

CHAPTER 100 HIGHWAY DESIGN PROCESS

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TYPICAL PROJECT DEVELOPMENT LIFE CYCLE

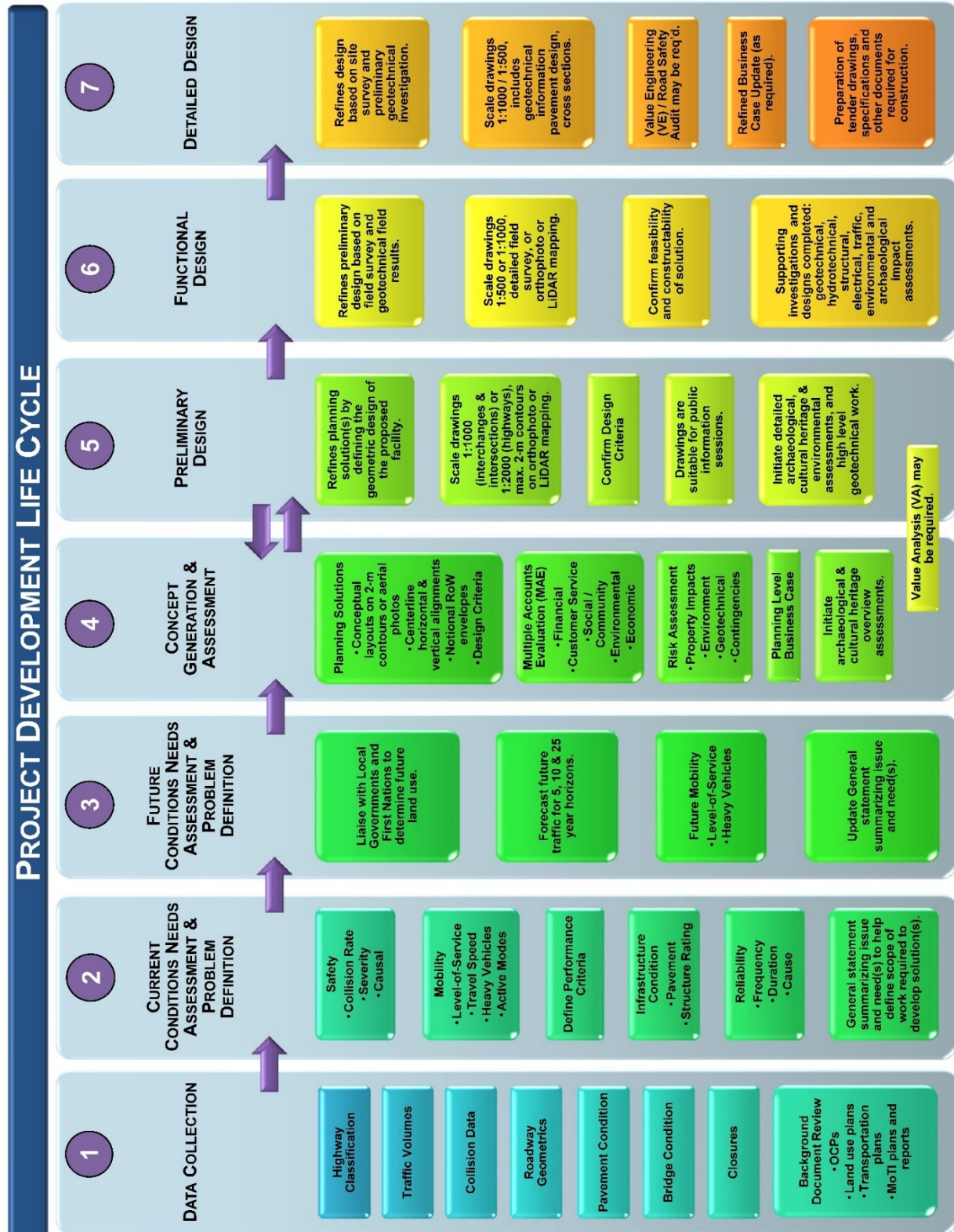


Chart by Planning Services, SIR; Rev: Jan 2018

Note: This chart is to be used as a general guide and the sequence of tasks may vary by project.

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HIGHWAY DESIGN PROCESS

100.1 INTRODUCTION

The purpose of this chapter is to provide guidance to designers in carrying out design assignments. This chapter is not intended to be prescriptive, but to list typical tasks that a designer may be required to complete depending on the scope and stage of the assignment. The information provided herein may be used for all types of project delivery.

100.2 COMMUNICATION

100.2.1 Project Management

The designer will confirm the scope, schedule and budget with the Ministry's Project Manager. Project deliverables checklists (see Section 100.11.3) should be prepared to identify the submittal requirements at the various submission stages.

100.2.2 Stakeholder Consultations

Unless otherwise directed, the project typically may include:

- Taking the lead role in advising and consulting with all parties or agencies directly affected by the design with respect to the effect and involvement of the proposed design on drainage, rights-of-way, accesses, and traffic.
- Contacting parties and agencies such as, but not limited to, local municipal, regional district, provincial and federal government officials, the local Transportation Authority, utility owners, railway authorities (through the Ministry's Rail/Navigable Waters Coordinator), Commercial Vehicle and Safety Enforcement, trucking associations, environmental agencies and other stakeholders.

- Ensuring all permits, approvals and other regulatory requirements are satisfied and obtained as necessary.
- Preparing materials to assist in advising and consulting with the media, elected officials, community groups, First Nations Bands, the Agricultural Land Commission and private property owners.

Consultants shall submit a copy of all relevant Project correspondence, including letters, memos, facsimiles, emails, conversation records, meeting minutes, decision papers, reports, etc., to the Ministry Contact Person as the design progresses.

100.2.3 Ministry Contact Person

In a Consulting Services Contract, the Ministry will name a Ministry Contact Person who may:

- Prepare and administer the contract.
- Monitor the contract to ensure that works are completed within the assignment schedules and budgets.

100.2.4 Consultant Contact Person

The Consultant shall:

- Identify a project manager who shall be the Ministry's point of contact on all aspects of their Consulting Services Contract.

100.3 PLANNING AND DESIGN STAGES

100.3.1 Planning Stages

Definition: The body of work that generally includes data collection, needs assessment, problem definition, concept (option) generation, and assessment to support capital investment decisions.

Planning precedes preliminary, functional, and detailed design, but for many projects, iterating into preliminary design may be needed to adequately develop the options for evaluation.

When requesting design and construction funding from the Transportation Investment Plan, a key output at the planning stage is a project business case.

The business case provides a recommendation and justification for a specific improvement option to proceed to the subsequent design stages. See the Typical Project Development Life Cycle chart at the beginning of this chapter.

100.3.1.1 Typical Planning Stage Studies

Corridor Management Plan

A study of an extended length of highway that carries out a high-level needs assessment, problem definition, option generation and option evaluation.

