

# **GUIDELINES FOR PROFESSIONAL SERVICES IN THE FOREST SECTOR—CROSSINGS**

V.2

APEGBC/ABC FP PROFESSIONAL PRACTICE GUIDELINES

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## 1.0 DEFINITIONS

All definitions contained in this section are strictly for the purposes of these guidelines.

### ***As Built/Record Drawing***

Professional documents which include drawings and ancillary documents forming a record of what was constructed and implemented at the *crossing*. The types of documents can include measurements, elevations, sizes or notes marked on the issued for construction documents, including any significant amendments or modifications to the *crossing design*.<sup>1</sup>

### ***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* as defined herein.

### ***Coordinating Registered Professional (CRP)***

The *CRP* is a registered *forest professional* or a *professional engineer* who is a member, in good standing, of the Association of British Columbia Forest Professionals (ABCFP) or the Association of Professional Engineers and Geoscientists of BC (APEGBC). The *CRP* is responsible for planning and coordinating all the professional services for the *crossing* project including the *design*, field reviews, *as built/record drawings* and *Crossing Assurance Statement*. The *CRP* must direct those activities with sufficient oversight and supervision such that they can take overall responsibility and accountability for the *crossing*.

### ***Crossing***

A forest road bridge or *engineered culvert*. Also referred to as a forest road *crossing*.

### ***Crossing 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 concepts and intent reflected in the issued for construction professional documents prepared for the *crossing*, including all revisions to the plans, field reviews and supporting documents for the *crossing*. The *Crossing Assurance Statement* can only be signed by the *professional of record/CRP*.

### ***Culvert***

A pipe, arch, box or log structure six metres or less 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***

In this document *design* refers to preparing *general arrangement drawings* for a *crossing*. The structural *design* of individual components of a *crossing* is considered to be separate from preparing the *general arrangement drawing*. The structural *design* must be performed by a *professional engineer*.

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<sup>1</sup> FLNRO Simple Stream *Crossings* – Guidelines for BCTS Coordinating Registered Professionals. Dec 2013.

**Design Aid**

A *design aid* is a document, prepared and sealed by a *professional engineer*, which provides an unambiguous result tied to clear parameters, and can be applied by others to a site-specific situation.

**Engineered Culvert**

Is a *crossing* where:

1. the *crossing* is used to carry ephemeral or perennial stream flow in a stream channel from one side to the other;
2. the *crossing* is not a log/wood *culvert*; and
3. the *crossing* is a *culvert* that:
  - a. is one of the following:
    - i. a pipe having a diameter of 2000 mm or greater;
    - ii. a pipe arch having a span of 2130 mm or greater;
    - iii. an open bottom arch having a span of 2130 mm or greater, or
  - b. has a maximum *design* discharge of 6 m<sup>3</sup>/s or greater.

**Field Splice**

Refers to girders that require a bolted or *field splice* connection during installation.

**Forest Professional**

A person admitted under Section 14 of the *Foresters Act* as a Registered Professional Forester, Registered Forest Technologist, or a holder of a special permit entitled to practice professional forestry as defined in the *Foresters Act*, SBC 2003 c. 19, as amended.

**Foundation**

A system or arrangement of structural members, which may include concrete strip, spread footings, or piles, through which loads from a structure are transferred to supporting soil or rock.

**General Arrangement Drawing**

A professional document that includes site specific issued for construction drawings that incorporate a plan view and profile view of the *crossing* including *foundations/substructures*, approaches, any applicable site data and specifications.

**Member**

A registered *member* in good standing with the ABCFP or the APEGBC.

**Non-composite**

A *superstructure* system that relies on a structural connection on site between the precast concrete deck and steel girders to deliver its primary *design* capacity.

**Non-skewed**

Is a *superstructure* that is rectangular or square in plan.

**Professional Engineer**

A person who is registered or licensed as a *professional engineer* under the *Engineers and Geoscientists Act*, RSBC, 1996 c. 116, as amended.

**Professional of Record (POR)**

A *professional engineer* or a *forest professional* responsible for the *design* of the *crossing* which includes all of the following:

- Preparation of the *general arrangement drawing*
- Completion of field reviews
- Completion of the *Professional of Record Crossing Assurance Statement* including preparation of *as built/record drawings*.

**Shop Drawings**

*Shop drawings* are drawings prepared by material fabricators to detail the structural *design* of *crossing* components (e.g., in forest road bridges, this has typically referred to the *design* of the individual components).

**Simple Crossing**

Is a *crossing* as defined in these guidelines, but does not include an *engineered culvert*.

**Single Span**

Means *crossings* with no pier, intermediate support or needle beams so that *substructure* components will only be found at the ends of the *superstructure*.

