



NATURAL RESOURCES

PROFESSIONAL SERVICES IN THE FOREST SECTOR: CROSSINGS

VERSION 3.0
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ENGINEERS &
GEOSCIENTISTS
BRITISH COLUMBIA



PREFACE

These *Joint Professional Practice Guidelines – Professional Services in the Forest Sector: Crossings* were developed by a team of representatives from the Joint Practice Board of the Association of British Columbia Forest Professionals (ABCFP) and Engineers and Geoscientists British Columbia (Engineers and Geoscientists BC), to guide professional practice related to the design and implementation of forest road Crossings.

These guidelines were first published in 2005 and were revised in 2008. They were once again revised in 2014 in response to issues raised in the Forest Practices Board report titled “Bridge Planning, Design and Construction – Special Investigation” (Forest Practices Board 2014).

This current revision was undertaken to reflect current industry standards and to update the content to reference the *Professional Governance Act*. In particular, this revision provides additional clarity on the responsibilities of the Coordinating Registered Professional (CRP) and Professional of Record (POR), the use of Hydrology and Hydraulics during the design process, climate change considerations, requirements of site surveys, skill sets required of CRPs and PORs, and the Assurance Statements for transferring responsibility between CRPs.

These guidelines were written for the information of registrants of the ABCFP and Engineers and Geoscientists BC, statutory decision makers, regulators, the public, and a range of other stakeholders who might be involved in—or have an interest in—the design and implementation of forest road Crossings. They provide a common level of expectation with respect to the degree of effort, due diligence, and standards of practice to be followed when undertaking Crossing design and implementation.

These guidelines were formally adopted by the councils of the ABCFP and Engineers and Geoscientists BC, and form part of both organizations’ ongoing commitment to maintaining the quality of services that their registrants provide to clients and the public. Registrants of both organizations remain professionally accountable for their work under the respective legislation regulating their professional work.

These guidelines describe expectations and obligations of professional practice to be followed at the time they were prepared. However, this is a living document that is to be revised and updated as required in the future, to reflect the developing state of practice.

TABLE OF CONTENTS

PREFACE	i		
ABBREVIATIONS	iv		
DEFINED TERMS	v		
VERSION HISTORY	ix		
1.0 INTRODUCTION	1		
1.1 PURPOSE OF THESE GUIDELINES	1		
1.2 SCOPE AND APPLICABILITY OF THESE GUIDELINES	2		
1.3 LEGISLATIVE FRAMEWORK	3		
1.3.1 Regulation of Professional Services Related to Crossings	3	3.4.4 Addressing Climate Change in the Design of Crossings	17
1.4 ACKNOWLEDGEMENTS	5	3.4.5 Crossing Alignment in Consideration of Stream and Road Alignment and Grades	17
2.0 ROLES AND RESPONSIBILITIES	6	3.4.6 Foundations and Substructures	18
2.1 TEAMWORK	6	3.4.7 Structural Components	18
2.2 RESPONSIBILITIES	6	3.4.8 Site Survey	19
2.2.1 Forest Professionals	6	3.4.9 General Arrangement Designs and Documentation	19
2.2.2 Coordinating Registered Professional (CRP)	7	3.5 CONSTRUCTION AND FIELD REVIEWS	21
2.2.3 Professional of Record (POR)	9	3.6 RECORD DRAWINGS AND OTHER DOCUMENTATION	22
2.2.4 Specialists	11	4.0 QUALITY MANAGEMENT IN PROFESSIONAL PRACTICE	23
3.0 GUIDELINES FOR PROFESSIONAL PRACTICE	12	4.1 INTRODUCTION	23
3.1 EXPECTATIONS FOR PROFESSIONAL CONDUCT	12	4.2 FOREST PROFESSIONALS	23
3.2 DEFINING CROSSINGS	13	4.3 ENGINEERING/GEOSCIENCE PROFESSIONALS	24
3.2.1 General Requirements for Crossings	13	4.4 INDEPENDENT REVIEW OF PROFESSIONAL WORK	25
3.2.2 Complex Crossings	13	4.5 DOCUMENTING SUPPORTING RATIONALE	25
3.2.3 Simple Crossings	13	4.6 SUPERVISION OF SUBORDINATES AND SPECIALISTS	25
3.3 PROJECT DOCUMENTATION	15	4.7 OTHER QUALITY MANAGEMENT REQUIREMENTS	26
3.4 CROSSING DESIGN	15	4.8 PRACTICE ADVICE	27
3.4.1 General Considerations for Crossing Design	16	5.0 EDUCATION, TRAINING, AND EXPERIENCE	28
3.4.2 Development and Use of Crossing Design Aids	16	5.1 INTRODUCTION	28
3.4.3 Hydrology, Hydraulics, and Geomorphology	16	5.2 SKILL SETS FOR THE CRP	29
		5.2.1 CRP Skill Sets for Crossings	29
		5.3 SKILL SETS FOR THE POR	30
		5.3.1 POR Skill Sets for Simple Crossings	30
		5.3.2 POR Skill Sets for Complex Crossings	31

6.0 REFERENCES AND RELATED DOCUMENTS	32	7.0 APPENDICES	36
6.1 LEGISLATION AND REGULATIONS	32		
6.2 REFERENCES	32		

LIST OF APPENDICES

Appendix A: Legislative and Regulatory Framework	38
Appendix B: Assurance Statements.....	40
<ul style="list-style-type: none"> Coordinating Registered Professional – Crossing Assurance Statement Professional of Record – Construction Assurance Statement Coordinating Registered Professional – Transfer of Professional Responsibility Statement 	
Appendix C: List of Maximum Bridge Spans for Maximum 200 kPa Bearing Pressure	48
Appendix D: Illustration of a Simple Crossing Slope.....	50

LIST OF FIGURES

Appendix D

Figure D - 1: Illustration of a Simple Crossing Slope.....	51
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LIST OF TABLES

Table 1: Example of a Professional of Record – Transfer of Professional Responsibility Checklist	11
--	----

Appendix C

Table C- 1: List of Maximum Bridge Spans for Maximum 200 kPa Foundation Bearing Pressure.....	49
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ABBREVIATIONS

ABBREVIATION	TERM
ABCFP	Association of British Columbia Forest Professionals
BC	British Columbia
CRP	Coordinating Registered Professional
<i>FRPA</i>	<i>Forest and Range Practices Act</i>
kPa	kiloPascal
MFLNRORD	Ministry of Forests, Lands, and Natural Resource Operations, and Rural Development
POR	Professional of Record
RFT	Registered Forest Technologist
RPF	Registered Professional Forester
SLS	Serviceability Limit State

DEFINED TERMS

The following definitions are specific to these guidelines. These words and terms are capitalized throughout the document.

TERM	DEFINITION
ABCFP Bylaws	The Bylaws of the Association of British Columbia Forest Professionals (ABCFP) made under the <i>Act</i> (ABCFP 2021a).
<i>Act</i>	The <i>Professional Governance Act</i> [SBC 2018], Chapter 47.
Bearing Pressure	The pressure applied to the soil or bedrock by the Crossing Substructure.
Complex Crossing	A Crossing that does not meet all the requirements of a Simple Crossing.
Composite	A term that applies to a Superstructure system that relies on a structural connection between components, such as a precast concrete deck and girders to deliver its design capacity.
Coordinating Registered Professional	The Forest Professional or Engineering Professional responsible for the coordination of all Crossing project activities, including planning and oversight, as specified in Section 2.2.2 Coordinating Registered Professional of these guidelines. Coordinating Registered Professionals must direct those activities with sufficient oversight and supervision such that they can take overall responsibility and accountability for the planning and coordination of the Crossing.
Coordinating Registered Professional – Crossing Assurance Statement	A professional document confirming that all of the planning and coordination of the Crossing project substantially complies in all material respects with the specifications, requirements, and intent reflected in the Crossing project plans. The Coordinating Registered Professional - Crossing Assurance Statement can only be authenticated (signed, sealed, and dated) by the Coordinating Registered Professional.
Coordinating Registered Professional – Transfer of Professional Responsibility Statement	A professional document to be authenticated (signed, sealed, and dated) by the transferring Coordinating Registered Professional, if the Coordinating Registered Professional changes during a Crossing project. The Coordinating Registered Professional – Transfer of Professional Responsibility Statement can only be signed by the transferring Coordinating Registered Professional.
Crossing	A forest road bridge or Major Culvert. Also referred to as a forest road Crossing.
Culvert	A pipe, arch, box, or log structure less than 6 metres centre-to-centre of bearing, covered with soil and lying below the road surface used to carry ephemeral or perennial stream flow in a stream channel from one side of a road to the other.
Design	The preparation of the General Arrangement Design for a Crossing. The structural design of individual components of a Crossing or other Specialist designs or prescriptions are considered to be separate from preparing the General Arrangement Design. The structural design must be performed by an Engineering Professional.

TERM	DEFINITION
Design Aid	A document prepared and authenticated (signed, sealed, and dated) by an Engineering Professional, which provides an unambiguous result tied to clear parameters, and can be applied by others to a site-specific situation. See Section 3.4.2 Development and Use of Crossing Design Aids .
Design Service Life	The number of years or seasons that the Crossing is designed to be in service at the Design Vehicle/Traffic Load.
Design Vehicle/Traffic Load	<p>The specified live load for which the Crossing is designed.</p> <p>The Design Vehicle/Traffic Load may be that of standard Forest Service design vehicles, as specified in the Ministry of Transportation and Infrastructure Supplement to the Canadian Highway Bridge Design Code, S6-14; the CL-W loading defined in the Canadian Highway Bridge Design Code (CAN/CSA S6); or an alternate design vehicle specified by the Coordinating Registered Professional.</p> <p>Note: the Design Vehicle/Traffic Load configuration is typically different than that used for Design Vehicle Tracking analysis.</p>
Design Vehicle Tracking	The full swept path of the limiting design vehicle, including the trailer(s) and overhanging payload as necessary, which can side-track from the centerline on a horizontal corner.
Engineering/Geoscience Professional(s)	Professional engineers, professional geoscientists, professional licensees engineering, professional licensees geoscience, and any other individuals registered or licensed by Engineers and Geoscientists BC as a “professional registrant”, as that term is defined in Part 1 of the Engineers and Geoscientists BC Bylaws.
Engineers and Geoscientists BC	The Association of Professional Engineers and Geoscientists of the Province of British Columbia, also operating as Engineers and Geoscientists BC.
Engineers and Geoscientists BC Bylaws	The Bylaws of Engineers and Geoscientists BC made under the <i>Act</i> (Engineers and Geoscientists BC 2021a).
Field Review	<p>Reviews conducted at the site—and/or at fabrication location(s)—of the implementation or construction of the design by Engineering Professionals or Forest Professionals, or a subordinate acting under their direct supervision. These are reviews that Engineering Professionals or Forest Professionals in their professional discretion consider necessary to ascertain whether the implementation or construction of the work substantially complies in all material respects with the engineering concepts or intent reflected in the design documents prepared for the work.</p> <p>See the Engineers and Geoscientists BC <i>Quality Management Guides – Documented Field Reviews During Implementation or Construction</i> (Engineers and Geoscientists BC 2021b).</p>
Field Splice	Girders that require connection of two or more girder sections during installation.
Forest Professional	A registered professional forester, registered forest technologist, special permit holder, or any other individual registered or licensed by the Association of British Columbia Forest Professionals as a “registrant”, as that term is defined in Schedule 1 of the <i>Act</i> and further described in ABCFP Bylaw 5.
Foundation	The native soil or bedrock supporting the Substructure.

TERM	DEFINITION
General Arrangement Design	A set of professional documents that include site-specific, issued-for-construction drawings and specifications that incorporate all aspects affecting the Crossing design, as specified in Section 3.4.9 General Arrangement Designs and Drawings of these guidelines.
Hydraulics	The study of the interaction of the design flood with the Crossing components and the stream.
Hydrology	The study of the catchment watershed of the Crossing to estimate peak water flow for a specific return period.
Major Culvert	<p>A Crossing that:</p> <ol style="list-style-type: none"> 1. is used to carry ephemeral or perennial stream flow in a stream channel from one side to the other; 2. is not a log/wood Culvert; and 3. is composed of one or more Culverts that <ol style="list-style-type: none"> a. are either <ol style="list-style-type: none"> i. a pipe having a diameter of 2,000 mm or greater, ii. a pipe arch having a span of 2,130 mm or greater, or iii. an open-bottom arch having a span of 2,130 mm or greater, or b. have a combined maximum design discharge of 6 m³/s or greater. <p>Note that Major Culverts are not considered Simple Crossings.</p>
Non-Composite	A term that applies to a Superstructure system that does not rely on a structural connection between the deck and girders to deliver its primary design capacity.
Non-skewed	A term that applies to a Superstructure that is rectangular or square in plan.
Professional of Record	<p>Either one or both of the following:</p> <ol style="list-style-type: none"> 1. The Engineering/Geoscience Professional who is professionally responsible for professional work, professional activities, or professional documents related to the engineering or geoscience practice. 2. An Engineering Professional or a Forest Professional responsible for the General Arrangement Design of the Crossing, which includes: <ul style="list-style-type: none"> – preparation of the General Arrangement Design; – completion of Field Reviews; and – completion of the Professional of Record – Construction Assurance Statement, including preparation of record drawings.
Professional of Record – Construction Assurance Statement	A professional document confirming that the implementation and significant aspects of the construction of the work substantially complies in all material respects with the specifications, requirements, and intent reflected in the design documents prepared for the Crossing, including all revisions to the plans, Field Reviews, and supporting documents for the Crossing. The Professional of Record – Construction Assurance Statement can only be signed by the Professional of Record.