The study should present an overall view of problems and options along a corridor and present a direction for the focus of subsequent project-level planning.

Project Planning Study

A study of a specific intersection or segment of highway that carries out a detailed project-level needs assessment, problem definition, option generation and option evaluation.

The study should produce a project-level business case when requesting design and construction funding from the Transportation Investment Plan.

Reconnaissance/Corridor/Route Studies

These three studies may be necessary if a needs assessment suggests that a “new” highway is required.

- Reconnaissance Study

Identify and review the feasibility of corridor options (a qualitative, high-level study).

- Corridor

An evaluation of corridor options.

- Route Study

Development and evaluation of optional road locations, and interchange and intersection configurations within the preferred corridor.

Other planning studies include Access Management Plans, Active Transportation Plans, Road Network Plans, Safety Reviews, and Transportation Master Plans.

A Value Analysis review may be required at the end of the planning stage before proceeding to the design stages.

100.3.2 Preliminary Design

Definition: Further development of the primary options generated in the planning stage to support an evaluation of the options and a recommended option for subsequent design stages.

Preliminary drawings are developed using accurate base mapping with appropriate contour intervals and should be based on an initial design criteria sheet.

The drawings are suitable for communicating the project intent at public information sessions. These drawings will include the following information:

1. Design parameters.
2. Curb lines, edge of pavement, medians, nose and gore points.
3. Radii, spiral information, critical dimensions.
4. Intersection movements, intersection operation.

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5. Proposed centreline and original ground profiles.
6. Developmental phasing options (based on need and fiscal funding).
7. Construction staging if critical to project.
8. Major drainage components, channel improvements.
9. Retaining walls and bridges.
10. Approximate limits of cuts and fills.
11. Utility and rail conflicts.
12. Access provisions.
13. Property acquisition concept and preliminary right-of-way requirements.
14. General, environmental, geotechnical, and archaeological constraints (where applicable).

The Preliminary Design may consist of several submissions such as the 50%, 90%, and 100% design stages. The preliminary design phase will usually include the following levels of detail:

1. Construction staging is considered for feasibility, but not detailed at this time.
2. Geotechnical field data is considered for natural hazards and foundation material competency. This may require drilling, sampling, and testing.
3. Vertical clearances are analyzed for verifying functionality.
4. Original terrain data may be taken from topographic mapping or LiDAR, as detailed field surveys are not usually carried out for preliminary design.
5. Initiation of the Canadian Environmental Assessment Act/BC Environmental Act (CEAA/BCEA) screening process if applicable.
6. Preliminary level cost estimates (refer to Section 100.6 Cost Estimating for intended precision).

If more than one alignment or configuration option is being considered, one will be selected as "preferred" through the planning/preliminary design process, based on its operational efficiency, construction feasibility, social, economic and environmental impacts, cost

estimates, user benefits, public input, and other parameters appropriate for the project.

The lower rated options may be reconsidered in later design stages if problems arise with the selected option.

100.3.3 Functional Design

Definition: The horizontal and vertical geometric design for the phase preceding the development of the final detailed, design drawing.

Functional design drawings are developed at the appropriate scale, using detailed field survey information, or accurate and field verified orthophoto mapping with appropriate contour intervals. These drawings include the following information:

1. All items listed under the Preliminary Design section and recommendations.
2. All horizontal geometric design details.
3. Profiles, with vertical geometric design details.
4. Control lines with stationing including side roads.
5. Design vehicle turning templates superimposed at critical locations. Consideration may also be required for oversize permitted vehicles.
6. Survey Control information.
7. Final right-of-way requirements.
8. Drainage details.
9. Guide signing information and locations.
10. Environmental drawings with sensitive zones, limits and setbacks from environmental features.

The Functional Design may consist of several submissions such as the 50%, 90%, and 100% design stages. Submissions will be similar to those outlined in Section 100.3.5, although not all of the same items will be required.

The following parameters are considered in Functional Design:

1. Geotechnical design information with respect to pavement structure, stability of rock cuts and earth slopes, overburden removal limits, potential preloading /

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surcharging, and necessary mitigative measures required for foundation and embankment stability, erosion control, and other special concerns.

2. Profiles are set using earth balance techniques.
3. Consideration of warning, regulatory, guide and informational signs.
4. Biologist field work and reports will be developed to define the environmentally sensitive features, restrictions and suggested mitigation measures.
5. Archaeological study and report.
6. Initial noise study if applicable.
7. Continuation of environmental screening process if applicable.
8. Cross sections for review purposes.
9. A finished grade Digital Terrain Model to check pavement drainage.
10. Functional level cost estimates for use in construction budgets (see Section 100.6 Cost Estimating for intended precision).

100.3.4 Detailed Design

Definition: The development of final construction (tender) drawings and technical specifications for construction, including the completed geometric and geotechnical design, special site considerations and construction details.

Finalize all parameters from the Functional Design stage.

Detailed design drawings including Front Page, Key Plan, Legend, Plans, Profiles, Typical Sections, Geometrics and Laning, Spot Elevations, Signing and Pavement Markings, Drainage and Utilities, Volume Overhaul Diagram, and Gravel Quantity and Haul Charts are prepared as needed. These drawings should include details in accordance with Chapter 1200. Cross sections are finalized in accordance with Chapter 400.

Final quantity estimates and Detailed Design level cost estimates (refer to Section 100.6 Cost Estimating for intended precision) are produced at this time along with Special Provisions.

Projects to be tendered require all appropriate tender documents and schedules (refer to Section 100.5.5.12 Deliverables).

100.3.5 Detailed Design Submissions

The Detailed Design may consist of several submissions to the Project Manager, including but not limited to:

- 50% Detailed Design
- 90% Detailed Design
- 100% Detailed Design

The Project Deliverables Checklist should be completed with each submission (see Section 100.11.03).

50% Detailed Design Submission

This submission consists of, but is not limited to:

- Survey complete and base plans produced.
- Plans showing alignments, access treatments, drainage structures, edges of pavement, roadside barriers and flares, clearing and grubbing limits, critical dimensions, cut / fill toes, utility conflicts, objects / items to be relocated or removed, fencing, limits of construction, survey control monuments with their coordinates.
- Profiles showing proposed grades, vertical curve data, K values, horizontal alignment schematic, superelevation, existing and proposed culvert locations, surcharge and preload areas and original ground profile.
- Typical sections showing lane and shoulder widths, clear zone requirements, roadway structure, excavation and embankment slopes, ditch details, stripping, and special treatments.
- Laning and geometrics showing access movements, design vehicles, design speed, and critical laning dimensions.
- Signing and pavement markings showing new sign locations, schedule of signs required, sign removals and relocations.
- Cross sections.
- Suggested staging drawings showing:
 - detours (if required),
 - typical sections, and

- cross sections (as required).
- Drainage drawings.
- Utility relocation drawings.
- Other miscellaneous drawings (as required).
- Updated design criteria document.
- Updated cost estimate.
- Draft special provisions.

