .2 Traffic design folders shall:
 - .1 Be in electronic format.
 - .2 Have a table of contents and title page.
 - .3 Follow the format of the attached sample in Appendix 200 - Design Folder
- .3 As a minimum, the traffic design folder shall contain the following:
 - .1 Project Information - Fill out Project Information Template in Generic Design Folder in Appendix 200.1.
 - .2 Key Correspondence and Information - This shall include records of e-mails and discussions of key issues.
 - .3 Relevant Calculations - Copy of Synchro or Highway Capacity Software files in hardcopy and digital files.

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- .4 *Traffic Engineering Checklists*- Checklists must be signed and sealed by the Engineer of Record and accepted by the Senior Traffic Operations Engineer.
- .5 *Signal Timing Sheets* - Sheets must be signed and sealed by Engineer of Record.
- .6 Drawings - One full size signed and sealed copy of applicable geometric, signing, and marking drawings.
- .7 Pictures of the site - Site pictures shall be labelled to identify location.
- .8 Traffic Count Data - In spreadsheet format defined in Appendix 400.

202.7 ELECTRICAL DESIGN FOLDERS

- .1 The Electrical Design Folders provide relevant data and information aiding in the design review. Electrical Design Folders are also useful when field changes are required during construction and for revisions at a later date.
- .2 Electrical design folders shall:
 - .1 Be in electronic format.
 - .2 Have a table of contents and cover page.
 - .3 Follow the format of the attached sample in Appendix 200.
- .3 The electrical design folder shall contain the following:
 - .1 Project Information Sheet - Copy of Project Information Sheet filled out with applicable information (refer to Appendix 200.1 for template).
 - .2 Key Correspondence and Information, such as copies of e-mails and other relevant documents.
 - .3 Construction Cost Estimate – Schedule 7.
 - .4 Photographs of the site - Copy of relevant pictures labelled to identify their location.
 - .5 Design Quality Review Checklist - Copy of Electrical Design Quality Review Checklist filled out and signed and sealed by the Engineer of Record (refer to Appendix 200.2 for sheet).
 - .6 Calculations - Copy of relevant calculations including voltage drop, fault current, conduit fill, lighting, pole capacity, power loading spreadsheets and others that may be applicable.
 - .7 *Traffic Engineering Checklists* and *Signal Timing Sheets* - Copy of Checklists and Sheets signed and sealed by the Engineer of Record and signed by the ministry.

- .8 Electrical Special Provisions - Copy of electrical special provisions (where applicable).

202.8 CONSTRUCTION

- .1 Electrical construction for Developers and Projects may be undertaken by a qualified Electrical Construction Contractor or by the ministry Electrical Maintenance Contractor.
- .2 Work undertaken by the ministry Electrical Maintenance Contractor is done so under the terms of the Electrical Maintenance Service Agreement, Schedule 8, “Additional Services”.
- .3 There is specific work that may only be undertaken by the ministry Electrical Maintenance Contractor. This work is listed in the Electrical Maintenance Service Agreement, Schedule 8, 1.1 (d) as “Guaranteed Additional Services”.
- .4 If work is to be undertaken by both the Electrical Construction Contractor and the Electrical Maintenance Contractor, the scope of work for each must be defined.
- .5 The Manager, Electrical Services will provide a price for any work to be completed by the Electrical Maintenance Contractor.
- .6 The Developer shall pay all costs incurred by the ministry for Development Approvals

203 SIGNING DESIGNS

203.1 GENERAL

- .1 Signing drawings shall include all required signs, with the exception of temporary signs.

203.2 SIGNING DRAWINGS AND SPECIFICATIONS

- .1 Signs shall be shown on drawings in accordance with Section 700 Drafting Standards. All signs shall be shown, both existing and new. Elevation drawings shall be provided for all Sign Records (refer to Section 500 Electrical and Sign Support Structures).
- .2 All signs shall be supplied and installed by the Contractor unless otherwise noted.
- .3 All signs purchased for use on ministry of Transportation & Infrastructure right of way must comply with the following:
 - .1 The Manual of Standard Traffic Signs and Pavement Markings:
https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/traffic-engineering-and-safety/traffic-engineering/traffic-signs-and-pavement-markings/manual_signs_pavement_marking.pdf
 - .2 The *Specification for Standard Highway Sign Materials, Fabrication and Supply*:
https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/traffic-engineering-and-safety/traffic-engineering/traffic-signs-and-pavement-markings/standard-traffic-signs/specifications/sign_fabrication_specs.pdf
 - .3 *Traffic Signs & Pavement Markings*:
<https://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/traffic-engineering-safety/traffic-signs-markings>
 - .4 Special Provisions shall be prepared by the Designer. Refer to *Section 800 - Contract Data* for generic *Special Provisions* which must be modified to suit the specifics of the work.
- .4 Signing drawings shall be signed and sealed by the Engineer of Record registered with EGBC

203.3 SERVICE AND ATTRACTION SIGNS

- .1 Refer to the ministry *Service and Attraction Signing Manual* for information on Service and Attraction Signs.

https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/traffic-engineering-and-safety/traffic-engineering/traffic-signs-and-pavement-markings/standard-traffic-signs/supplemental-traffic-signs/service_and_attraction_signs.pdf

203.4 GUIDE SIGNS

- .1 The engineering consultant shall prepare small scale concept drawing (1:2000 scale) showing guide sign locations, sizes and messages on the geometrics and laning drawings. This drawing shall be submitted to the Senior Traffic Operations Engineer for review at the preliminary design stage. The design guide shall be developed in conjunction with the civil design.
- .2 Once the small scale sign concept drawings are accepted by the Senior Traffic Operations Engineer, the concept drawing and the geometric and laning drawings shall be submitted to the ministry sign shop who will prepare publication sign records.
- .3 It is important to note the production of drawings takes 4 to 8 weeks depending on the size of the project and the complexity of the signing. The size of the sign will define the requirements of the support structure, therefore sign sizes shall be verified early in the design process to avoid structure and foundation redesign due to changes in sign sizes.
- .4 Once sign records are produced they shall be incorporated into the tender package.

204 ENGINEERING WORK ACCEPTANCE

204.1 DEFINITION OF ACCEPTANCE

- .1 The ministry will perform a cursory review and accept drawings and documents from the engineering consultant that comply with the intent and the scope of work. This acceptance should not be interpreted as a quality assurance check of the engineering work.
- .2 Any errors or omissions in engineering work that results in additional costs to the ministry will be charged back to the engineering consultant.

205 QUALITY MANAGEMENT

205.1 QUALITY MANAGEMENT

- .1 Engineering consultants shall have a Quality Management Plan. This plan shall identify quality control and quality management tasks, as well as identify the staff that will be responsible for each task. The quality management staff and their reporting relationships shall be shown in a project organization chart.
- .2 All work shall be carried out in accordance with the procedures described in the Quality Management Plan.
- .3 Upon request, the engineering consultant shall provide a quality management plan document. The ministry may audit the engineering consultant's quality management program.
- .4 If the engineering consultant cannot demonstrate that they are following an appropriate Quality Management Plan, the ministry may choose to withhold acceptance of engineering work until it is demonstrated there is an acceptable quality management plan in place. Failure to employ an appropriate Quality Management Plan will result in poor consultant performance evaluations which may impact future consultant assignments.