TERM	DEFINITION
Record Drawings; Record Documents; As-built Drawing	Professional documents, which include drawings and ancillary documents, which record the design and development of the Crossing that was constructed as well as any relevant conditions that existed at the time of construction. Note: The ABCFP and Engineers and Geoscientists BC encourage use of the term “record drawings” instead of the term “as-built drawings”, as the latter term implies that the drawings show exactly what was built or constructed. However, the As-built Drawing is a regulated requirement of the FPPR Section 77(1)(b). For the purposes of these guidelines, Record Drawings and As-built Drawings as defined in the FPPR are the same.
Structural Designs	Designs, including detailed drawings and specifications, prepared and authenticated (signed and sealed) by an Engineering Professional to facilitate the fabrication and assembly of the Superstructure and/or Substructure bridge/Crossing components.
Shop Fabrication Drawings	The drawings, diagrams, illustrations, schedules, and other data produced by the fabricator and intended to illustrate details of a portion of the items of work to be fabricated.
Simple Crossing	A Crossing that meets the requirements of Section 3.2.3 Simple Crossings of these guidelines, not including a Major Culvert.
Single Span	Describes a crossing with no pier, intermediate support, or needle beams.
Specialist	A specialist who is responsible for providing one or more services required for a Crossing project at the request of the Coordinating Registered Professional or the Professional of Record. Examples of Specialists include Geoscience Professionals, registered professional biologists, qualified environmental professionals, Engineering Professionals, and Forest Professionals.
Substructure	The portion of the Crossing that bears on the Foundation and supports the Superstructure. The Substructure may consist of steel or concrete caps, log cribs, concrete spread footings, timbers, interlocking concrete blocks, piles, or steel towers with footings. The Substructure also includes placed materials such as riprap or engineered fills.
Superstructure	The portion of the Crossing that rests on the Substructure. The Superstructure generally consists of log stringers/steel girders, concrete slab girders, associated decking, and bullrails.

VERSION HISTORY

VERSION NUMBER	PUBLISHED DATE	DESCRIPTION OF CHANGES
3.0	December 15, 2021	Updated to reflect current industry standards and practices and to reference the <i>Professional Governance Act</i> . In particular, this revision provides additional clarity on responsibilities of the Coordinating Registered Professional and Professional of Record; use of Hydrology and Hydraulics during the design process; climate change considerations; requirements of site surveys; and skill sets required of Coordinating Registered Professionals (CRPs) and Professionals of Record. This revision also adds a professional Statement for transferring responsibility between CRPs.
2.0	June 2014	Revised in response to issues raised in the Forest Practices Board report titled “Bridge Planning, Design and Construction – Special Investigation.”
1.1	September 2008	Minor revision to define the role of the CRP and add the definition for “engineered culvert”.
1.0	March 2005	Initial version.

1.0 INTRODUCTION

These *Joint Professional Practice Guidelines—Professional Services in the Forest Sector: Crossings* provide guidance on professional practice for Engineering/Geoscience Professionals and Forest Professionals who coordinate and complete the design and installation of forest road Crossings. These guidelines describe expectations and obligations of professional practice that registrants of both the Association of British Columbia Forest Professionals (ABC FP) and Engineers and Geoscientists British Columbia (Engineers and Geoscientists BC) who undertake these activities are expected to have regard for.

Having regard for professional practice guidelines means that Engineering/Geoscience Professionals and Forest Professionals must follow established and documented procedures to stay informed of, be knowledgeable about, and meet the intent of any professional practice guidelines related to their area of practice. By carefully considering the objectives and intent of a professional practice guideline, an Engineering/Geoscience Professional or Forest Professional can then use their professional judgment when applying the guidance to a specific situation. Any deviation from the guidelines must be documented and a rationale provided. Where the guidelines refer to professional obligations specified under the *Act*, the Bylaws of the ABC FP and Engineers and Geoscientists BC, and other regulations/legislation, Engineering/Geoscience Professionals and Forest Professionals must understand that such obligations are mandatory.

Forest resource managers rely on professionals to deliver the services related to the planning, design, construction, inspection, and maintenance of Crossings. Delivery of professional services for a Crossing can involve the practice of professional

forestry and professional engineering and geoscience. There is long-standing historical involvement of professional forestry and professional engineering and geoscience, with respect to Crossing projects in the natural resource sector.

These guidelines were first published in 2005 and were revised in 2008. They were revised again in 2014 in response to issues raised in the Forest Practices Board report titled “Bridge Planning, Design and Construction – Special Investigation” (Forest Practices Board 2014).

This current revision was undertaken to reflect current industry standards and to update the content to reference the *Professional Governance Act* (the *Act*). In particular, this revision provides additional clarity on responsibilities of the Coordinating Registered Professional (CRP) and Professional of Record (POR), use of Hydrology and Hydraulics during the design process, climate change considerations, requirements of site surveys, and skill sets required of CRPs and PORs. This revision also adds a professional Statement for transferring responsibility between CRPs.

1.1 PURPOSE OF THESE GUIDELINES

Registrants of the ABC FP and Engineers and Geoscientists BC have professional obligations under their respective organization’s code of ethics to provide for user and worker safety and to protect the environment in the conduct of their work. These guidelines are meant to assist in fulfilling those obligations by providing guidance on professional practice to Forest Professionals and Engineering/Geoscience Professionals who have professional involvement in the planning, design, and construction of specific Crossings.

These guidelines are intended to describe expectations and obligations of practice that Forest Professionals and Engineering/Geoscience Professionals must meet to fulfill professional obligations, including the duty to protect the safety, health, and welfare of the public and the environment

The following related documents have also been issued by the ABCFP and Engineers and Geoscientists BC. Forest Professionals and Engineering/Geoscience Professionals are expected to be aware of relevant sections of these documents while working on Crossing projects:

- *Guidelines for Professional Services in the Forest Sector – Forest Roads* (ABCFP and Engineers and Geoscientists BC 2012)
- *Guidelines for Management of Terrain Stability in the Forest Sector* (ABCFP and Engineers and Geoscientists BC 2008)
- *Guidelines for Professional Services in the Forest Sector – Terrain Stability Assessments* (ABCFP and Engineers and Geoscientists BC 2010)

1.2 SCOPE AND APPLICABILITY OF THESE GUIDELINES

These guidelines apply to the involvement of Engineering Professionals and Forest Professionals in all phases of the planning, design, and construction of a Crossing project including:

- project organization and assignment of responsibilities;
- planning, location, and design;
- general considerations;
- Hydrology and Hydraulics;
- plans and supporting documents;
- approaches and alignment;
- Foundations and Substructures;
- Superstructures;
- construction and Field Reviews;

- CRP – Crossing Assurance Statement
- CRP – Transfer of Professional Responsibility Statement (if required); and
- POR – Construction Assurance Statement.

These guidelines establish the responsibilities of the CRP and the POR and define their respective tasks, to assist them in fulfilling their professional obligations related to public and worker safety and the protection of the environment. Every Crossing project must have a CRP and a POR; these roles can be filled by either the same or different Forest Professionals and/or Engineering/Geoscience Professionals, as defined in these guidelines.

These guidelines apply to the planning, design, and construction phases of a Crossing project. The care, use, maintenance, and inspections of the Crossing are outside the scope of these guidelines. However, at the end of a Crossing project, the POR and any Specialists must communicate to the CRP any requirements for use, maintenance, monitoring and inspection, and Design Service Life. Some aspects of the roles and responsibilities during the inspection, maintenance, deactivation, and removal phases of the life cycle of Crossings are addressed in the *Practice Advisory – Professional Roles and Responsibilities for the Life Cycle of Forest Road Crossings* (ABCFP and Engineers and Geoscientists BC 2019); practitioners should refer to that document for more guidance on these phases.

Although these guidelines may provide thresholds above which professional involvement is specified as being required, Forest Professionals and Engineering/Geoscience Professionals must always use their professional knowledge, experience, and judgment to provide the appropriate level of service that is commensurate with the risk of their professional activities to public safety and/or the environment.

The decision of a Forest Professional or Engineering/Geoscience Professional not to follow one or more aspects of these guidelines does not necessarily represent a failure to meet their professional obligations.

An Engineering/Geoscience Professional may depart from these guidelines if it is appropriate to do so for an identified reason. In such circumstances, the registrant must document the reason for departing from any relevant portion of these guidelines. The registrant should consider supporting this decision through a documented risk assessment. The rationale must be consistent with the professional's obligations under the *Act*, relevant regulations, the Engineers and Geoscientists BC Bylaws, and the Engineers and Geoscientists BC Code of Ethics. Given the potential risks to the public and the environment that such departures pose, the registrant should evaluate whether to have the departure reviewed before implementation by an independent Engineering/Geoscience Professional with relevant expertise who was not involved with the design. For more information on how an Engineering/Geoscience Professional may appropriately depart from the practice guidance within these guidelines, refer to the *Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021c), Section 3.4.2.

In exceptional circumstances, a Forest Professional may depart from a particular standard set out in guidelines specified in Schedule B of the ABCFP Bylaws if it is appropriate to do so for an identified reason, which must be specifically documented and supported by a written rationale that is consistent with the ABCFP Code of Ethical and Professional Conduct (ABCFP 2021b and 2021c).

1.3 LEGISLATIVE FRAMEWORK

The planning, design, construction, and use of Crossings is governed by legislation. Crossings are built by government organizations, tenure holders, or permittees, and in most cases are overseen by Engineering Professionals and Forest Professionals.

The *Act*, regulations, and bylaws of the respective regulatory bodies (i.e., ABCFP and Engineers and Geoscientists BC) govern the professional activities

of Forest Professionals and Engineering/Geoscience Professionals. The *Forest and Range Practices Act* (also known as *FRPA*), the *Forest Planning and Practices Regulation*, and other legislation and regulations specify that certain professional documents are required for the planning, Design, and construction of Crossings.

The Government of British Columbia regulates forest management on Crown and private land separately. The *Act* does not distinguish the practice of forestry by land ownership. Crossings must be consistent with all applicable legislation in the area where these activities are carried out.

The aim of these legislative requirements is to ensure the safety of Crossings for industrial users, while protecting forest resources such as water, soil, and fish. See also [Appendix A: Legislative and Regulatory Framework](#).

In the event of any inconsistencies or contradictions between these guidelines and current legislation and regulations, the latter shall prevail.

1.3.1 REGULATION OF PROFESSIONAL SERVICES RELATED TO CROSSINGS

The delivery of professional services related to Crossings involves the practices of professional forestry, professional engineering, and professional geoscience (see [Section 3.0 Guidelines for Professional Practice](#)).

The ABCFP and Engineers and Geoscientists BC have the legislative authority to regulate registrants of their respective organizations who are working in the forest sector. This authority includes determining what constitutes professional work in each profession and developing related standards of practice and guidelines.

These guidelines are based on a framework for:

- adhering to the *Professional Governance Act*, *Engineers and Geoscientists Regulation*, and the *Forest Professionals Regulation*;

- meeting the requirements of the bylaws of the respective regulatory bodies (ABCFP and Engineers and Geoscientists BC);
- fulfilling professional obligations to protect the interests of the public, worker safety, and the environment;
- relying on the training, experience, and professionalism of Forest Professionals and Engineering/Geoscience Professionals; and
- defining the responsibilities of Forest Professionals and Engineering/Geoscience Professionals when delegating professional work to others under their direct supervision and/or relying on other qualified professionals to assist in the delivery of a Crossing project.

1.3.1.1 Role of the Association of British Columbia Forest Professionals (ABCFP)

The ABCFP has a statutory duty to serve and protect the public interest as it relates to the practice of professional forestry, including regulating the conduct of Forest Professionals. The ABCFP is responsible for establishing, monitoring, and enforcing the standards of practice, conduct, and competence for Forest Professionals. One way the ABCFP exercises these responsibilities is by publishing and enforcing professional practice guidance that contain practice and competence standards.

The *Forest Professionals Regulation* and the ABCFP Bylaws define the practice of professional forestry as:

- the provision of the services of managing, advising on, performing or directing works, services or undertakings respecting trees, forests, forest lands, forest resources, forest ecosystems or forest transportation systems in a natural or managed, rural or urban environment, and any related, incidental or ancillary services or activities, and;
- the promotion and implementation of principles of forest stewardship.

The ABCFP Bylaw 9 outlines the ethical, professional conduct, practice, and competence standards necessary for ABCFP registrants, and the guidelines where additional professional practice and competence standards can be found.

1.3.1.2 Role of Engineers and Geoscientists BC

Engineers and Geoscientists BC has the statutory duty to serve and protect the public interest as it relates to the practice of professional engineering and professional geoscience, including regulating the conduct of Engineering/Geoscience Professionals. Engineers and Geoscientists BC is responsible for establishing, monitoring, and enforcing the standards of practice, conduct and competence for Engineering/Geoscience Professionals. One way that Engineers and Geoscientists BC exercises these responsibilities is by publishing and enforcing the use of professional practice guidelines, as per Section 7.3.1 of the Engineers and Geoscientists BC Bylaws.

Section 7 of the Engineers and Geoscientists BC Bylaws outlines the standards of conduct and competence for Engineering/Geoscience Professionals, including adhering to the Engineers and Geoscientists BC Code of Ethics, meeting the intent of professional practice guidelines, and establishing and maintaining documented quality management processes for the practices.

1.3.1.3 Addressing Practice Overlap

Engineers and Geoscientists BC and the ABCFP recognize that the professional practice activities described in these guidelines are in an area of practice overlap for registrants of their respective organizations.