90% Detailed Design Submission

This submission consists of, but is not limited to:

- All revisions and outstanding issues identified in previous submissions complete.
- All agreements in place (e.g. ALR, Environment, Utilities, Municipal, etc.).
- Updated drawings.
- Updated Right-of-Way acquisition drawings complete.
- Updated suggested staging drawings.
- Updated utility relocation drawings (also submitted to the Utilities).
- Updated cross sections.
- Updated quantities and estimates, including quantity estimate with neat-line, best case and worst-case quantities.
- Updated special provisions.
- Other miscellaneous drawings and associated special provisions (e.g. structural).
- Project Data Archive for data compliance check unless advised otherwise by Ministry Field Services (see Section 1280).
- Final signed and sealed design criteria document.
- All reports in draft final format.

100% Detailed Design Submission

This submission consists of, but is not limited to:

- All revisions and outstanding issues identified in previous submissions complete.
- Final Tender Documents, including the completed design and viewing documents (refer to Section 100.5.5.12 Deliverables).
- Relevant rollup documents from project file (such as: planning report, preliminary design report, geotechnical report, etc.).

100.4 REFERENCE MATERIAL

100.4.1 Design Guides

The designer shall use the current edition of both the *Geometric Design Guide for Canadian Roads*, Transportation Association of Canada (TAC) and the *BC Supplement to TAC Geometric Design Guide* (this document) to produce designs for Ministry projects in the following manner:

1. The *Geometric Design Guide for Canadian Roads* is the principal reference for:
 - the fundamental principles of highway design that form the basis of the Ministry's approved design practice; and
 - the justification of design exceptions from the Ministry's preferred practice.
2. The *BC Supplement to TAC Geometric Design Guide* is the reference for:
 - the Ministry's recommended preferred design practice in specific situations mostly to ensure better design consistency and lower life cycle costs for the overall Provincial Highway system;
 - the Ministry's complement to and interpretation of the TAC Guide; and
 - specific instructions for preparing design documentation for Ministry projects.

See the Preface of the *BC Supplement to TAC* for more information.

3. *A Policy on Geometric Design of Highways and Streets* (AASHTO) is recommended as a secondary reference.

In addition to the above, the current editions of the following Ministry reference manuals are to be used, but not limited to:

1. [Guidelines for the Design of Lighting, Signal and Sign Installations](#)
2. [Manual of Standard Traffic Signs and Pavement Markings \(PDF\)](#)
3. [Catalogue of Standard Traffic Signs; and Supplemental Traffic Signs](#)
4. [Policy Manual for Supplemental Signs](#)

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5. [Manual of Bridge Standards and Procedures](#)
6. [Landscape Design - Manual of Aesthetic Design Practice](#)
7. [Utility Policy Manual \(PDF\)](#)

100.4.2 Technical Circulars

Technical Circulars are used to provide general information on changes in operational policy and programs.

Technical Circulars typically introduce approved policy and program changes which may have application, or is required information, for a wider Ministry audience. Technical and/or administrative details may be cited but alternative distribution such as Technical Bulletins are encouraged where the information applies to a more specific audience.

Designers should check the [Technical Circulars](#) website when starting a design assignment to determine if any Technical Circulars are relevant to their project.

100.4.3 Technical Bulletins

[Technical Bulletins](#) are used to provide interim updates to technical and administrative manuals that have been adopted and supported by the Ministry.

Supported manuals are updated on a regular basis to include information contained in the Bulletins.

Technical Bulletins generally cover changes in procedures, standards, guidelines, etc. within the subject matter covered in the related manual.

100.4.4 Other Reference Documents

1. [Standard Specifications for Highway Construction](#)
2. [Traffic Management Manual for Work on Roadways](#)
3. [Manual of Control of Erosion and Shallow Slope Movement \(PDF\)](#)
4. [Management of Fish Habitat Policy](#), DFO

5. [Land Development Guidelines for the Protection of Aquatic Habitat \(1992\)](#), available from Department of Fisheries and Oceans Canada, Habitat Management Division, or Ministry of Environment, Lands and Parks, Integrated Management Branch
6. Equipment Rental Guide, available for ordering at: www.roadbuilders.bc.ca/blue-book
7. Master Municipal Construction Documents, available for ordering at: www.mmcd.net/order_documents.html
8. AASHTO Roadside Design Guide, available for ordering at: store.transportation.org
9. TAC Guide to Bridge Hydraulics
TAC Bikeway Traffic Control Guidelines
TAC Roundabout Design Guide
TAC Road Safety Audit Guide
tac-atc.ca/en/bookstore-and-resources/bookstore
10. [NCHRP Report 672; Roundabouts: An Informational Guide, Second Edition](#)
11. [CSPI Handbook of Steel Drainage & Highway Construction Products](#)
12. [NCHRP Report 711 Guidance for the Selection, Use, and Maintenance of Cable Barrier Systems](#)
13. [Transport Canada Grade Crossing Standards](#)

Many Ministry engineering branch publications are available at:

[Engineering Standards and Guidelines](#)

Transportation Infrastructure main page:

www.gov.bc.ca/gov/content/transportation/transportation-infrastructure

Some publications are available through Queen's Printer at:

www.publications.gov.bc.ca

100.4.5 Proprietary Products

The Ministry's Recognized Products List is posted on the following website:

<http://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/recognized-products-list>

Proprietary products must not be named in the Special Provisions but referenced using generic terminology and described using product specifications.

100.4.6 Sensitive Information

Information on archeological site locations and particulars that expose a threat to public security may need to be removed from publicly available documents.

Privacy related Personal Information must be removed from publicly available documents.

This includes but is not limited to documents for tender and those made available for public information meetings.

Please refer to the Freedom of Information and Protection of Privacy Act, the Privacy Act, the Heritage Conservation Act and related policies.

laws-lois.justice.gc.ca/eng/acts/p-21/fulltext.html

www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96165_00

www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96187_01

www.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology/bulletins-policies

100.5 ENGINEERING DISCIPLINES

Most projects involve multiple engineering disciplines. The Ministry requires a single-point engineer, a Coordinating Professional Engineer (CPE), to coordinate the engineering aspects of the work. The CPE ensures that the work has been performed by or under the direction of appropriate registered professionals and that the interrelationships between the involved engineering disciplines have been assessed and issues have been addressed or brought to the

attention of the Ministry. A CPE is required when there is more than one Engineer of Record (EOR). Refer to [Technical Circular T-06/09](#) for complete information on roles and responsibilities.

100.5.1 Geomatics, Survey & Mapping

The [General Survey Guide](#) describes standard procedures and deliverables for survey services for the Ministry. The guide covers a variety of topics and is designed to be used as both a contract terms of reference and reference guide.

This guide shall be considered as a minimum requirement of all surveys by or for the Ministry.

If needed, identify and request additional survey work that would be required to complete the assignment.

100.5.2 Traffic Engineering

Liaise with the traffic engineer for traffic design requirements such as, but not limited to:

- auxiliary lane requirements
- traffic volumes
- laning configuration
- signing
- pavement markings
- traffic safety
- vulnerable road users

100.5.3 Geotechnical Engineering

100.5.3.1 Geotechnical Investigation

Examine and assess all geotechnical information, designs and reports provided to establish their completeness with respect to the earthwork design requirements.

If needed, identify and request additional geotechnical information required to complete the design (e.g. drill logs, soil tests, pavement evaluation data, geo-environmental site assessments of contaminated materials, foundation reports for structures, etc.).

100.5.3.2 Pavement Structure Design

As the design progresses, reappraise the proposed pavement structure design to achieve the most economical solution compatible with

the proposed profile and geometric design. The recommended pavement structure design must be approved by the Ministry's Geotechnical Engineer.

100.5.3.3 Geotechnical Design

Designers should liaise with the geotechnical engineer for geotechnical design requirements.

Incorporate into the roadway design geotechnical recommendations such as, but not limited to:

- cut and fill slopes
- stripping depths
- shrink/swell factors
- pavement structure
- retaining walls
- berms
- geotextile requirements
- erosion control
- surcharging
- Special Provisions language

100.5.3.4 Aggregate Sources

Liaise with the Ministry's Regional Gravel Manager with respect to the supply and costs of aggregate.

100.5.4 Environmental Management

100.5.4.1 Environmental Design

A current list of environmental agency contacts is available from:

Environmental Management
Ministry of Transportation and Infrastructure
4B - 940 Blanshard Street
PO Box 9850 Stn Prov Govt
Victoria BC V8W 9T5

Review existing environmental assessment reports for the Project area.

Incorporate environmental mitigation and/or compensation recommendations, and drawings as appropriate.

Prepare environmental Special Provisions for the tender documents.

Prepare/incorporate a set of drawings for environmental regulatory approval submissions in accordance with Figure 1220.S.

100.5.4.2 Landscaping

Identify landscaping requirements. Liaise with the Ministry's Environmental Roadside Manager with respect to the final landscaping design criteria and levels of landscape treatment required.

100.5.4.3 Archaeological Assessment & Approvals

This is part of the CEAA/BCEA screening process. If needed, modify the design to avoid any archaeological impacts.

100.5.4.4 Socio-community Issues

If needed, incorporate noise assessment and mitigation into the design in accordance with the new Noise Policy for mitigating the effects of traffic noise.

100.5.5 Highway Engineering

100.5.5.1 Design Criteria

Prepare and recommend Design Criteria for acceptance by the authorized Ministry engineering management (see Section 100.11.3 for a Typical Project Design Criteria Sheet).

100.5.5.2 Geometrics

Prepare a detailed roadway and drainage design in accordance with the recommended Design Criteria in conjunction with the Ministry's *B.C. Supplement to TAC Geometric Design Guide*, the *TAC Geometric Design Guide for Canadian Roads*, and the Ministry's Technical Bulletins, Technical Circulars and project specific design documentation.

The design shall accommodate cyclists (where allowed) in accordance with the [Ministry's cycling policy](#).

The design drawings shall illustrate complete detail and geometry required to lay out and construct the roadway and drainage facilities. Drawings may include, but are not limited to,

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details of clearing and grubbing, organic stripping, contaminated soil areas, surcharge, granular base and sub-base, subgrade, open or enclosed drainage courses and structures, asphalt pavement, bikeways, bus bays, accesses, enforcement bays, pullouts and footpaths for maintenance access to high mast light poles and power distribution kiosks, traffic barriers, impact attenuators, retaining walls, fencing, sound barriers, pavement markings, signage, seeding, landscaping and other right-of-way treatment.

Refer to Ministry [CAD standards](#) and [Geometric Design Guidelines](#) (BC Supplement to TAC, Section 1200), for contract drawing requirements, drafting standards and drafting samples. Also satisfy municipal requirements for drawings illustrating their utility services.

The designer should summarize existing accesses and their treatments (i.e. retained, relocated, or closed) as well as proposed accesses. The summary should be submitted for review and approval by the appropriate Ministry District Manager, Transportation.

100.5.5.3 Right-of-Way Requirements

Identify proposed right-of-way acquisition boundaries and required easements on the Property Acquisition Plans. Give consideration to right-of-way costs when determining the most cost-effective solution.

Everything that is required for the road and its supporting structures should be encompassed within the right-of-way. In flat terrain, right-of-way should generally be 3 to 5 m from the toes. Where terrain is sloping, use the cross sections to determine the severity of the slope and select a pessimistic offset from the toes (e.g. fill slopes may extend farther due to deeper than anticipated stripping depths or back slopes may extend farther than the cross sections indicate). Other considerations for selecting the offset from the toes are: utility requirements, future maintenance requirements, access, storage of stripping, and foundation excavation for retaining walls.

The final right-of-way line should generally, wherever possible, form a uniform, constant line without frequent jogs or kinks.

Calculate and record the required areas on the plans and on the Ministry's Clearing, Grubbing and Right-of-Way Areas (H749) form, or equivalent, showing the breakdown of right-of-way areas by parcel. Forward the completed forms and plans to the Ministry's Property Services Branch in order that the purchase of required right-of-way and easements may commence prior to the completion of the detailed design. Investigate the feasibility of design revisions to address concerns identified during the property acquisition process and incorporate these changes where feasible.

Due to the complexity of property negotiations, good liaison with the Property Services Branch is required throughout the design process. Refer to Section 1220.11 for further information.

The Property Acquisition Coordinator will review zoning plans and advise the Designer of impacts to Agricultural Land Reserve lands.

100.5.5.4 Signing & Pavement Markings

Locate all regulatory, warning and guide signs in accordance with the Ministry's Manual of Standard Traffic Signs and Pavement Markings. Ensure that all signs are located to allow for appropriate decision sight distance. Design all permanent pavement markings and delineators in accordance with the aforementioned manual.

The Ministry's Catalogue of Standard Traffic Signs is to be used for reference to provincial standard traffic signs utilized along the provincial highway system.

Prepare signing and pavement marking drawings showing the proposed highway layout and all regulatory, warning and customized guide sign placements, proposed messaging, sizes and shapes required by and affected by the Project. Prepare designs and determine locations for sign structures and foundations. (Note that the guide sign layout may extend beyond the actual limits of construction and may include interim signing.) Liaise with a regional Ministry Traffic Engineer with respect to guide sign design policy and practice, and assistance with messaging.

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Prepare a separate, complete and continuous set of signing and pavement marking contract drawings detailing all signing and pavement marking requirements for the Project.

Prepare Ministry approved customized guide sign and messaging designs for final signing and pavement marking drawings. Include the location of all route marker and street name guide signs and information signs. Complete individual Ministry Sign Record (H0172) sheets.