These guidelines were prepared by a team of representatives of the Joint Practice Board¹ of the ABCFP and Engineers and Geoscientists BC. The Joint Practice Board was mandated by the councils of the ABCFP and Engineers and Geoscientists BC, in a Memorandum of Understanding originally signed in

¹ Under the *Act*, the Joint Practice Board has been renamed the Engineering, Forestry, and Geoscience Joint Practice Panel. For legacy reasons it is still referred to in these guidelines as the Joint Practice Board.

1994, and updated in 2006 and 2013, to make recommendations to their respective councils on matters related to the practice overlap between the professions.

1.4 ACKNOWLEDGEMENTS

These guidelines were prepared by a Task Force of representatives of the ABCFP and Engineers and Geoscientists BC Joint Practice Board.

The ABCFP and Engineers and Geoscientists BC thank the authors and reviewers of the original document, as well as the authors and reviewers of this revision, for their time and effort in sharing their knowledge and experience.

The ABCFP and Engineers and Geoscientists BC would also like to thank contributors from the following organizations and groups for their direct input into the preparation of these guidelines:

- Joint Practice Board of the ABCFP and Engineers and Geoscientists BC
- Engineers and Geoscientists BC's Engineers and Geoscientists in the Resource Sector Division
- ABCFP Professional Practice Committee
- BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)

The cover photograph "Fibre Reinforced Glulam Bridge, Constructed by FLNRORD on the McGillivray Forest Service Road" was provided by FLNRORD.

2.0 ROLES AND RESPONSIBILITIES

2.1 TEAMWORK

Teamwork is essential to achieve the best outcome for a Crossing project. A forest road Crossing project must have continuous professional oversight from planning to crossing removal. The professional members of the team will generally consist of a Coordinating Registered Professional (CRP), a Professional of Record (POR), and one or more specialists. There must be a CRP and POR for every Crossing; however, these roles may be filled by the same professional.

Best practice is to have consistent team members for the duration of the Crossing project. However, if Forestry Professionals and/or Engineering/Geoscience Professionals filling the role of CRP or POR must change during a Crossing project, formal transfer of information and professional responsibility is necessary.

Examples of best practices for transfer of professional responsibility for the Crossing project are found in [Section 2.2.2.4 CRP Transfer of Responsibility](#) and [Section 2.2.3.4 POR Transfer of Responsibility](#).

2.2 RESPONSIBILITIES

2.2.1 FOREST PROFESSIONALS

Forest Professionals include registered professional foresters (RPF), registered forest technologists (RFT), and special permit holders who are registered by the ABCFP and entitled under the *Act* to engage in the practice of professional forestry in British Columbia (BC).

Under the *Act* and the ABCFP Bylaws, the ABCFP registers different categories of registrants based on their education, training, and experience relating to the practice of professional forestry. The registrants of the ABCFP have authority to practice as follows:

- RPFs have the authority to practice professional forestry, including:
 - planning, locating, and approving forest transportation systems including forest roads; and
 - auditing, examining, and verifying the results of activities involving the practice of professional forestry, and the attainment of goals and objectives identified in or under professional documents.
- Special permit holders have the authority to practice to the extent identified on their license document. Words of limitation are written on the license that constrain the scope of authorized professional work.
- RFTs have the authority to practice professional forestry in four general practice areas: forest measurements, silviculture, forest operations, and forest protection. An RFT's authority to practice contains a pre-existing condition that must be met, prior to undertaking the work. Refer to the ABCFP guidelines regarding scope of practice for RFTs. RFTs can also seek the professional certification of an ABCFP limited license to extend their practice scope.

Note that for the purpose of the ABCFP Bylaw 9-2 Schedule B, these guidelines are considered a practice standard, and [Section 5.0 Education, Training, and Experience](#) of these guidelines is considered a competence standard for Forest Professionals.

2.2.2 COORDINATING REGISTERED PROFESSIONAL (CRP)

The CRP must be either a Forest Professional or an Engineering Professional, and in either case must have the required education and experience related to Crossings. See also [Section 5.2 Skill Sets for the CRP](#).

The CRP is professionally responsible for coordinating all Crossing project activities, including planning and oversight:

- Planning includes:
 - specifying/prescribing project-specific requirements/constraints;
 - coordinating required professional services;
 - carrying out, or reviewing and accepting results of, professional services;
 - incorporating environmental and stakeholder considerations and agency approvals ;
 - determining the timing of planning, design, and construction activities; and
 - determining the Crossing site location.
- Project oversight includes:
 - reviewing and accepting results of required professional services, including those works for which the POR takes professional responsibility;
 - ensuring professional services and Specialist input, incorporated stakeholder considerations, and agency requirements have been integrated and addressed as the project progresses;
 - ensuring environmental monitoring during construction is carried out as required (this may be required even in the absence of Specialist input during planning);
 - reviewing, accepting, and documenting changes as the project progresses;
 - completing or obtaining the Professional of Record - Construction Assurance Statement; and

- completing the Coordinating Registered Professional - Crossing Assurance Statement (see [Appendix B: Assurance Statements](#)).

The CRP must direct those activities with sufficient oversight and supervision, in order to take overall responsibility and accountability for the planning and coordination of the Crossing. The CRP can only take professional responsibility for aspects of a project for which they have the necessary training, knowledge, and experience.

The following sections describe the responsibilities of the CRP for each stage of a Crossing project.

2.2.2.1 Prior to Construction

The CRP must:

- oversee and take professional responsibility for all planning and coordinating work;
- understand the roles and responsibilities of, and define the scope of work for, all team members involved in the planning, location, Design, and construction of the Crossing project;
- retain appropriately qualified Specialists, including the POR, in the Design and construction of a Crossing, when required;
- establish a communication protocol to be followed by all team members with respect to changed circumstances, Design changes, scheduling changes, and Field Reviews;
- ascertain, specify, or prescribe project-specific requirements and constraints;
- determine the timing of planning, design, and construction activities;
- determine the general location for the Crossing in the context of the overall development;
- consider all resources and stakeholders that could potentially be affected by the Crossing;
- understand all generally accepted uncertainties inherent in the Crossing project, including assumptions made by the POR and/or Specialists;

- provide relevant design criteria to the POR and Specialists, including Design Vehicle/Traffic Load, Design Service Life, available or preferred materials, Specialist reports, environmental and fish passage requirements, construction timing, and limiting vehicle configuration for Design Vehicle Tracking;
- consider the safety of those who will use the Crossing;
- review and accept the results of POR and Specialist designs and recommendations for consistency with the objectives of the Crossing project, and confirm that the necessary assessments for the project have been completed;
- ensure professional services, Specialist input, stakeholder considerations, and agency requirements have been integrated or addressed as the project progresses;
- consider applicable professional obligations, higher level plans, and governing legislation, and ensure that the required approvals, licenses, and permits have been obtained; and
- review the qualifications of the builder and ensure all required materials and components are available or provided to meet the design intent.

2.2.2.2 During Component Fabrication and Crossing Construction

The CRP must:

- confer with the owner to suggest an appropriate in-plant quality control process is in place;
- monitor Crossing construction progress while considering project plans specified in [Section 3.4.9 General Arrangement Designs and Documentation](#);
- ensure required POR and/or Specialist Field Reviews are completed as required;
- ensure environmental monitoring is carried out as required;
- review and accept changes as the project progresses; and

- ensure all appropriate Shop Fabrication Drawings, material test results, and material certificates are provided, where available.

2.2.2.3 On Completion

The CRP must:

- ensure the Professional of Record – Construction Assurance Statement (see [Appendix B: Assurance Statements](#)) is signed by the POR prior to use, or a written assurance of safe use is provided by the POR and the Assurance Statement is provided afterward in a timely manner;
- ensure the Record Drawings and documentation are completed;
- sign and seal the Coordinating Registered Professional – Crossing Assurance Statement (see [Appendix B: Assurance Statements](#)); and
- in consultation with the POR, provide all Crossing documentation and convey any requirements for use, maintenance, monitoring, recommended inspection frequency, and Design Service Life to the owner.

2.2.2.4 CRP Transfer of Responsibility

Best professional practice is to have consistent team members for the duration of the Crossing project. However, if the CRP must change during a Crossing project, a formal transfer of information and professional responsibility is necessary, to ensure all relevant information is transferred from the current CRP to the new CRP.

All information relevant to the Crossing project must be transferred to the new CRP, so the new CRP can take full professional responsibility for the planning and coordination of the Crossing, including relying on the professional services provided by the previous CRP, assuming responsibility for all other professional and non-professional services for the Crossing project in the context of the overall development, and signing and sealing the Coordinating Registered Professional – Crossing Assurance Statement ([Appendix B: Assurance Statements](#)).

Therefore, when a change of CRP is anticipated on a Crossing project, the current CRP must provide an authenticated (signed, sealed, and dated) Coordinating Registered Professional – Transfer of Professional Responsibility Statement ([Appendix B: Assurance Statements](#)) summarizing the project up to the date when the current CRP is no longer involved, so that the new CRP can rely on the previously completed project work.

A package of information to be transferred includes, but is not limited to:

- all documents/permits obtained;
- all outstanding documents/permits needed and their current status;
- all relevant Design criteria;
- all relevant fabrication information and documentation;
- all relevant Crossing project notes and correspondence that support why decisions were made and show how the project progressed to that point;
- a list of the project team members and their responsibilities, including the POR and all Specialists;
- confirmation that the Crossing project conforms with all relevant legislation and higher-level plans; and
- an authenticated (signed, sealed, and dated) CRP – Transfer of Professional Responsibility Statement.

When the CRP is no longer involved in a project, the CRP must complete, sign, and seal the Coordinating Registered Professional – Transfer of Professional Responsibility Statement, whether it is because of a formal hand-off to another CRP, the project has been delayed and the role has ended, or the original CRP must leave or is excused from the project.

See [Appendix B: Assurance Statements](#) for the Coordinating Registered Professional – Transfer of Professional Responsibility Statement.

2.2.3 PROFESSIONAL OF RECORD (POR)

The POR is either an Engineering Professional or a Forest Professional with the required education and experience related to Crossings. See also [Section 5.3 Skill Sets for the POR](#).

The POR is responsible for the design and construction of the Crossing, which includes:

- preparation of the General Arrangement Design;
- completion of Field Reviews during construction; and
- completion of the Professional of Record – Construction Assurance Statement (see [Appendix B: Assurance Statements](#)) and preparation of Record Drawings.

2.2.3.1 Design

The POR must:

- consider all factors that may impact the proposed Crossing;
- consider the safety of those who will use the Crossing;
- consider risks to the environment, utilities, water supplies, water quality and quantity, fish habitat, and other resources that could potentially be caused by the Crossing;
- take professional responsibility for the final General Arrangement Design;
- communicate to the CRP other impacts of the Design, such as changes to the road alignment and environmental concerns;
- provide relevant information received to the CRP and/or Specialists;
- review Specialist Designs, reports, and recommendations, and ensure all relevant aspects are considered in the Design;
- review the Shop Fabrication Drawings of fabricated components to determine whether they meet the intent of the General Arrangement Design;

- review new and/or reused fabricated components to ensure they are suitable for use (e.g., they have no structural damage);
- ensure the Design incorporates the recommendations, designs, and prescriptions of Specialists; and
- review the Design Vehicle/Traffic Load requirements provided by the CRP and any other planned equipment or vehicle use to determine if the design vehicle is appropriate.

2.2.3.2 Field Reviews

During construction, the POR must undertake sufficient Field Reviews, including determining their timing and extent.

The responsibility for Field Reviews does not necessarily mean that the POR must personally conduct all Field Reviews, but the Field Reviews must be carried out under the POR's direct supervision, in such a way that the POR can take responsibility and provide a Professional of Record – Construction Assurance Statement (see [Appendix B: Assurance Statements](#)).

2.2.3.3 On Completion

In order to determine whether the Crossing has been constructed in conformance with the General Arrangement Designs, the POR must:

- revise the Design and document any revisions, to address changed conditions encountered during construction;
- where possible, review and accept in-plant quality control documentation or carry out appropriate measures to ensure the fabricated structure is in general conformance with the design and appropriate for use;
- prepare Record Drawings;
- prepare and obtain other relevant component fabrication records, and field and construction data related to the Crossing;
- prepare, sign, and seal a Professional of Record – Construction Assurance Statement (see [Appendix B: Assurance Statements](#)); and

- recommend inspection frequency, highlight maintenance and monitoring items, and provide the Design Service Life to the CRP.

2.2.3.4 POR Transfer of Responsibility

Best professional practice is to have consistent team members for the duration of the Crossing project. However, if the POR must change during a Crossing project, a formal transfer of information and professional responsibility from the current POR to the new POR is necessary.

The information that must be carried forward to the new POR will vary, depending on when the Crossing project transfer of professional responsibility occurs. However, in most cases this transfer takes place between the Design and construction phases. Therefore, the content in [Table 1: Example of a Professional of Record – Transfer of Professional Responsibility Checklist](#) below is tailored to the transfer of responsibility between the Design and construction phases.

If a transfer of responsibility occurs prior to the final General Arrangement Design, then the new POR must have a corresponding level of understanding of the Crossing project, in order to accept full responsibility for the General Arrangement Design.

Table 1: Example of a Professional of Record – Transfer of Professional Responsibility Checklist

<i>Check that the transfer of information for the following has been completed:</i>	
<input type="checkbox"/>	1. Underlying Design assumptions (where not listed on the General Arrangement Design)
<input type="checkbox"/>	2. Subsurface conditions
<input type="checkbox"/>	3. Historical data or observations
<input type="checkbox"/>	4. Specialist prescriptions or designs
<input type="checkbox"/>	5. Site Hydrology estimation methodology
<input type="checkbox"/>	6. Stakeholders inputs
<input type="checkbox"/>	7. Downstream resources
<input type="checkbox"/>	8. Crossing type rationale
<input type="checkbox"/>	9. Crossing location rationale
<input type="checkbox"/>	10. Site risk factors
<input type="checkbox"/>	11. Fabrication and construction records

2.2.4 SPECIALISTS

A Crossing project may require the use of one or more Specialists. The Specialist must obtain all relevant project information from the CRP and the POR, and carry out the specific duties and tasks that have been assigned to the Specialist by the CRP and the POR.