Liaise with the Ministry Sign Shop.

Consult with the Ministry's Area Manager for current Service and Attraction Sign requirements.

100.5.5.5 Drainage

Refer to Chapter 1000 Hydraulics for drainage design.

As required, prepare separate drainage contract drawings detailing all drainage requirements for the project.

Produce a drainage report which details stormwater requirements and hydraulic analysis, if required.

Include a copy of all drainage design calculations (hydrology and hydraulics) in the Design Folder. This includes the Design Criteria Sheet for Climate Change Resilience.

Culverts ≥ 3 m in span are structures and fall under the Structural Engineering discipline.

100.5.5.6 Utilities

Review and update existing underground utility information necessary to complete the Design. Arrange for locating and uncovering critical utilities if warranted. BC One Call (www.bc1c.ca, Ph. 800-474-6886) is a valuable resource for assistance with locating underground utilities.

Identify all public or private utilities or other installations on or close to the present and proposed rights-of-way to be removed, relocated, adjusted or protected as a result of the improvements. Contact and meet with utility owners to establish their constraints and review their requirements with respect to the Project.

Include and incorporate utility relocation design drawings and Special Provisions prepared by others in the tender documents.

Provide technical assistance to help with negotiating relocation arrangements with the utility owners.

Review utility pole relocation designs supplied by utility owners to establish conformance with Ministry clear zone guidelines and to determine possible conflicts with other aspects of the Project.

100.5.5.7 Railway Crossings and Navigable Waters

Liaise with the Ministry's Rail/Navigable Waters Coordinator.

A special purpose drawing may be required for new at-grade railway crossings, as well as reconstruction, relocation, or revision of an existing crossing. Significant lead time may be required for the approvals process. Refer to Section 1100.1 for more information.

Transport Canada has authority of works over or in Navigable Waters. This can typically affect the highway profile alignment due to the vertical clearance requirement under bridges. This will require liaising with the Structural Engineering department (also see 100.5.7.1).

100.5.5.8 Value Engineering Review

The project may be subject to a Value Engineering review. The Designer shall cooperate and participate in the review process which will be conducted by others.

100.5.5.9 Road Safety Audits

Projects may be subject to a Road Safety Audit at the preliminary, functional, or detailed design stage. The Designer shall cooperate and participate in the Road Safety Audit process which will be conducted by others in accordance with the Transportation Association of Canada's *Road Safety Audit Guide* (ref. Technical Circular T-02/04, Road Safety Audit Guidelines).

The Road Safety Audit team is often invited to attend the Value Engineering session with the Design Team and Ministry engineering staff.

100.5.5.10 Constructability

Conduct a constructability review of design alternatives evaluating them with respect to their constraints. Recommend provisional construction scheduling, including the scheduling of future utility installations and relocations of existing services, and critical path networks for the recommended alternative. Prepare drawings illustrating practical staging of construction, general detour routings and special traffic handling provisions.

100.5.5.11 Maintenance & Operations

Meet with the Ministry's Area Manager with respect to maintenance procedures and operational requirements or problems with existing facilities. Include necessary maintenance, emergency, and traffic operation features as may be necessary both during construction and after the Project is completed.

Obtain approval from the District Manager, Transportation for the Traffic Management Special Provisions clause.

100.5.5.12 Deliverables

A Project Deliverables Checklist should be completed (see Section 100.11.3).

Professional Engineers are required to sign and stamp all drawings, specifications, design criteria documents and reports as per the Engineer's Act. The Ministry's policy on the Engineer of Record and Field Review Guidelines is provided in [Technical Circular T-06/09](#).

Prepare a final set of documentation for tender and construction purposes.

The following documentation is typically required:

- Drawings

Submit original full size signed and stamped contract drawings. Submit all drawings in the current Ministry Autodesk DWG format.

Include and incorporate drawings prepared by others (e.g. bridge, electrical, landscaping, and utility relocation designs) in the tender documents.

- Cross Sections

Prepare working cross sections as reference information for the contract. Refer to the *BC Supplement to TAC*, Section 410, for cross section format and content requirements.

- Schedule 7, Approximate Quantities & Unit Prices

The current version of the Excel spreadsheet form [H0088](#) must be used. Always use the drop down boxes to select units. Ensure section headings correspond to those in the Special Provisions.

- Construction Tender Data Package (see Section 1280)

- Any additional explanatory material and bills of material as required

- Design Folder

This folder, provided in a ringed binder or electronic format, is an essential source of information for the Project. Contents should include:

- Table of Contents
- Design Criteria (see Section 100.11.1)
- Project Data Archive and Deliverables including checklist (see Section 1280)
- Electronic media (e.g. USB) containing the Civil 3D project files.
- Quantity calculation sheets for all items (i.e. each item in Schedule 7 must have a corresponding section in the Design Folder that shows how its estimated quantity was determined)
- Drainage calculations to support culvert and ditch sizing
- Quality management (QC & QA) checklist (see Section 100.11.3)
- Project correspondence, including minutes of meetings
- Project photos

- Final Design Report / Letter

When required, prepare a Final Design Report / Letter including, but not limited to, summaries of the following:

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- existing conditions
- the initial Project scope
- design activities that have resulted in revisiting previous designs, and their outcomes
- subsequent major revisions and/or scope changes and the reasons for them
- significant features of the design that could require special attention from the field inspection staff or the Design Engineer during construction
- grading distribution report
- drainage report
- all utility contacts, potential conflicts and required relocations and their status
- all environmental agency contacts and concerns
- critical construction staging and traffic control considerations
- all provisional sums shown on Schedule 7, including a brief explanation for each. Include details of any factors considered to be beyond the Designer's control which qualify or are likely to qualify the accuracy of the cost estimate.
- all unresolved design issues, all agreements, and any other special conditions and considerations that may impact on the construction of the Project
- variances in design criteria, including a signed copy of the Achieved Design Criteria with supporting documentation for not meeting or exceeding values specified in the Recommended Design Criteria.

For projects to be tendered, the following guidance is provided. Always refer to the table on the Construction Maintenance Branch's [Tender & Contract Documentation](#) website to ensure that the latest forms are being used to prepare tender documentation. The table contains links to the current version of all schedules. Ensure that the title of the Project is consistent throughout all schedules in the Tender Document Package.

Designers should submit to the Project Manager the following Tender Documents as applicable:

- Schedule T3, Contract Specific Reference Documents

Provide the Construction Tender Data Package (as defined in Section 1280).

Provide Project specific reference material, e.g. cross sections, geotechnical reports, environmental reports, contaminated site assessments, as-built drawings, etc.

- Schedule 1, Supplemental General Conditions

Use the appropriate link in the table and use as directed (see "Hidden Text" within the Supplemental General Conditions document).

- Schedule 3, Special Provisions & Appendices

Use the appropriate link in the table and use as directed (see "Hidden Text" within the Sample Special Provisions document). Include and incorporate special provisions prepared by others (e.g. bridge, electrical, landscaping, and utility relocation designs).