3.0 GUIDELINES FOR PROFESSIONAL PRACTICE

These guidelines apply to the planning, Design, and construction phases of a Crossing project, establish the responsibilities of the Coordinating Registered Professional (CRP) and the Professional of Record (POR), and define their respective tasks, to assist them in fulfilling their professional obligations.

The planning, Design, construction, and use of Crossings is governed by legislation. The *Act* governs the professional activities of Forest Professionals and Engineering Professionals. The *Forest and Range Practices Act*, the *Forest Planning and Practices Regulation*, and other legislation and regulations specify that certain professional documents are required for the planning, Design, and construction of Crossings. See [Section 1.3 Legislative Framework](#) for more information.

In addition, Forest Professionals and Engineering/Geoscience Professionals are expected to be aware of relevant sections of these related documents while working on Crossing projects:

- *Guidelines for Professional Services in the Forest Sector – Forest Roads* (ABCFP and Engineers and Geoscientists BC 2012)
- *Guidelines for Management of Terrain Stability in the Forest Sector* (ABCFP and Engineers and Geoscientists BC 2008)
- *Guidelines for Professional Services in the Forest Sector – Terrain Stability Assessments* (ABCFP and Engineers and Geoscientists BC 2010)

3.1 EXPECTATIONS FOR PROFESSIONAL CONDUCT

As defined in their respective organizations' bylaws, Forest Professionals and Engineering/Geoscience Professionals must only practice in areas where they are appropriately trained and experienced. In addition, these guidelines are mandatory guidance for Forest Professionals; registrants of the ABCFP who provide professional services for Crossing projects must comply with these guidelines, with the exception of specific circumstances as outlined in the ABCFP Bylaws.

The ABCFP and Engineers and Geoscientists BC support the principle that appropriate financial, professional, and technical resources should be provided (i.e., by the client and/or the employer) to support Forest Professionals and Engineering/Geoscience Professionals who are responsible for carrying out professional activities, so they can comply with the standards of practice provide in these guidelines. These guidelines may be used to assist in establishing the objectives and scope of Crossing projects, level of service, and terms of reference of an agreement between a Forest Professional and/or Engineering/Geoscience Professional and a client.

In addition, Engineering/Geoscience Professionals involved in Crossing projects must provide notification related to liability insurance, in accordance with Engineers and Geoscientist BC Bylaws.

For additional information on legislation governing professional conduct, see [Section 1.3 Legislative Framework](#).

3.2 DEFINING CROSSINGS

3.2.1 GENERAL REQUIREMENTS FOR CROSSINGS

Crossings are forest road bridges or Major Culverts, and are either Simple Crossings or Complex Crossings.

Structural elements of Crossings must be designed by an Engineering Professional or provided in a Design Aid prepared by an Engineering Professional. This applies to new and reused structural elements.

Combining these elements in a Crossing can be undertaken by a Forest Professional or Engineering Professional.

3.2.2 COMPLEX CROSSINGS

A Complex Crossing is a Crossing that includes complex technical aspects requiring a higher level of engineering Design than a Simple Crossing.

[Section 3.2.3 Simple Crossings](#) defines the conditions that must be present for a Crossing to be considered a Simple Crossing. Crossings that do not meet all of the conditions listed in that section are considered Complex Crossings. Major Culverts are also considered Complex Crossings.

Complex Crossings require a higher level of professional oversight from the CRP and POR; a POR for a Complex Crossing must have the skill sets listed in [Section 5.3.2](#).

3.2.3 SIMPLE CROSSINGS

Simple Crossings must meet all of the conditions presented in the following sections. If any condition is not met, the Crossing is not considered a Simple Crossing.

3.2.3.1 Hydrology and Hydraulics

A Crossing is considered a Simple Crossing if it meets the following conditions:

- The channel is historically stable and well-contained with no evidence of scour of the channel or the stream banks.

- The channel may be historically unstable if the POR has indicated on the Design that the Crossing and/or the approaches are suitable for the period the Crossing remains on the site.
- The Crossing does not significantly alter the hydraulic characteristics of the design flow.

3.2.3.2 Approaches, Alignment, and Gradient

A Crossing is considered a Simple Crossing if the Approaches meet the following conditions:

- The native ground at the approaches is stable.
- Excluding log structures, the road approach is aligned to ensure the design vehicle tracks straight onto and off the Crossing with minimal side tracking.
- Excluding log structures with gravel decks, the maximum Crossing grade is 4 percent.

3.2.3.3 Foundation Soils or Rock

A Crossing is considered a Simple Crossing if the Foundation soils or bedrock can safely support a design Bearing Pressure of 200 kPa (Serviceability Limit State [SLS], Combination 1) or more, if composed of unweathered bedrock free of adverse jointing and discontinuities, dense/hard till, or dense sandy gravel.

These ground conditions should be adequate to support the anticipated loads with acceptable settlement (less than 25 mm total and differential), provided they meet the requirements of [Section 3.2.3.4 Substructure](#) and the following conditions:

- If on soil, the groundwater table is a minimum of 1 metre below the base of the footings during industrial operations.
- The bearing surface has less than a 5 percent slope in any direction.
- There is no evidence of slope or channel instability in the vicinity of the Crossing that could impact the proposed structure.
- The footing bears on undisturbed soil, bedrock, or a leveling course of compacted granular fill does not exceed 0.3 metre.

- The leveling course of granular fill is compacted to a minimum of 95 percent of the standard proctor maximum dry density, the total thickness of the fill does not exceed 0.3 metre, and the natural ground surface below the fill meets all of the above criteria.

It is recognized that soil and bedrock types and conditions vary across BC, and there can be a Design Aid to address the conditions; e.g., a single log sill structure. In some areas, the Foundation soil or bedrock on which the Substructure bears may not be able to support a design Bearing Pressure of 200 kPa (SLS, Combination 1) due to local or temporary conditions. In these cases, it may be possible to develop geotechnical Design Aids for local or temporary use, in order for the Crossing to qualify as a Simple Crossing.

These Design Aids must:

- clearly define the soil and bedrock types and conditions and the design Bearing Pressure that the soil or bedrock can safely support;
- delineate the geographic area within which the Design Aids apply;
- explain any limitations in the application of the Design Aids, such as restrictions on Foundation materials, site preparation techniques, Substructure configurations, or construction methods; and
- indicate any Field Reviews required by the Engineering Professional to confirm the validity of the Design Aids and application.

See [Appendix C: List of Maximum Bridge Spans for Maximum 200 kPa Bearing Pressure](#) for sample span limitations for various bridge Superstructures and typical Substructure types.

3.2.3.4 Substructure

A Crossing is considered a Simple Crossing if it meets the following conditions:

- Substructures constructed from log sills, log cribs, or pre-cast interlocking concrete blocks (with or without concrete footings) are 2 metres or less in height (including footings and caps).
- Plans for Substructures over 2 metres high are prepared using Design Aids.
- SLS, Combination 1 (CAN/CSA-S6, Canadian Highway Bridge Design Code), imposes a Bearing Pressure less than 200 kPa on the Foundation soils or bedrock, unless a higher design Bearing Pressure is provided in a Design Aid.
- The 2-metre height limitation for log cribs is measured from the lowest point of the Substructure (including granular fill) where it bears on the Foundation soils or rock to the top of the bearing sill or bridge soffit. Sills and caps are transitions to connect the Superstructure to the Substructure and are included as part of the maximum allowable Substructure height.
- The Substructure height has not been increased to greater than 2 metres by combining different Substructures. For example, a 1.5-metre high log crib supporting 1.5-metre high interlocking concrete blocks would not qualify as a Simple Crossing.
- If using log or timber sills, the sills are no smaller than 0.4 metre in width at their narrowest point, or are larger than 0.4 metre if ripped to support a bridge-bearing plate.
- The entire base of the footings/crib is set back at least 1.5 metre horizontally from a 2:1 horizontal to vertical plane extrapolated upwards from the toe of soil slopes, or 1.5 metre back from the crest of the slope, whichever is greater. (See [Appendix D: Illustration of a Simple Crossing Slope](#).)

- The Substructure does not have engineered soils (geosynthetic reinforced soil or mechanically stabilized earth).
- The Substructure does not require structural field welding or structural concrete grouting.

3.2.3.5 Superstructures

A Crossing is considered a Simple Crossing if the Superstructure:

- is Non-Composite;
- is Single Span and simply supported;
- incorporates Structural Designs prepared by an Engineering Professional;
- does not require engineered installation procedures (for example, specialized lifts or launches);
- does not require Field Splices;
- does not require structural field welding or structural concrete grouting; and
- is Non-skewed (excluding log structures).

3.3 PROJECT DOCUMENTATION

The CRP is responsible for coordinating the documentation of the Crossing project including, but not limited to:

- site surveys;
- Specialist reports;
- General Arrangement Designs;
- Field Review documentation;
- Record Drawings;
- the Coordinating Registered Professional – Crossing Assurance Statement;
- the Coordinating Registered Professional – Transfer of Professional Responsibility Statement (if required); and

- the Professional of Record – Construction Assurance Statement.

All project documentation must be retained for the life of the Crossing, or longer as required by legislation. See also [Section 4.0 Quality Management in Professional Practice](#).

3.4 CROSSING DESIGN

The POR is responsible for communicating the Crossing project objectives to others in a clear, concise, and detailed manner, through the project Designs and supporting documents. The project documents should provide sufficient information to facilitate the fabrication and installation of the Crossing.

A complete set of documents includes the General Arrangement Designs supplemented with detailed Structural Designs, and other fabrication, material, and construction specifications. Structural Designs and/or Shop Fabrication Drawings detailing individual Crossing components prepared by fabricators should be included as part of the project documentation.

General Arrangement Designs are the result of the Design process; as such, they should clearly depict the proposed components, connections, and configuration of the Crossing in relation to the forest road, stream, and stream banks. They should include a site survey, profile drawings, and Crossing elevations. The General Arrangement Designs should contain references to all Design Aids used to facilitate their development.

The General Arrangement Drawings must be appropriately authenticated (signed and sealed) by the POR. (See [Section 4.0 Quality Management in Professional Practice](#).)

3.4.1 GENERAL CONSIDERATIONS FOR CROSSING DESIGN

Bridge design and fabrication should reference accepted engineering practice documents including, but not limited to the following:

- *CSA S6 – Canadian Highway Bridge Design Code* (CSA 2019)
- *Canadian Foundation Engineering Manual* (Canadian Geotechnical Society 2006)
- [BC Ministry of] Forests, Lands, Natural Resources, and Rural Development (FLNRORD) Bridge Guidelines, Standards, and Specifications website (BC MFLNRORD 2021)
- BC Ministry of Transportation and Infrastructure (BC MOTI) *Supplement to Canadian Highway Bridge Design Code (CHBDC), S6-14* (BC MOTI 2016)
- MFLNRORD Engineering Manual (BC MFLNRORD 2019)
- Associated documentation, where appropriate.

3.4.2 DEVELOPMENT AND USE OF CROSSING DESIGN AIDS

A Design Aid is a document prepared and authenticated by an Engineering Professional that provides an unambiguous result tied to clear parameters, which can be applied by others to a site-specific situation.

When preparing Design Aids, Engineering Professionals should clearly state:

- the intended purpose, authorized users, and application for the Design Aid;
- requirements and restrictions for those using the Design Aid (such as Design Vehicle/Traffic Load, specific material or site conditions, specific aspects requiring higher level oversight, materials, or connection requirements);
- assumptions made, codes referenced, and, where applicable, factors of safety used in producing the Design Aid;

- limitations for application of the Design Aid (e.g., the date the Design Aid was signed, and/or a date when the Design Aid is no longer valid or applicable); and
- the name, signature, and seal of the Engineering Professional taking professional responsibility for the Design Aid.

When using a Design Aid, a POR should:

- obtain authorization from the Engineering Professional responsible for the Design Aid prior to using the Design Aid;
- discuss the Design Aid with the Engineering Professional to ensure that the POR understands its limitations;
- reference the Design Aid(s) in the project documentation;
- include copies of the Design Aid(s) with the project documentation; and
- seek Specialist assistance (usually from an Engineering Professional) when applicability of the Design Aid is in question or unforeseen circumstances make the Design Aid inapplicable or questionable.

3.4.3 HYDROLOGY, HYDRAULICS, AND GEOMORPHOLOGY

Factors for Hydrology and Hydraulics are basic to the planning and Design of a Crossing and roadway and can affect the road location. Inadequate consideration of hydraulic and geomorphic factors can result in problems, such as increased maintenance costs, failure of a Crossing, unnecessarily expensive Crossings, and environmental damage. Physical changes at the Crossing site may result in impacts at considerable distance from the Crossing, such as geomorphic changes that affect a river upstream or downstream.

When designing a Crossing, the POR must consider hydrologic, hydraulic, and geomorphic factors, including determining an appropriate design flow and potential impacts of a Design on the stream morphology and natural flood regime. The POR must

also consider the limiting design event type for the Crossing. This may be a clear water flood, debris flood, or debris flow.

An appropriate design flow must be determined for the Crossing site. Determining design flow usually involves applying several different methods and then using professional judgment to select an appropriate design value. The POR should compare flow discharge estimates derived from the site information to other data and theoretical derivations. The final selection of design flow should then be based on the judgment of the POR or Specialist, while considering these derivations and potential climate changes. Using a simplistic calculation such as “three times high-water area” is not generally suitable as the primary or only means of design flow analysis for Crossings.