- Schedule 4, Drawings

List all drawing numbers complete with the latest revision letter. Do not list Contract Specific Reference drawings here, e.g. cross sections.

- Schedule 5, Time Schedule

- Schedule 6, Insurance Specifications

Include a completed INS-152 form. Include Part 2 if applicable.

- Schedule 7, Approximate Quantities and Unit Prices

100.5.6 Electrical Engineering Integration

Overlay the electrical design onto the roadway design to confirm the constructability of pole bases, checking for conflicts with existing or proposed underground utilities and drainage. Also check to ensure that signing is not obscured. Design accesses to high mast light poles where required.

100.5.7 Structural Engineering Integration

Liaise with the Structural Engineering department to ensure bridges, retaining walls, culverts with spans ≥ 3 m, etc. work with the highway design.

100.5.7.1 Hydraulic Engineering

Liaise with the Hydraulics Engineer concerning issues pertaining to structure clearances and profile elevations.

100.5.7.2 Proprietary Structure Design

Liaise with the Structural and Geotechnical Engineers concerning issues pertaining to the requirements for proprietary structure design.

100.6 COST ESTIMATING

Information on transportation project cost estimating can be found on the [Transportation Project Cost Estimating](#) website.

This site provides guidelines and tools for cost estimating, as well as instructions on how to access the [Construction Cost Data](#), a restricted province-wide website that Consultants must submit a written request to access.

Describe and list contract items in accordance with the terminology and in the order of the Ministry's Cost Estimating Framework. Number contract items using a numeric decimal system, e.g. #.##.##.

Prepare a construction cost estimate (Ministry Estimate) with most probable quantities falling between the best case and worst case, or with neat-line quantities for contract items which include materials to be supplied by the Contractor, e.g. catch basins, manholes, culverts, concrete roadside barrier, etc.

The intended accuracy of cost estimates under normal circumstances is as follows:

<u>Estimate Level</u>	<u>Range of Precision</u>
Preliminary Design	-15% to +50%
Functional Design	-10% to +25%
Detailed Design	-5% to +10%

Each successive "Estimate Level" should indicate a greater level of confidence than the preceding estimate. Each subsequent estimate should be more accurate (closer to the final anticipated cost of the project) and more precise (the range around the anticipated cost should decrease).

Maintain an updated estimate of costs on the Schedule 7 as the design progresses. Provide an overall cost summary including estimated costs of utility relocations, engineering supervision during construction, property acquisition, contingency amounts, and costs of materials and services to be provided by the Ministry and others.

The current version of the Excel spreadsheet form [H0088](#) must be used for the final Schedule 7 submission.

100.7 SPECIAL PROVISIONS

If required, write special provisions supplementary to the Ministry's current issue of Standard Specifications for Highway Construction. Use the Sample Special Provisions format and wording found in the table (see the Construction Contract Services [Tender & Contract Information](#) website) for the appropriate type of construction contract. Submit in an MS Word DOC file including Table of Contents. In the table under the heading Additional Related Documents, you will find a link to "SpecProvAmendmentTable" which lists all changes to the sample Special Provisions between the current version and earlier versions.

Include and incorporate special provisions prepared by others (e.g. bridge design, electrical design, landscaping design, utility relocation designs). If applicable, appendices should include copies of approved Sign Records.

100.8 GENERAL ENGINEERING

100.8.1 During Tender

Prepare language, sketches or drawings, including the Construction Tender Data Package, for inclusion as addenda to the Tender Documents.

100.8.2 During Construction

Attend the preconstruction meeting and subsequent meetings related to questions on the Detailed Design to provide technical advice or clarifications as required.

Respond to requests from the Ministry's Project Manager, Construction Services Manager, or delegate (Project Supervisor or Resident Engineer) to provide Engineering Services, if required, during the construction phase (i.e. after the award of tender for construction).

Provide the following Engineering Services as requested:

- Carry out periodic field reviews as necessary to satisfy APEGBC bylaw requirements and attend meetings on site.
- Respond to specific queries.
- Make design revisions.
- Prepare revised signed and stamped Construction drawings.
- Respond to Road Safety Audit recommendations.
- Review and evaluate contractor initiated alternative designs and value engineering proposals.

Refer to [Technical Circular T-06/09](#) "Engineer of Record and Field Review Guidelines" for additional roles and responsibilities.

100.8.3 Post-Construction

Attend Project debriefing/close-out meeting to discuss lessons learned.

Prepare and submit "Record" drawings in accordance with the guidelines in Technical Circulars [T-06/09](#) and [T-07/09](#).

100.9 QUALITY MANAGEMENT

Quality Management is intended to be integral to the various design processes required to produce the assignment deliverables.

Quality Management is composed of two parts:

- Quality Control (QC), and
- Quality Assurance (QA)

Quality Control consists of the set of actions performed to identify and correct design deficiencies through the independent checking of work to ensure the product meets expectations and standards. Quality Control is the responsibility of the organization carrying out the design work.

Quality Assurance consists of the set of actions intended to prevent design deficiencies from occurring through the review of the overall system and procedures established to ensure the quality of the design product. Quality Assurance is the responsibility of those overseeing or monitoring the work. This responsibility may rest with the organization carrying out the work; however, it must be performed independently from Quality Control.

The Ministry may choose to use periodic Quality Audits as a tool to review design deliverable submittals.

100.9.1 Quality Management for Ministry In-house Design Assignments

Quality Management for all in-house design assignments performed by Ministry staff should follow the Ministry's *OQM Professional Practice Manual* and *Highway Design Engineering OQM Practice Guidelines*. These practice documents meet the spirit of the Quality Control and Quality Assurance as outlined in the following sections.

100.9.2 Quality Management for Consultant Assignments

The following sections discuss the minimum Quality Management requirements that Consultants must meet. As stipulated in the [Quality Management Accord](#), for each assignment, "consulting engineering firms must have an effective, documented Quality Management System in place and be fully responsible for the Quality Control and Quality Assurance of their product".

Consultants shall have their own project-specific Quality Management Program in place prior to preparing any designs or data. Failure to maintain an effective project-specific Quality Management Plan shall result in poor

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performance ratings in the Consultant Performance Evaluation process and will affect future project work for the Consultant.

100.9.3 Consultant's Quality Control and Quality Assurance Role

The Consultant is responsible for the Quality Control of the work done by its staff in accordance with Engineers and Geoscientists BC Bylaw 14(b).

Consultant's Quality Assurance activities involve periodic reviews of the Quality Control Reports/Design Checklists (a requirement of technical review submissions) and confirming that the Consultant's Quality Management Plan for the design assignment has been followed.

The Consultant's Design Manager or designate is responsible for spot checking the components of the Consultant's work for general compliance with standards, accuracy of drawings and reports, appropriateness, good form and engineering common sense as deliverables are submitted.

100.9.4 Ministry's Quality Audit Role

Informal Quality Audit is an ongoing activity on the part of the appropriate Ministry engineering representative. This involves experience and judgment in the assessment of the acceptability of the concepts or documents submitted by the Consultant to the Ministry to meet the Ministry's guidelines and design assignment requirements.

A typical Quality Audit Checklist is provided, as part of the Quality Management Record (see Section 100.11.3), for the Ministry Highway Design representative to document the Quality Audit process.

100.9.5 Objectives of the Consultant's Quality Management Plan

The Consultant's Quality Management Plan shall govern the Consultant's internal review and checking process throughout the entire course of the work. The Quality Management Plan is intended to demonstrate how the Consultant shall achieve the following results:

1. All design is carried out in accordance with good engineering practice and all work meets the requirements of the Ministry as set out in the Terms of Reference, the *TAC Geometric Design Guide for Canadian Roads*, the *BC Supplement to TAC Geometric Design Guide*, the *Electrical and Traffic Engineering Manual* and other applicable guidelines, procedures and standards.
2. All drawings, calculations and other items submitted to the Ministry are free of errors, conflicts and misalignments, having been independently checked and re-checked by experienced engineers or technicians who have been assigned that responsibility.
3. Effective internal communication with the whole Consultant team (including its own staff and that of any sub or associated consultants) is ensured by means of an appropriate system for disseminating and storing information on standards, policies, guidelines and engineering correspondence.

100.9.6 Requirements for a Consultant's Quality Management Plan

The Quality Management Plan shall set out a general review and checking program to be carried out by identified members of the Consultant's staff. Using the checklist, however, does not relieve the Consultant of basic professional responsibility for sound, effective, accurate engineering, analysis and design in all aspects of the assignment.

The designer, checker, draftsperson and quality control reviewer shall be clearly identified by name (initials not acceptable) on the contract drawings. Where required, all reports, construction control documents and any other relevant documented work shall be initialed by the persons designated in the Quality Management Plan.

All original drawings and calculations shall be retained on file by the Consultant for the duration of the contract, or until required to be submitted as specified by the Ministry.

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The Consultant's Design Manager shall convene periodic quality control meetings with the members of the project team responsible for the various components of the work underway. The Quality Management Plan shall also identify the nature of the internal communication system relating to dissemination of information on standards, policies, guidelines and engineering information.

The Quality Management Plan shall include the following:

1. Checking protocol; the nature, scope, and persons responsible for checking shall be identified and related to both time and process Milestones and Deliverables.
2. The specific nature of the various checks shall be identified, such as:
 - conformity to project requirements, preliminary information,
 - appropriateness of design procedures used,
 - consistency with views / recommendations / findings of other disciplines,
 - consistency with adjacent sections of the Project,
 - conformity to presentation standards (drafting, terminology),
 - conformity to Design Criteria (where applicable), and
 - accuracy of calculations.
3. Specific procedures shall be identified in the following three areas:

Design Methods - the senior designer in each discipline shall establish a written design process for that discipline's component of the Project. This process shall typically identify the standards, guidelines, formulas, procedures, etc., to be used for design. Quality control responsibilities for the senior designer shall include monitoring and documenting reviews of the work at defined intervals to ensure that the above process had been appropriately followed.

Calculations - the recording format for all calculations shall be specified, in order to ensure that a neat, logical record of all calculations is maintained. The checkers shall be required to complete their work as soon as the design is complete. Errors noted shall be recalculated by the designer and rechecked by the checker. Computer generated calculation shall be spot-checked and reviewed for logic.

Drawings - shall be checked by the designated checker and the senior designer. Checking shall be for conformity with design standards or guidelines, drafting protocol, clarity and good professional practice. Also, conformity with adjacent plans shall be checked.

4. Quality Management responsibilities shall be specifically identified by naming the Consultant's Quality Control staff and the nature and timing of their responsibilities. A chart format is useful in this regard and shall show the originator/designer, checker and the senior technical person responsible for quality in that area of work.
5. Documentation related to the Project shall be kept in files separate from files for other work the Consultant may have. The Consultant's Design Manager shall be responsible for designing and managing the filing system. All design notes, calculations and other pertinent written information related to the various components of the Project shall be prepared in neat, legible fashion in the Ministry's "H" form format (where applicable) or equivalent and maintained in binders or folders as appropriate. Each design engineer and technician shall be responsible for maintaining notes. All computer files shall be backed-up in accordance with a specified schedule.
6. Resolution of differing technical points of view within the Consultant shall be the responsibility of the Consultant's Design Manager. The process for resolving such differences shall be specified.

7. Design change control procedures shall be developed as part of the Plan. The focus and responsibility and the process shall be described.
8. Internal approval procedures shall be established and documented. These shall involve those at the various responsibility levels. The Consultant's Design Manager shall conduct a final review of all items prior to submission.

100.9.7 Evidence of Implementing the Quality Management Plan

Evidence that the Consultant's Quality Management Plan is functioning effectively shall be provided by the submission, with key deliverables, of "Quality Control Reports", as specified in the various design processes. Failure to submit an acceptable Quality Control Report at the agreed point in the process may result in relevant submissions of work being returned to the Consultant without review and the action noted in the final performance evaluation.

100.9.8 Typical Design Checklists Provided

The Ministry has developed a typical checklist (refer to Section 100.11.3) for the Consultant to modify and use as appropriate for the design deliverables. The design checklist needs to be adapted by the Consultant for the required use in the project-specific Quality Management Plan.

100.10 MINISTRY ROLES AND RESPONSIBILITIES FOR CONSULTANT ASSIGNMENTS

While the Ministry will strive to provide adequate and timely information, the Consultant shall review in detail all information to ensure it provides all the details necessary for a comprehensive, thorough and accurate detailed design.

Depending on the scope of the consultant's assignment, the Ministry will provide some or all of the following information or services with respect to the Project as required. A more

comprehensive list of Ministry responsibilities may be outlined in the Request For Proposals.

100.10.1 General

Provide access to all available pertinent reports, drawings, inventories and correspondence that will assist in the design process.

Prepare and undertake a communications strategy to communicate and receive input from residents and stakeholders on the design and engineering scope of the Project. Take the lead role in advising and consulting with the media, elected officials, community groups, First Nations Bands, the Agricultural Land Commission, private property owners and environmental agencies.

Review the work as it proceeds and advise on matters regarding standards, guidelines and policy when possible. This review does not constitute an acceptance of liability by the Ministry or its employees for the design, but is solely conducted as a check to ensure the Ministry's interests are being considered and assured. Scope changes are the Ministry's responsibility after considering the consultant's advice and recommendation. Changes to the design shall remain the Consultant's responsibility for completeness and accuracy.

100.10.2 Property Acquisition

Provide cost estimates for proposed property acquisitions as available.

Negotiate and acquire highway right-of-way.