The POR must translate the design flow into the hydraulic impacts on the proposed site, channel, and Crossing. Hydraulic analysis is necessary to determine the required waterway opening and structure configuration, as well as the assessment for scour potential and the appropriate means of scour/erosion protection. Consideration should also be given to environmental conditions that could affect the Crossing, including but not limited to, conveyance of debris and bedload, ice jams, or other factors that might influence the channel, stream stability, and the Crossing’s ability to convey the design flow over the Design Service Life of the Crossing.

3.4.4 ADDRESSING CLIMATE CHANGE IN THE DESIGN OF CROSSINGS

Climate change is expected to affect the design and maintenance of Crossings, primarily through an increased variability in weather affecting hydrologic and geomorphic processes, in conjunction with changes in precipitation and snowmelt patterns. Stream hydrographs are expected to continue adjusting in response to changes in temperature and precipitation.

Several sources of future climate data are available that can indicate how the temperature and rainfall patterns are changing in the future (see below). These tools

provide various relevant information to help carry out sensitivity analyses that are useful for design flood Hydrology risk considerations. While these resources do not readily indicate how the frequency and magnitude of extreme events may change into the future, they provide relevant information to help carry out sensitivity analyses useful for design flood Hydrology risk considerations.

The following resources provide information on climate change:

- Engineers and Geoscientists BC Climate Change Information Portal (egbc.ca/Practice-Resources/Programs-Resources/Climate-Sustainability/Climate-Change-Information-Portal)
- Pacific Climate Impacts Consortium Plan2Adapt tool (pacificclimate.org/analysis-tools/plan2adapt)
- Climate Data Canada website (climatedata.ca)
- Centre for Forest Conservation Genetics (CFGC) ClimateBC_Map (climatewna.com/ClimateBC_Map.aspx)
- IDF_CC Tool 4.0 (Computerized Tool for the Development of Intensity-Duration-Frequency Curves under Climate Change, Version 4.0) (idf-cc-uwo.ca)

3.4.5 CROSSING ALIGNMENT IN CONSIDERATION OF STREAM AND ROAD ALIGNMENT AND GRADES

Planning for approach roads around Crossings must address issues related to sight lines, design speed, Design Vehicle Tracking, slope stability, and drainage, as well as minimize impacts to the stream. The POR must also consider impacts on riparian habitat. The alignment of a Crossing and the road prism relative to a stream can influence stream Hydraulics, and the Design must consider hydraulic and attendant erosion issues. The General Arrangement Design must also consider the expected stream behaviours while minimizing impacts to the environment, including water quality and fish passage.

Forest roads and Crossings are sources of sediment and can detrimentally impact other forest resources such as water quality, fish streams, and fish habitat. Particular attention to sediment management is necessary during the design and construction of the Crossing to minimize sediment development and mitigate direct delivery into streams. It is more effective and efficient to integrate sediment management into Crossing planning, design, and construction than to deal with it in a reactive manner. Consideration for management of sediment should continue to be made through the life-cycle phases of Crossings and the associated forest roads as each phase impacts sediment development and mobilization.

Approach roads are those sections of road on either side of the Crossing, extending for a sufficient distance to allow for the safe passage of the design vehicle over the Crossing. Considerations for approaches include the vertical and horizontal road alignment, turnouts, surface drainage, sediment management, and related safety issues such as visibility and signage. The approaches and adjacent road alignment must be considered in the overall Design and installation of the Crossing.

A Crossing and its approach roads must be aligned to accommodate side tracking of the design vehicle. For many Crossings, the POR will complete a quantitative analysis of the Design Vehicle Tracking to determine the optimum approach road geometry. Where required, the Crossing geometry may need to be modified to accommodate vehicle tracking.

3.4.6 FOUNDATIONS AND SUBSTRUCTURES

The structural design of Substructures must be carried out by Engineering Professionals who have the appropriate skills and knowledge. However, this does not preclude Forest Professionals from utilizing Design Aids prepared by Engineering Professionals.

Site conditions that include Foundation soils and/or rock and proposed fills should be described and classified. The strength and drainage characteristics should be established to determine the design bearing

capacity, the allowable extent and slope of excavations, and the type and amount of fill. The design of retaining structures must account for lateral earth pressures, drainage characteristics of the backfill, degree of compaction, and the stability of the retained fill.

The design and placement of Substructures or Major Culverts is governed by the observed and anticipated site conditions. Natural channel banks and escarpments should be assessed to identify any potentially unstable slopes located either at or adjacent to the proposed Crossing, given the proposed applied loads. Approach excavations or fills and their Foundations should be reviewed to determine that they will remain stable under Design conditions for the Design Service Life of the Crossing.

3.4.7 STRUCTURAL COMPONENTS

Structural Designs for Superstructures must be prepared by Engineering Professionals who have the appropriate skills and knowledge. However, this does not preclude Forest Professionals from utilizing Design Aids prepared by Engineering Professionals.

The structural design of a Superstructure should be guided by the General Arrangement Drawing. The POR should determine whether the structural design of the Superstructure has accommodated the overall objectives of the Crossing, including but not limited to:

- anticipated Design loading and structural requirements;
- Design Service Life of the structure;
- availability of materials and equipment;
- environmental risks;
- road alignment;
- Design Vehicle Tracking; and
- sediment control.

An Engineering Professional with the appropriate training and experience in Superstructure design is responsible for:

- preparing and sealing the Structural Drawings and Design Aids for all Superstructures, including log stringer Superstructures; and

- assessing structural components prior to use, where damage or deterioration has been identified.

The POR must ensure all structural components adhere to the Design specifications and there is no significant damage or deterioration of the structural components at the time of installation.

3.4.8 SITE SURVEY

Site surveys must include information from the Crossing site in sufficient detail to properly account for all aspects of the General Arrangement Design, including, but not limited to, Hydraulics, Hydrology, and morphology; Crossing alignment and road alignment; Foundation and Substructure, and constructability.

Data collected in the Site Survey includes, but is not limited to:

- ground surface geometry and site features, including sloughs, abandoned channels, overflow channels, sand/gravel bars, log jams, boulder areas, debris accumulations, vegetation boundaries, trails, ice jam areas, and other significant features;
- survey control for construction and any other local survey markers;
- surficial material types, including estimates of horizon depths and bedrock presence;
- stream channel information, including high water levels, present water levels, stream thawing, bedload composition, and stream bank composition; and
- existing infrastructure details and geometry.

3.4.9 GENERAL ARRANGEMENT DESIGNS AND DOCUMENTATION

The General Arrangement Design is a professional document that includes site-specific, issued-for-construction drawings that incorporate all aspects affecting the Crossing Design.

The extent of the documentation is a function of risk and complexity, where risk is the likelihood of a detrimental effect to people or the environment, and complexity is a measure of the activities required to implement the plan.

Following is a list of the items that are required within the General Arrangement Design.

3.4.9.1 General Items

The following information is included in this documentation:

- Title block information on each sheet of the drawing set.
- Drawing name and title that clearly and uniquely describes the Crossing.
- Names of the CRP and POR who designed the Crossing and the name of the professional reviewer.
- Design date.
- Site survey date, with the names of individuals or company who completed the survey.
- Revision numbers and dates.
- Line type and symbol legend.
- Drawing number unique to that sheet.
- Title page.
- Site location map or specific description of Crossing location.
- List of sheets within the drawing set, including drawing numbers and description of content.
- Owner/client name.
- Design company name (as required).
- Background design information.
- Design standards used.

- Design Service Life of the Crossing in estimated years or seasons. Influencing factors may include, but are not limited to construction materials, stream morphology, and maintenance.
- Design Vehicle/Traffic Load.
- Vehicle configuration used for Design Vehicle Tracking, including minimum clearances from the swept path to the edges of the deck or approach roads.
- References to current, authenticated Design Aids used, and attached as required.
- Design flood estimation method used, estimated design flood, average velocity used for end area requirements, and other relevant watershed information.
- Stream class information (that is, the class indicates a potential environmental constraint governing the design of the Crossing).
- Other natural resources governing the Design of the Crossing, such as whether fish are present at the site and the proximity to downstream fish habitat.
- Materials specifications for fabricated materials and member selection and/or use in the detailed structural design of components and connections.
- Geotechnical information, including a description of the investigation methodology, assumed or tested bearing material characteristics, and instructions for cases of change conditions and/or description of what constitutes a changed condition.
- A recommendation for the frequency of routine maintenance inspections, provided by the POR. Any specialized items requiring specific or special monitoring should be identified by the POR for subsequent inspections.

3.4.9.2 Site Preparation and Installation

The following information is included in this documentation:

- Notes for Foundation excavation requirements specific to the anticipated subsurface conditions and the Substructure type that references information regarding worker safety, slopes, drainage, work process, and environmental considerations.
- Riprap gradation, estimated quantity required, rock quality and/or type, and rock shape. Alternatively, the Design may refer to an established standard within the public domain for a description of the riprap required.
- Description and specifications for required backfill, bedding, surfacing, capping, or leveling course materials, along with estimated quantities and requirements for placement and compaction.
- Description and specifications for erection, including connections of components.
- List of activities that will require Field Review by the POR or the POR's designate.
- Description of how sediment and erosion control is addressed.
- Requirements for working in and around the stream and riparian area, including environmental monitoring and/or fish salvage, where required.
- Requirements for materials testing of structural components placed or fabricated in the field (that is, grout, structural fill compaction testing, field welds and/or splices).

3.4.9.3 Plan Views

The following information is included in this documentation:

- Site topography with cardinal direction.
- Existing infrastructure (if not a new Crossing).
- Control points (benchmarks and reference points).
- Stream extents and direction of flow.
- Proposed or existing road extents with stationing and approach direction labels.

- Location of Crossing (including layout table or drawing with reference to the control or reference points).
- Extents of riprap and abutment excavations.
- Extents of the approach road excavations.
- Vehicle side tracking showing curve data including the design vehicle, required road widening, clearances, and curve offsets from the Crossing for the horizontal design vehicle traveling in both directions.

For an example of typical plan detail requirements for site plans, refer to the [MFLNRORD Bridge Guidelines, Standards, and Specifications website](#) under “Site Plan Requirements” (BC MFLNRORD 2021).

3.4.9.4 Profile Views

The following information is included in this documentation:

- Overall centerline profile view showing road approach grades and ground profile and structure placement at the Crossing.
- Detailed profile or elevation view of the Crossing only with existing and proposed ground and structure profiles and all limits of excavation both temporary and permanent.
- Elevations of the footings and Superstructure and design flood (and clearance) and placement and configuration of all components of the Superstructure and Substructure.
- Profile view of the stream including the proposed structure. The profile view must be long enough to properly model the natural stream profile. For Crossings where the previous structure or the proposed structure influences the stream morphology, the constructed stream bottom and/or the expected long-term stream bottom profile must be shown.

- Abutment elevation views for both abutments including all applicable Substructure and Superstructure components. This may include further detailed drawings showing specific layout details (i.e., footing layout details for skewed Crossings, connection details, or riprap placement).

For an example of profile drawing requirements for typical site plans, refer to the [MFLNRORD Bridge Guidelines, Standards, and Specifications website](#) under “Site Plan Requirements” (BC MFLNRORD 2021).

3.5 CONSTRUCTION AND FIELD REVIEWS

The construction of a Crossing may include:

- site preparation and construction of approach roads;
- installation of abutments and piers;
- installation of caps and sills;
- assembly and/or installation of stringers;
- installation and/or grouting of deck components;
- installation of bullrails and curb logs;
- assembly and embedding of Culvert sections;
- installation of riprap; and
- approach structures and signage.

A POR who is an Engineering/Geoscience Professional must determine that the requirements of section 7.3.3 of the Engineers and Geoscientists BC Bylaws for documented Field Reviews have been carried out on the project during construction. In meeting the intent of the Engineers and Geoscientists BC Bylaws, having responsibility for Design and Field Reviews does not necessarily mean that the POR must personally conduct all Design and Field Reviews, but the POR must see that they are carried out under the POR’s direct supervision in order to sign and seal the Professional of Record – Construction Assurance Statement. (See [Appendix B: Assurance Statements](#).)

A POR who is a Forest Professional must determine that the requirements under the *Act* and the ABCFP Bylaws for “auditing, examining and verifying the results of

activities involving the practice of professional forestry, and the attainment of goals and objectives identified in or under professional documents have been documented in a record and achieved in order to sign and seal the Professional of Record – Construction Assurance Statement. (See [Appendix B: Assurance Statements](#).)

The responsibility for determining the nature and extent of Field Reviews, and who should undertake them, is left to the judgment of the POR. While tasks can be delegated to employees, colleagues, and subcontractors, the overall responsibility for the Crossing remains with the POR.

The POR must consider whether to conduct Field Reviews during construction activities, including:

- layout;
- Foundation;
- component assembly;
- erosion control measures;
- approach roads; and
- riprap installation.

Prior to opening a Crossing for use, and after construction of a Crossing, the POR and CRP must assure the Crossing for the intended use.

3.6 RECORD DRAWINGS AND OTHER DOCUMENTATION

Record Drawings and related documentation record the design and development of the Crossing that was constructed, and they document any relevant conditions that existed at the time of construction. Record Drawings and documents are required by legislation. For example, the “As-built Drawing” in Section 77 of the *Forest Planning and Practices Regulation* is a Record Drawing. The term “Record Drawings” does not imply that the drawings show

exactly what was built or constructed, nor does it suggest a level of certification.

When Crossing construction has been completed, the POR should prepare Record Drawings and related documentation, to document what was constructed or implemented at the Crossing. The types of documented information will vary according to each project, but usually include measurements, elevations, sizes, or notes marked on the approved construction documents, including any significant amendments or modifications to the Crossing Design.

Once the documentation has been completed, the POR prepares the Record Drawings and documents according to guidance for document control and retention. The CRP is responsible for coordinating the retention of project documentation, and may also compile other documentation that is not within the scope of the POR.

The types of changes recorded on Record Drawings and other documentation can include:

- actual log stringer, curb, needle beam, and crib log dimensions and diameters, species and grades, and span lengths;
- any changes to fabricated materials;
- actual footing base elevation, deck elevation, and alignment location;
- confirmation of scour protection requirements, thicknesses, and extents;
- fabrication plant inspection reports, including mill test certificates and concrete test results;
- any other pertinent fabrication, field, and construction data, including but not limited to pile driving and compaction records;
- Shop Fabrication Drawings where available; and
- record documentation for the activities of other Forest Professionals, Engineering/Geoscience Professionals, or Specialists, based on their individual scopes of work during construction.

4.0 QUALITY MANAGEMENT IN PROFESSIONAL PRACTICE

4.1 INTRODUCTION

Forest Professionals and Engineering/Geoscience Professionals are required to follow quality management processes and standards for all of the professional work they complete.

The purpose of quality management is to check that the completed work is technically correct and complies with applicable codes, standards, and regulatory requirements. Quality management requires the implementation of suitable protocols to ensure that appropriate quality assurance and quality control reviews are completed.

4.2 FOREST PROFESSIONALS

These guidelines contain practice and competence standards for Forest Professionals (ABCFP Bylaw 9, Schedule B12A).

The ABCFP Bylaw 9, Standards of Ethical and Professional Conduct contains a standard of due diligence. A Forest Professional can meet the standard for due diligence by being prudent and doing all work with constant and careful attention, including:

- meeting all relevant legal requirements;
- having a clear understanding of client or employer objectives and how those objectives relate to other values or interests which are relevant to the work or may impact it;
- being personally familiar with all relevant characteristics of the area affected by the work;

- gathering and incorporating all appropriate background information;
- consulting with all appropriate experts or specialists for those areas for which the Forest Professional is not qualified to practice or express an opinion;
- confirming, when external advice is sought from a Specialist, that the Specialist is qualified and competent to give that advice and the advice given makes sense based on the Forest Professional's own personal knowledge;
- confirming, when data is collected by another person, that the person is qualified and competent to collect that data and the data collected makes sense based on the Forest Professional's own personal knowledge;
- confirming that sufficient data was collected as per required standards; and
- making a proper assessment of risks and outcomes.

Exercising due diligence also means that:

- Forest Professionals have documented the rationales for decisions to accept, control, or reduce risks; and
- Forest Professionals have signed and sealed the work for which they are responsible.

Forest Professionals must retain all documentation, including checklists and references to standard operating procedures or other mechanisms, demonstrating that all appropriate procedures were followed and confirming all relevant steps and considerations were included. They must also retain all background information, including Specialist assessments, upon which they relied to formulate the rationale for their decisions.

4.3 ENGINEERING/GEOSCIENCE PROFESSIONALS

For Engineering/Geoscience Professionals, a quality management program must satisfy the requirements of Engineers and Geoscientists BC section 7.3.2 of the Engineers and Geoscientists BC Bylaws for quality management.

To meet the intent of the quality management requirements, Engineering/Geoscience Professionals must establish, maintain, and follow documented quality management policies and procedures for the following activities:

- Use of relevant professional practice guidelines
- Authentication of documents and use of the Engineers and Geoscientists BC seal
- Direct supervision of delegated professional engineering or professional geoscience activities
- Retention of complete project documentation for a minimum of ten years after the completion of a project or ten years after engineering or geoscience documentation is no longer in use
- Regular, documented checks of engineering and geoscience work, using a written quality control process
- Documented Field Reviews of the constructed work at the Crossing site that the Engineering/Geoscience Professional considers necessary to ascertain whether the significant aspects of the work are in general compliance with the plans and supporting documents.
- Documented independent review of high-risk professional activities or work
- Where applicable, documented independent review of structural designs prior to construction

Failure to appropriately authenticate and apply the permit to practice number to documents is a breach of the Engineers and Geoscientists BC Bylaws.

Engineering/Geoscience Professionals employed by a Registrant firm are required to follow the quality management policies and procedures implemented by the Registrant firm as per the Engineers and Geoscientists BC's permit to practice program.

These requirements are addressed further in the following quality management guides:

- *Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021c)
- *Guide to the Standard for the Authentication of Documents* (Engineers and Geoscientists BC 2021d)
- *Guide to the Standard for Direct Supervision* (Engineers and Geoscientists BC 2021e)
- *Guide to the Standard for Retention of Project Documentation* (Engineers and Geoscientists BC 2021f)
- *Guide to the Standard for Documented Checks of Engineering and Geoscience Work* (Engineers and Geoscientists BC 2021g)
- *Guide to the Standard for Documented Field Reviews During Implementation or Construction* (Engineers and Geoscientists BC 2021b)
- *Guide to the Standard for Documented Independent Review of Structural Designs* (Engineers and Geoscientists BC 2021h)
- *Guide to the Standard for Documented Independent Review of High-Risk Professional Activities or Work* (Engineers and Geoscientists BC 2021i)

4.4 INDEPENDENT REVIEW OF PROFESSIONAL WORK

Both the ABCFP and Engineers and Geoscientists BC consider independent review to be an important part of quality management of professional practice. Where a Forest Professional or an Engineering/Geoscience Professional considers it appropriate or where required by the Bylaws of either regulatory body, the quality management program should include an independent peer review of those aspects of the plan that are considered complex and/or where life safety implications are a major factor. The peer review should occur before the Design/planning for the relevant aspects of the Crossing project are completed.

The reviewer should be independent of the project team and not have been involved in the development of any stages of the original plan. Independent peer reviews can be performed by members of the same firm that generated the original professional documents, provided an independent perspective is maintained.

The level of peer review should be based on the professional judgment of the Forest Professional or Engineering/Geoscience Professional. Considerations should include the stability and complexity of the Crossing; type of elements at risk; availability, quality, and reliability of background information and field data; and the training and experience of the Forest Professional or Engineering/Geoscience Professional.

The independent peer review process should be appropriately documented for the circumstances and include the following documentation, as a minimum:

- Engineering Professionals should
 - include an authenticated (signed, sealed, and dated) letter or report in the plan that includes
 - documentation of the limitations and qualifications with regards to the review, and
 - the results of the review.
- Forest Professionals should
 - include a professional identification and
 - documentation of the limitations and qualifications with regards to the review, and
 - the results of the review.

For both internal and external peer reviews, the name of the reviewing Forest Professional or Engineering/Geoscience Professional should be identified in the report.

4.5 DOCUMENTING SUPPORTING RATIONALE

Forest Professionals and Engineering/Geoscience Professionals should provide documented rationale to support their professional judgments and decisions, including descriptions of the methods chosen, conclusions reached, and judgments made. In addition, Forest Professionals have an obligation to demonstrate how conclusions have been reached (ABCFP Bylaw 9, Schedule A).

In general, supporting rationale in the context of Crossings relates to the documented design standards and criteria and other supplementary data upon which the professional documents are based.

4.6 SUPERVISION OF SUBORDINATES AND SPECIALISTS

The concept of direct supervision involves taking responsibility for the conduct and control of the work of a subordinate. Forest Professionals and Engineering/Geoscience Professionals may delegate tasks to others who work under their direct supervision, or they may rely on the work of others, such as Specialists, who have the skill sets necessary to complete a task and take responsibility for it.

Delegators should provide sufficient direction to the individuals to whom they are delegating work, commensurate with that person's level of expertise. When seeking advice from a Specialist, Forest Professionals and Engineering/Geoscience Professionals are responsible both for checking that Specialists are qualified and competent to give that advice, and for ascertaining that the advice makes sense based on their own knowledge and professional judgment.

When considering whether to delegate work to others, Engineering/Geoscience Professionals must follow the Engineers and Geoscientists BC *Quality Management Guides – Guide to the Standard for Direct Supervision* (Engineers and Geoscientists BC 2021e).

When considering whether to delegate work to others, Forest Professionals must follow the *Practice Guidance – Supervising the Practice of Professional Forestry* (ABCFP 2021d). Forest Professionals must be able to undertake the necessary due diligence, in order to assume professional accountability for the “professional forestry” work done by individuals under their direct supervision who are not ABCFP registrants. The assumption of accountability by a Forest Professional is based on the personal knowledge of the day-to-day “professional forestry” and job performance of the person being supervised.

Forest Professionals and Engineering/Geoscience Professionals must accept full responsibility for all work delegated to subordinates and must be certain that the delegate's work meets professional standards.

When providing direction to a subordinate, Forest Professionals and Engineering/Geoscience Professionals with overall responsibility should consider:

- the complexity of the project and the nature of the risks;
- which aspects of the work should be delegated;
- the training and experience of individuals to whom work is delegated; and
- the amount of instruction, supervision, and review required.

Careful consideration must be given to delegating Field Reviews. Due to the complex nature of Field Reviews, Forest Professionals or Engineering/Geoscience Professionals with overall responsibility should exercise judgment when relying on delegated field observations and should conduct a sufficient level of review to have confidence in the quality and accuracy of the field observations.

4.7 OTHER QUALITY MANAGEMENT REQUIREMENTS

Forest Professionals and Engineering/Geoscience Professionals must also be aware of any additional quality management requirements from other sources that are relevant to their work, which may include but are not limited to:

- legislation and regulations at the local, regional, provincial, and federal levels;
- policies of authorities having jurisdiction at the local, regional, provincial, and federal levels;
- agreements and service contracts between clients and Forest Professionals and/or Engineering/Geoscience Professionals or their firms; and/or
- standards for forestry, engineering, and/or geoscience firms, particularly those that apply to quality management system certification, such as the ISO 9000 family.

Forest Professionals and Engineering/Geoscience Professionals should assess any areas of overlap between the Engineers and Geoscientists BC and ABCFP quality management requirements and the requirements of other applicable sources. If the requirements of different sources overlap, Forest Professionals and Engineering/Geoscience Professionals should attempt to meet the complete intent of all requirements.

Where there are conflicts between requirements, Forest Professionals and Engineering/Geoscience Professionals should negotiate changes or waivers

to any contractual or organizational requirements that may conflict with requirements of legislation, regulation, or their respective organization's code of ethics.

Generally, no contractual obligation or organizational policy that may apply to a Forest Professional or Engineering/Geoscience Professional will provide justification or excuse for breach of any of the Forest Professional's or Engineering/Geoscience Professional's obligations under any legislation, regulation, or their respective organization's code of ethics. Where such conflicts arise and cannot be resolved, Forest Professionals and Engineering/Geoscience Professionals should consider seeking legal advice from their own legal advisers on their legal rights and obligations in the circumstances of the conflict, and they may also seek practice advice from their respective regulatory body on any related ethical dilemma that they may face in the circumstances.

4.8 PRACTICE ADVICE

The ABCFP and Engineers and Geoscientists BC provides their registrants and others with assistance addressing inquiries related to professional practice and ethics.

Practice advisors at Engineers and Geoscientists BC and ABCFP Practice Stewards can answer questions regarding the intent or application of the professional practice or quality management aspects of these guidelines.

To contact a practice advisor, email Engineers and Geoscientists BC at practiceadvisor@egbc.ca.

To contact a Practice Steward, email ABCFP at practiceadvice@abcfp.ca.

5.0 EDUCATION, TRAINING, AND EXPERIENCE

5.1 INTRODUCTION

Professional qualification and competence refer to having sufficient knowledge, ability, and experience to suitably undertake and complete the necessary tasks. Forest Professionals and Engineering/Geoscience Professionals must adhere to their respective organization's code of ethics and have the appropriate education, training, and experience consistent with the services being provided. By maintaining appropriate professional qualifications and competence, they ensure they are capable of addressing matters undertaken on their clients' behalf, thereby upholding the integrity of professional forestry, professional engineering, and professional geoscience practices, and maintaining the confidence of stakeholders of those professions.

Forest Professionals or Engineering/Geoscience Professionals who offer specialty services require education, training, and experience in that area of specialty. Those who undertake professional work without being qualified by training or experience would be in breach of their professional obligations and may consequently face disciplinary action.

Professional qualification and competence in a subject area is gained from a combination of the following sources:

- Formal study such as university courses, or equivalent knowledge gained from short courses, workshops, and self-study.
- Work experience, usually with mentoring by a senior professional with relevant expertise.

- Typically, a minimum of five years of work experience in a field of practice working under the supervision or mentoring of a senior professional.
- Continuing education, such as keeping up to date with emerging literature, research, and studies; attending conferences, workshops, seminars, and technical presentations; reading new texts and periodicals; reading relevant web content; and participating in field trips.

Forest Professionals or Engineering/Geoscience Professionals are required to be able to demonstrate that they have the requisite competence to undertake the professional work in question. Certifications, course records, letters of reference, and portfolios of experience are the possible ways that competence can be demonstrated.

If a Forest Professional or Engineering/Geoscience Professional does not have the required knowledge and skills for a particular professional activity, the required knowledge and skills can be brought together using a team approach. Team members must be qualified for and competent in their own tasks and have an understanding of how the work fits within the overall objectives of the team.

The Forest Professional or Engineering/Geoscience Professional responsible for coordinating the team must also have sufficient knowledge to assess the accuracy of the results provided by each team member, to achieve the intended outcome.