100.10.3 Electrical

All electrical drawings shall be issued a drawing series number provided by the Ministry Electrical and ITS Engineering Section, South Coast Region.

100.10.4 Signing

Discuss directional guide sign messaging with municipalities. Review preliminary / approve final message text designs, layouts and locations for all directional guide signs, and service and attraction signs.

100.10.5 Railway Regulatory Liaison

Make formal application and Notices to the regulatory agencies and stakeholders as required by the Canadian Transportation Act and the Railway Safety Act and applicable regulations for crossings of Federally or Provincially Chartered railways. Make financial arrangements and outline facility provision after consultation with the railway and stakeholders. Give direction and provide overview of the design of roads crossing the railway. Prepare Agreements and sign on behalf of the Ministry for railway crossings.

100.10.6 Navigable Waters Liaison

Review site information for determination if a Navigable Waters Protection Act approval is required. Determine navigational clearance requirements, signs, lights and protection works in consultation with Transport Canada and stakeholders. Give direction and provide overview of the design of culverts, bridges and in water works associated with highways including rip rap, rock spurs, diversions, etc. Make formal application to the regulatory agencies and stakeholders as required by the Navigable Waters Protection Act.

100.11 DESIGN CRITERIA AND TYPICAL CHECKLISTS

Typical criteria sheets and checklists described by this section are available from the website that hosts this Supplement. A link is provided at the end of this section.

100.11.1 Project Design Criteria Acceptance and Exceptions to Design Criteria

100.11.1.1 Design Criteria Acceptance

All projects involving construction or rehabilitation of provincial highway infrastructure require Project Design Criteria acceptance by authorized Ministry engineering management.

For a discussion on Design Criteria related to Climate Change Adaptation, refer to Section 1010.02 in the Hydraulics chapter.

Terms of Reference (TOR) for engineering consultant design assignments must clearly set out the Province's design criteria requirements.

For projects to be designed and/or delivered by other agencies, but involving provincial highway infrastructure, design criteria and performance specification requirements will be set out by the Ministry regional office. This includes Design/Build projects and Partnership projects with other agencies or as part of a Public Private Partnership process.

For projects to be designed and/or delivered by developers, but involving provincial highway infrastructure, design criteria and performance specification requirements will be set out by the Ministry district office with advice from the Senior Highway Design Engineer at the regional office. This includes projects driven by Development Approval processes that involve provincial highway infrastructure.

The design criteria acceptance process is as follows:

- i) A Project Design Criteria Document will be produced for all highway design projects. This document will identify and define the problem(s) being addressed, the options considered, the scope of the project, and the development of the design criteria. Note that the Project Design Criteria Document is a required part of the project design file and subject to audit.
- ii) Complete the Project Design Criteria sheet. A typical Project Design Criteria sheet, including a cover sign-off page, for highway geometric design is provided (see 100.11.3). Similar processes for documentation of acceptance of design criteria and exceptions to engineering guidelines or accepted practice should be followed for other engineering disciplines.
- iii) Ministry acceptance of the design criteria is required before the design starts and upon completion of the design. The Project Design Criteria Sheet is included in the Project Design Criteria Document, which is in turn an essential part of the Project Design Folder.

100.11.1.2 Exceptions to Design Criteria

For all projects involving provincial highway infrastructure, any variance from engineering guidelines or accepted practice requires the acceptance of authorized Ministry engineering staff, starting with the Senior Engineering Manager, Highway Design Services. The Senior Engineering Manager, Highway Design Services will determine if exceptions to guidelines or accepted practice require the further acceptance of the Chief Engineer for the Ministry.

The acceptance process for exceptions to guidelines or to accepted current engineering practice is as follows:

- i) Carry out an economic or other appropriate analysis as required justifying any variation in the project design criteria from the *TAC Geometric Design Guide*, the *BC Supplement to TAC* or of accepted current engineering practice.
- ii) Where Ambient Condition consideration is recommended for a project within a highway corridor, acceptance of the Project Design Criteria sheet will follow the procedure set out in the “Guidelines for the Development and Preparation of the Project Design Criteria for Construction and Rehabilitation Projects” (March 3/99). This document is located behind Tab 13.
- iii) Where Context Sensitive Design consideration is recommended for a project within a highway corridor, acceptance of the Project Design Criteria sheet will follow a similar procedure to that which is set out in the “Guidelines for the Development and Preparation of the Project Design Criteria for Construction and Rehabilitation Projects” (March 3/99). This document is located behind Tab 13.
- iv) For any other recommended variance from the *TAC Geometric Design Guide*, the *BC Supplement to TAC* or of accepted current engineering practice, the Project Design Criteria sheet must clearly highlight the variance in forwarding the document for acceptance. Full discussion justifying the

variation in the project design criteria must be contained in the document.

100.11.1.3 Project Design Criteria

The first two items listed on the Project Design Criteria sheet specify road classifications. The possible options are as follows:

Functional Classification¹:

Primary, Secondary, Major, Minor, or Local

Design Classification:

LVR, RLU, RCU, RCD, RAU, RAD, RED, RFD, ULU, UCU, UCD, UAU, UAD, UED, or UFD

Legend:

LVR = Low Volume Road (LVR),

A = Arterial, C = Collector, D = Divided,

E = Expressway, F = Freeway, L = Local,

R = Rural, Uxx = Urban, xxU = Undivided

¹ For further information on these classifications, refer to the following website and document:

[Highway Classification](#) - Numbered Highways Functional Classification List

¹ To determine the classification of a particular highway, refer to the lists under the title:

British Columbia Numbered Highways - Functional Classification

¹ Classification descriptions are in the section titled:

Overview of B.C. Highway Functional Classification

100.11.2 Roundabout Design Criteria

Refer to the Roundabouts section (Chapter 700, Section 740) for design guidelines. A link to a typical Roundabout Design Criteria Sheet is provided at the end of this section.

Due to the wide variety of roundabout configurations, there are no specific minimum criteria for all of the listed geometric parameters.

There are only five items under the Ministry Guidelines Criteria column that have values listed on the Information Sheet. Four items are standardized criteria for all roundabouts and the fifth item, the inscribed circle diameter, is to be

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filled in with a range based on the number of lanes and whether it is urban or rural. For each leg of the roundabout, the proposed criteria for all Geometric Design Elements are to be listed.

It is possible that some of the guidelines criteria may not be achievable. In this case, justification for deviation from guidelines must be documented and signed off following procedures similar to 100.11.1.2 Exceptions to Design Criteria.

100.11.3 Typical Criteria Sheets and Checklists

Please visit the [BC Supplement to TAC](#) website and refer to the **Useful Tools** area.

The following typical criteria sheets and checklists are provided:

- Typical Project Design Criteria Sheet
- Typical Roundabout Design Criteria Sheet
- Typical Quality Management Record
- Typical Design Checklist
- Typical Project Deliverables Checklist