5.2 SKILL SETS FOR THE CRP

As described in [Section 2.2.2 Coordinating Registered Professional](#), the CRP is responsible for planning and coordinating a Crossing project; however, the CRP also functions in a technical capacity and must have the required education and experience to carry out the professional work. This section describes the skill sets required of a CRP.

As described in [Section 5.1 Introduction](#) above, professional competence in a subject area is typically gained through a combination of education and experience, particularly the following:

- Formal study such as university courses or equivalent knowledge gained from a combination of short courses, workshops, and self-study.
- Work experience under the mentored direction of a qualified registered professional.
- Continuing professional development, such as keeping up to date with emerging literature, research, and studies.

CRPs should self-assess their professional authority and competency against the roles and responsibilities described in [Section 2.2.2 Coordinating Registered Professional](#) and must have the knowledge and experience about the plan, assessments, and construction methods for the Crossing to competently carry out the duties of the CRP.

With respect to the CRP, directly related work experience is a requirement. This includes experience in coordinating the work related to Crossings under the mentored direction of a qualified registered professional.

5.2.1 CRP SKILL SETS FOR CROSSINGS

A CRP for Crossing projects must be able to demonstrate competence, relative to the complexity of the Crossing.

The CRP for Crossings must:

1. have appropriate education, training, and experience within the discipline of forest operations or engineering as required to

successfully plan and coordinate all aspects of the Crossing project;

2. have appropriate working knowledge of planning, approving, locating, and constructing forest roads and Crossings, including geometric road design;
3. be familiar with appropriate Crossing configurations, including Superstructure and Substructure types commonly used in the forest industry;
4. be familiar with terrain stability considerations and associated forest road and Crossing construction techniques present and relative to the Crossing;
5. have appropriate working knowledge of all applicable professional obligations, guidelines, and governing legislation associated with planning, locating, and constructing forest roads and Crossings;
6. have a working knowledge of resources potentially affected by the Crossing project, including but not limited to
 - a) soils and sedimentation issues,
 - b) water quality,
 - c) Hydrology,
 - d) fish, fish habitat, and applicable timing windows,
 - e) wildlife and biodiversity within riparian areas,
 - f) terrain stability,
 - g) windthrow,
 - h) avalanche,
 - i) visual quality, and
 - j) cultural heritage resources; and
7. have appropriate working knowledge of stakeholders potentially affected by the Crossing project, including but not limited to
 - a) public access and safety,
 - b) water resource users, and
 - c) First Nations.

5.3 SKILL SETS FOR THE POR

As described in [Section 2.2.3 Professional of Record](#), the POR of a Crossing project functions in a technical capacity so must have the required education and experience to carry out the professional work. This section describes the skill sets required of the POR.

As described in [Section 5.1 Introduction](#) above, professional competence in a subject area is typically gained through a combination of education and experience, particularly the following:

- Formal study such as university courses or equivalent knowledge gained from a combination of short courses, workshops, and self-study.
- Work experience under the mentored direction of a qualified registered professional.
- Continuing professional development, such as keeping up to date with emerging literature, research, and studies.

PORs should self-assess their professional authority and competency against the roles and responsibilities described in [Section 2.2.3 Professional of Record](#) and must have the knowledge and experience to carry out the duties of the POR.

In addition, the POR is required to have directly related work experience. This includes experience in the preparation of professional documents and associated work related to Crossings under the mentored direction of a qualified registered professional.

5.3.1 POR SKILL SETS FOR SIMPLE CROSSINGS

A POR for a Simple Crossing must be able to demonstrate competence, relative to the complexity of the Crossing, in the following.

1. Site survey, including
 - a) documentation of field conditions;
 - b) completion of topographic survey;
 - c) understanding of survey accuracy and sources of error;
 - d) site plan (compilation of data); and
 - e) field referencing for re-establishment of survey controls.
2. Consideration of design flow, including knowledge of
 - a) Hydrology, specifically calculating design flow;
 - b) Hydraulics, specifically calculation of velocity and water elevation;
 - c) stream morphology and stability;
 - d) debris, sediment, and bedload sources and potential; and
 - e) erosion/scour protection.
3. Understanding the effects that debris and bedload have on freeboard requirements.
4. Substructure support, including
 - a) recognizing Foundation soil and bedrock types and corresponding bearing capacities;
 - b) interpretation of terrain;
 - c) working knowledge of calculating Bearing Pressure on Foundation soils;
 - d) working knowledge of various earth retention systems; and
 - e) understanding of the effects that additional loads from earth retention systems and Substructures have on the embankment stability.
5. Approach alignments and grades, including
 - a) geometric road design;
 - b) Crossing General Arrangement Design;
 - c) understanding of differences in Design Vehicle Tracking of various vehicle configurations; and
 - d) road safety, specifically stopping distance, maximum/minimum grades, sight lines, vehicle containment on the bridge and approaches.
6. Load determination and distribution, including
 - a) understanding of the load effects of different loads and vehicle configurations (wheeled versus tracked) on a Crossing; and

- b) ability to identify the limiting vehicle configurations to be used for the Design Vehicle/Traffic Load and Design Vehicle Tracking.
- 7. Understanding of the various bridge structure types, components, and connections available for use in Crossings and their application and limitations.
- 8. Understanding of Crossing component fabrication.
- 9. Knowledge of layout and construction, and the preparation of the Professional of Record – Construction Assurance Statement.
- 10. Working knowledge of guidance available in guidebooks and professional guidelines applicable to Crossings, such as
 - a) fish stream identification;
 - b) fish stream Crossings;
 - c) forest road engineering;
 - d) terrain stability management and assessment;
 - e) riparian management;
 - f) gully assessment;
 - g) requirements of the current MFLNRORD Engineering Manual (BC MFLNRORD 2019);
 - h) requirements of the FLNRORD Bridge Guidelines, Standards, and Specifications website (BC MFLNRORD 2021); and
 - i) current MFLNRORD standard bridge and major culvert design drawings (BC MFLNRORD 2020).
- 11. Protection of the environment as it applies to the Design and construction of the Crossing.

5.3.2 POR SKILL SETS FOR COMPLEX CROSSINGS

In addition to the requirements for Simple Crossings, the POR for a Complex Crossing must have the following education and experience:

- Undergraduate degree level course work or equivalent in
 - structural analysis and design;
 - geometric design of roads;
 - soil mechanics and Foundation design;
 - geotechnical engineering; and
 - Hydraulics and Hydrology.
- Working knowledge of CAN/CSA-S6 – Canadian Highway Bridge Design Code (CSA 2019).
- Working knowledge of the Canadian Foundation Engineering Manual (Canadian Geotechnical Society 2006).
- A minimum of four years of documented work experience under the direct supervision of, or review by, a professional qualified in design of Complex Crossings in the forest sector.

6.0 REFERENCES AND RELATED DOCUMENTS

Documents and legislation cited in the main guidelines appear in Section 6.1 Legislation and Regulations and Section 6.2 References.

6.1 LEGISLATION AND REGULATIONS

The following legislation and regulations are referenced in these guidelines:

- Forest and Range Practices Act [SBC 2002], Chapter 69.
- Forest and Range Practices Act, Forest Planning and Practices Regulation [B.C. Reg. 14/2004].
- Forest and Range Practices Act, Woodlot Licence Planning and Practices Regulation [B.C. Reg. 21/2004].
- Professional Governance Act [SBC 2018], Chapter 47.
- Professional Governance Act, Engineers and Geoscientists Regulation [B.C. Reg. 14/2021].
- Professional Governance Act, Forest Professionals Regulation [B.C. Reg. 15/2021].
- Workers Compensation Act [RSBC 2019], Chapter 1.
- Workers Compensation Act, Occupational Health and Safety Regulation [B.C. Reg. 296/97].

6.2 REFERENCES

The following documents are referenced in these guidelines:

- Association of British Columbia Forest Professionals (ABCFP). 2021a. ABCFP Bylaws. [February 5, 2021]. Vancouver, BC: ABCFP. [accessed: 2021 Oct 18]. <https://abcfp.ca/web/ABCFP/ABCFP/Governance/Bylaws.aspx>.
- ABCFP. 2021b. Bylaw 9 – Code of Ethical and Professional Conduct. Vancouver, BC: ABCFP. [accessed: 2021 Oct 18]. <https://abcfp.ca/web/ABCFP/About Us/Governance/Code-of-Ethical-and-Professional-Conduct/ABCFP/Governance/Code-of-Ethical-and-Professional-Conduct.aspx?hkey=d1008b68-5221-4a13-ae31-f618f1e5d15a>.
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ABCFP. 2021d. Practice Guidance – Supervising the Practice of Professional Forestry. [November 2021]. Vancouver, BC: ABCFP. [accessed: 2021 Nov 02].
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7.0 APPENDICES

Appendix A: Legislative and Regulatory Framework	38
Appendix B: Assurance Statements.....	40
• Coordinating Registered Professional – Crossing Assurance Statement	
• Professional of Record – Construction Assurance Statement	
• Coordinating Registered Professional – Transfer of Professional Responsibility Statement	
Appendix C: List of Maximum Bridge Spans for Maximum 200 kPa Bearing Pressure	48
Appendix D: Illustration of a Simple Crossing Slope.....	50

APPENDIX A: LEGISLATIVE AND REGULATORY FRAMEWORK

The content of this appendix was adapted from the Forest Practices Board report titled “Bridge Planning Design and Construction – Special Investigation” (Forest Practices Board 2014). See also [Section 1.3 Legislative Framework](#) of these guidelines.

The planning, Design, and construction of Crossings on resource roads are governed by legislation, and because these activities involve the practices of professional forestry, professional engineering, and professional geoscience, they must be overseen by Forest Professionals and Engineering/Geoscience Professionals.

The *Forest and Range Practices Act*, *Forest Planning and Practices Regulation*, and *Woodlot Licence Planning and Practices Regulation* specify certain requirements for the planning, design, and construction of Crossings. In general, the aim of these requirements is to ensure Crossings are safe for industrial users, and forest resources such as water, soil, and fish are protected.

Other legislation and regulations also apply to the planning, Design, and construction of Crossings on Crown land; for example, the *Workers Compensation Act* and the *Occupational Health and Safety Regulation*.

This combination of requirements ensures Crossings are safe for industrial users and for the protection of forest resources.

The following requirements of the *Forest Planning and Practices Regulation* are related to Crossings:

- Section 39: Natural surface drainage patterns must be maintained
- Section 55: The stream channel and banks must be protected
- Section 56: Fish passage must be maintained
- Section 57: Activities must not harm fish or damage habitat
- Section 72: Bridges must be safe for industrial users
- Section 73: Bridges must be designed to meet or exceed applicable standards
- Section 74: Bridges must be designed to pass the highest expected peak flows
- Section 75: Structural defects must be corrected
- Section 76: Culvert materials standards must be followed
- Section 77: Certain records and record drawings must be retained

APPENDIX B: ASSURANCE STATEMENTS

- Coordinating Registered Professional – Crossing Assurance Statement
- Professional of Record – Construction Assurance Statement
- Coordinating Registered Professional – Transfer of Professional Responsibility Statement

COORDINATING REGISTERED PROFESSIONAL – CROSSING ASSURANCE STATEMENT

Note: This Coordinating Registered Professional - Crossing Assurance Statement* should be used for bridges, Major Culverts, and other engineered structures, and should be submitted with the Record Drawings and documents after construction.

Site/bridge identifier:	Company or owner:	Operating area:
Road name and location		<input type="checkbox"/> Simple Crossing <input type="checkbox"/> Complex Crossing
Type: <input type="checkbox"/> Bridge <input type="checkbox"/> Major Culvert <input type="checkbox"/> Other engineered structure		Watercourse Name:
Description of project covered by this Assurance Statement:		
Name of the Professional of Record (POR) responsible for construction (Engineering Professional or Forest Professional):		
Design Vehicle/Traffic Load (e.g., BCFS L165, BCL625):	Design Service Life (years):	
List of approved Design Drawings/Record Drawings, Specialist reports, Design Aids, and other supporting documentation – Drawing Number(s), Name, Revision Number, Date:		

This is to advise that I am the **Coordinating Registered Professional (CRP)**, and I am:

- ☐ an Engineering Professional (P.Eng., P.L.Eng.), registered with the Engineers and Geoscientists BC; or
- ☐ a Forest Professional (RPF, RFT, LL), registered with the Association of British Columbia Forest Professionals (ABCFP).

I hereby give my assurance** that,

- ☐ I am responsible for the planning and coordination of all professional services, or
- ☐ I reviewed all the relevant documentation from the professional services provided for this Crossing project; determined that this work was done to an acceptable standard for this Crossing project, including planning, design, and Field Reviews; and completed the work as required under the legislation for my profession and the *Joint Professional Practice Guidelines – Professional Services in the Forest Sector: Crossings**** as applicable to this project and by good practice.

Name and title of Coordinating Registered Professional (CRP): <i>(print)</i>		<i>(Affix professional seal, signature, and date here)</i>
Company name and address: <i>(print)</i>		
Telephone:	Email:	

NOTES:

* This form adopts the defined terms as used in the *Joint Professional Practice Guidelines – Professional Services in the Forest Sector: Crossings*.

** “Assurance” means that Engineering Professionals or Forest Professionals, as appropriate, have undertaken the design and/or Field Reviews that, in their professional judgment are considered necessary to ascertain whether the significant aspects of the Crossing project substantially comply in all material respects with the engineering concepts or intent reflected in the engineering design documents (approved design drawings, specifications, and all applicable supporting engineering documents), inclusive of all revisions.

*** For specific requirements, refer to [Section 2.2.2 Coordinating Registered Professional](#) of the *Joint Professional Practice Guidelines – Professional Services in the Forest Sector: Crossings*.

PROFESSIONAL OF RECORD – CONSTRUCTION ASSURANCE STATEMENT

Note: This Professional of Record – Construction Assurance Statement* should be used for bridges, Major Culverts, and other engineered structures, and should be submitted with the Record Drawings and documents after construction.

Site/bridge identifier:	Company or Owner:	Operating area:
Road name and location		<input type="checkbox"/> Simple Crossing <input type="checkbox"/> Complex Crossing
Type: <input type="checkbox"/> Bridge <input type="checkbox"/> Major Culvert <input type="checkbox"/> Other engineered structure		Watercourse Name:
Description of project covered by this Assurance Statement:		
Name of the Coordinating Registered Professional (CRP) for this Crossing project:		
Design Vehicle/Traffic Load (e.g., BCFS L-165, BCL-625):	Design Service Life (years):	
List of approved Design Drawings/Record Drawings, Design Aids, and other supporting documentation - Drawing Number(s), Name, Revision Number, Date:		

This is to advise that I am the **Professional of Record (POR)**, and I am:

- ☐ an Engineering Professional (P.Eng., P.L.Eng.), registered with the Engineers and Geoscientists BC; or
☐ a Forest Professional (RPF, RFT, LL), registered with the Association of British Columbia Forest Professionals (ABCFP).

1. I completed the Field Reviews** during construction for this Crossing, in accordance with the legislation and bylaws for my profession and the *Joint Professional Practice Guidelines – Professional Services In The Forest Sector: Crossings* as applicable to this project and by good practice.

2. General Arrangement Design:

☐ I prepared the General Arrangement Design; or

☐ Name of Professional of Record (POR) who prepared the General Arrangement Design _____

P.Eng. or Forest Professional

3. Based on the Field Reviews, I hereby give my assurance*** that

- the work substantially complies in all material respects with the engineering concepts or intent reflected in the engineering design documents (approved design drawings, specifications, and all applicable supporting engineering documents), inclusive of all revisions; and,
- any modifications from the Crossing design documents
 - ☐ have been approved by the POR that prepared the General Arrangement Design (see attached documentation authenticated by the POR who prepared the General Arrangement Design), OR
 - ☐ the undersigned takes full responsibility for the modifications; and
- any modifications have been documented and marked on the attached Record Drawings and documents.

4. The structure includes: ☐ New components; and/or ☐ Reused components (as described above, on the Record Drawings, and/or on attached documentation)

5. I have reviewed the main structural components and give my assurance*** that there is no significant damage or deterioration of the main structural components.

Name and title of Professional of Record (POR): <i>(print)</i>		<i>(Affix professional seal, signature, and date here)</i>
Company name and address: <i>(print)</i>		
Telephone:	Email:	

NOTES:

* This form adopts the defined terms as used in the *Joint Professional Practice Guidelines – Professional Services in the Forest Sector: Crossings*.

** "Field Reviews" refer to reviews conducted at the site [and/or at fabrication location(s)] of the implementation or construction of the design by Engineering Professionals or Forest Professionals, as appropriate, or a subordinate acting under their direct supervision, that the Engineering Professionals or Forest Professional in their professional discretion consider necessary to ascertain whether the implementation or construction of the work substantially complies in all material respects with the engineering concepts or intent reflected in the design documents prepared for the work. See the Engineers and Geoscientists BC *Quality Management Guides – Documented Field Reviews During Implementation or Construction*.

*** "Assurance" means that Engineering Professionals or Forest Professionals, as appropriate, have undertaken the design and/or Field Reviews that in their professional judgment are considered necessary to ascertain whether the significant aspects of the Crossing project substantially comply in all material respects with the engineering concepts or intent reflected in the engineering design documents (approved design drawings, specifications, and all applicable supporting engineering documents), inclusive of all revisions. The Professional of Record (POR) must ensure all structural components adhere to the design specifications and that there is no significant damage or deterioration of the main structural components.

COORDINATING REGISTERED PROFESSIONAL – TRANSFER OF PROFESSIONAL RESPONSIBILITY STATEMENT

Note: This form should be used where the Coordinating Registered Professional (CRP) changes during a Crossing project.

Site/bridge identifier:	Company/owner:	Operating area:
Road name and location:		Watercourse name:
Description of project covered by this Coordinating Registered Professional - Transfer of Professional Responsibility Statement:		
Name of the Professional of Record (POR) for this Crossing project:		
Name and title of the outgoing Coordinating Registered Professional (CRP):	Name and title of the incoming CRP (if known):	
Effective date of transfer of responsibility*:		
List of relevant information completed/compiled by the outgoing CRP (as attached to this Statement):		
List of known outstanding relevant information identified by the outgoing CRP:		

1. This is to advise that as of this date I am transferring my role as the **Coordinating Registered Professional (CRP)**, and I am:
 - ☐ an Engineering Professional (P.Eng., P.L.Eng.), registered with Engineers and Geoscientists BC; or
 - ☐ a Forest Professional (RPF, RFT, SP-LL), registered with the Association of British Columbia Forest Professionals (ABCFP)
2. I am responsible for the planning and coordination of all completed/compiled professional services listed above, and I have determined that this work has been done to an acceptable standard and listed all known outstanding relevant information for this Crossing project up to this date, as required under the legislation and bylaws for my profession and the *Joint Professional Practice Guidelines – Professional Services in the Forest Sector: Crossings*, as applicable to this project and by good practice, and
3. I have either:
 - ☐ provided all relevant information for the incoming CRP, or
 - ☐ reviewed/discussed all of the relevant information with the incoming CRP, and have transferred the information to the possession of the CRP.

OUTGOING COORDINATING REGISTERED PROFESSIONAL		<i>(Affix professional seal, signature, and date here)</i>
Name:		
Company name and address: <i>(print)</i>		
Telephone:	Email:	

1. This is to advise that as of this date I am taking over in the capacity of **the Coordinating Registered Professional (CRP)** for this project, and I am:
 - ☐ an Engineering Professional (P.Eng., P.L.Eng.), registered with Engineers and Geoscientists BC; or
 - ☐ a Forest Professional (RPF, RFT, LL), registered with the Association of British Columbia Forest Professionals (ABCFP)
2. I have received the information listed above from the outgoing CRP.

INCOMING COORDINATING REGISTERED PROFESSIONAL		
Name:		
Company name and address: <i>(print)</i>		
Telephone:	Email:	
Signature:	Date:	

NOTES:

- * “Effective date” refers to the last day on which the outgoing Coordinating Registered Professional (CRP) has professional responsibility for the project and the accuracy and completeness of relevant information and documentation for the project.

APPENDIX C: LIST OF MAXIMUM BRIDGE SPANS FOR MAXIMUM 200 KPA BEARING PRESSURE

The following [Table C-1](#) illustrates span limitations for various bridge Superstructures and simple typical Substructure types. This table was modified from the MFLNRORD document *Simple Stream Crossings – Guidelines for BCTS Coordinating Registered Professionals* (BC MFLNRORD 2013).

Note that this table is not a comprehensive listing of all Superstructure and Substructure types and is not a Design Aid. This table is only intended to be used as a general reference to determine whether or not a Crossing could be considered a Simple Crossing due to Bearing Pressure.

The MFLNRORD Bridge Guidelines, Standards, and Specifications website provides a limitation on Foundation pressures to no more than 200 kPa. For most Crossings, this restricts the span of the bridge for a Simple Crossing to one where the combined live and dead loading on the span results in a Bearing Pressure of less than 200 kPa.

A POR assuming responsibility for a Crossing should have a working understanding of bridge Bearing Pressure determination and limitations, and a POR who is directly conducting this work must be competent in the determination of Design Bearing Pressure and capacity.

Assumptions in the table include the following:

- Allowable bearing capacity of soil = 200 kPa
- Timber/log sill bearing area equals:
 - $400 \times 4,500 = 1.8 \text{ m}^2$
 - $600 \times 4,500 = 2.7 \text{ m}^2$
 - $800 \times 4,500 = 3.6 \text{ m}^2$
- Lock block abutment bearing area equals:
 - $750 \times 6,000 = 4.5 \text{ m}^2$

Table C- 1: List of Maximum Bridge Spans for Maximum 200 kPa Foundation Bearing Pressure

		MAXIMUM SPAN FOR SPECIFIED DESIGN VEHICLE CONFIGURATION (metres)		
		Factor of Safety = 1.2 (DL + LL) ^a		
BRIDGE TYPE	ABUTMENT CONFIGURATION	HIGHWAY	OFF-HIGHWAY	
		BCL-625	L100	L165
All steel portable	Single row blocks ^b	20	14	>200 kPa
	Two rows high blocks ^b	20	12	>200 kPa
	400 wide timber/log sill	>200 kPa	>200 kPa	>200 kPa
	600 wide timber/log sill	14	>200 kPa	>200 kPa
	800 wide timber/log sill	20	12	>200 kPa
Timber deck on steel girders	Single row blocks ^b	28	15	>200 kPa
	Two rows high blocks ^b	23	13	>200 kPa
	400 wide timber/log sill	>200 kPa	>200 kPa	>200 kPa
	600 wide timber/log sill	14	>200 kPa	>200 kPa
	800 wide timber/log sill	23.5	12.5	>200 kPa
Concrete deck on steel girders	Single row blocks ^b	19.5	12.5	>200 kPa
	Two rows high blocks ^b	16	11	>200 kPa
	400 wide timber/log sill	>200 kPa	>200 kPa	>200 kPa
	600 wide timber/log sill	11.5	>200 kPa	>200 kPa
	800 wide timber/log sill	16.5	10.5	>200 kPa
Concrete slabs	Single row blocks ^b	13.5	9	>200 kPa
	Two rows high blocks ^b	11.5	>200 kPa	>200 kPa
	400 wide timber/log sill	>200 kPa	>200 kPa	>200 kPa
	600 wide timber/log sill	>200 kPa	>200 kPa	>200 kPa
	800 wide timber/log sill	11.5	>200 kPa	>200 kPa

NOTES:

Abbreviations: DL = dead load; kPa = kiloPascal; LL = live load

^a This factor of safety is not consistent with ULS, Combination 1 in the *CAN/CSA S6 Canadian Highway Bridge Design Code*.

^b Interlocking concrete blocks

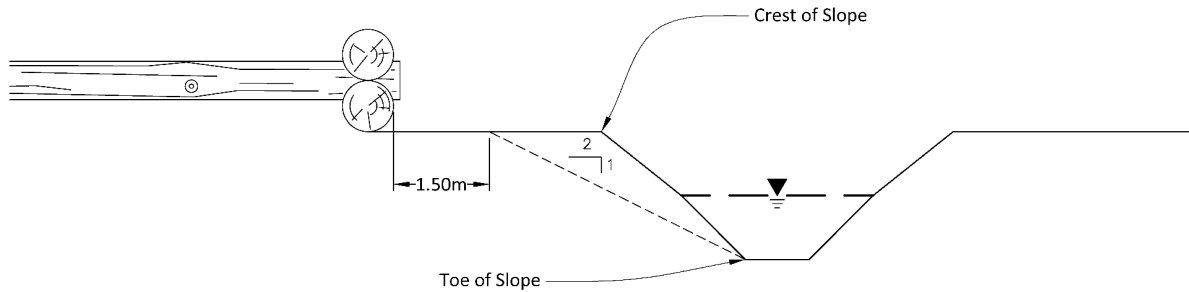
APPENDIX D: ILLUSTRATION OF A SIMPLE CROSSING SLOPE

A Simple Crossing occurs where the conditions presented in [Section 3.2.3 Simple Crossings](#) are met. Any Crossing that does not meet all of these conditions is a Complex Crossing.

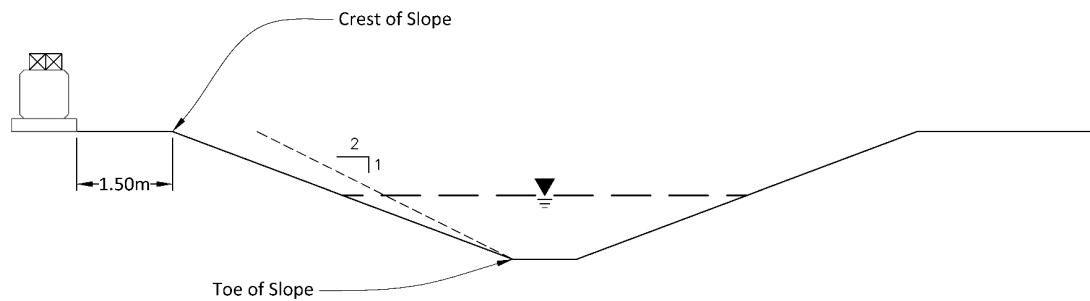
Substructures for Simple Crossings, as described in [Section 3.2.3.5 Substructure](#), require the entire base of the footings/crib to be set back at least 1.5 m horizontally from a 2:1 horizontal to vertical plane extrapolated upwards from the toe of soil slopes or 1.5 m back from the crest of the slope, whichever is greater.

See [Figure D - 1: Illustration of a Simple Crossing Slope](#) below.

DEFINING A SIMPLE CROSSING [BY FOOTING/CRIB LOCATION]



Where the existing slope is steeper than 2H:1V, the entire base of the footing or cribs must be set back a minimum of 1.5m from a 2H:1V line projected from the toe of the slope.



Where the existing slope is shallower than 2H:1V, the entire base of the footing or cribs must be set back a minimum of 1.5m from the crest of the slope.

*If the leading face of the footings/crib is closer than either measurement, it is not a simple crossing.

Figure D - 1: Illustration of a Simple Crossing Slope

NOTE:

Figure prepared for Engineers and Geoscientists BC by StoneCroft Engineering. Drawing No. 20-012 A1-1. [dated: 16 Oct 2020].