**Specialist**

A *specialist* is responsible for providing one or more services required for a *crossing* project at the request of and under the supervision of the *CRP* or the *POR*. Examples of persons who may be *specialists* include: professional geoscientists, registered forest technologists, registered professional biologists, *professional engineers* and *forest professionals*.

**Substructure**

The *substructure* is that portion of the *crossing* that rests on the *foundation* and below the *superstructure* and generally consists of log cribs, interlocking concrete blocks, piles or steel towers with footings. In some instances, such as interlocking concrete blocks without footings, the *substructure* and *foundation* are synonymous. Wood box *culverts* are not considered *substructures* for the purpose of this document.

**Superstructure**

The *superstructure* is that portion of the *crossing* that rests on the *substructure* and provides the traveling surface for the *crossing*. It generally consists of log stringers/steel girders, concrete slabs, associated decking, and guardrails.

## 2.0 INTRODUCTION

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. The *Foresters Act* includes, within the definition of the practice of professional forestry, “planning, locating and approving forest transportation systems including forest roads”. The *Engineers and Geoscientists Act* includes, within the definition of the practice of professional engineering, “design or directing the construction of public utilities, industrial works, railways, bridges ...”. There is long-standing historical involvement of *members* of each profession with respect to *crossing* projects.

This guideline was first developed in 2005 and revised in 2008. The current version dated 2014 includes revisions made in response to issues raised in the *Forest Practices Board Report – Bridge Planning, Design and Construction*.

## 2.1 PURPOSE AND SCOPE OF GUIDELINES

*Members* of the ABCFP and APEGBC have professional obligations 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 these obligations by providing guidance to *members* who have professional involvement in specific *crossings*. The following related documents have also been issued by ABCFP and APEGBC:

- *Guidelines for Professional Services in the Forest Sector – Forest Roads* (June 2012)
- *Guidelines for Management of Terrain Stability in the Forest Sector* (May 2008)
- *Guidelines for Professional Services in the Forest Sector – Terrain Stability Assessments* (August 2010)

These guidelines are intended to establish standards of practice that *members* should meet to fulfill professional obligations, including the duty to protect the safety, health and welfare of the public and the environment. Failure to meet the intent of these guidelines could be evidence of unprofessional conduct and may give rise to disciplinary proceedings by the ABCFP or the APEGBC.

These guidelines apply to all phases of a *professional engineer's* or *forest professional's* involvement in a *crossing* project including;

- Project organization and assignment of responsibilities,
- Planning and *design*,
- General considerations,
- Hydrology and hydraulics,
- Plans and supporting documents,
- Approaches and alignment,
- *Foundations* and *substructures*,
- *Superstructures*,
- Construction and field reviews, and
- *Crossing Assurance Statement*.

These guidelines establish the requirements for and specify the tasks that should generally be performed by the *CRP* and the *POR* (as defined herein), to assist them in fulfilling their professional obligations related to public and worker safety and protection

of the environment. Every *crossing* project must have a *CRP* and a *POR*. These roles can be filled by the same or different *members*.

## 2.2 LEGISLATIVE FRAMEWORK

The planning, *design*, construction and use of *crossings* is governed by legislation and are built by government, tenure holders, or permittees and are overseen, in most cases, by *professional engineers* and *forest professionals*. The *Foresters Act* and the *Engineers and Geoscientists Act* are the professional regulatory Acts governing *forest professionals* and *professional engineers* respectively. The *Forest and Range Practices Act* (FRPA) and the *Forest Planning and Practices Regulation* (FPPR) and other legislation/regulations specify that certain professional documents are required for the planning, *design* and construction of *crossings* (*general arrangement drawings*, *as built/record drawings*, and *Crossing Assurance Statement*). These requirements are aimed at ensuring *crossings* are safe for industrial users and that forest resources such as water, soil and fish are protected. See Appendix C.

Delivery of professional services relating to *crossings* involves professional forestry, professional engineering and professional geoscience (Section 4).

These guidelines are based on the following framework:

- Adherence to the *Engineers and Geoscientists Act*;
- Adherence to the *Foresters Act*;
- Fulfilling professional obligations to protect the interests of the public, worker safety and the environment;
- Relying on the training, experience and professionalism of *members*; and the appropriateness for *members* to delegate professional work to others under their direct supervision and/or to rely upon other qualified professionals to assist in the delivery of a *crossing* project.

Government has granted ABCFP and APEGBC legislative authority to regulate *members* working in the forest sector. This authority includes determining what is professional work of *members* and developing practice standards. These guidelines have been prepared by the Joint Practice Board (JPB) comprising *members* of ABCFP and APEGBC. The JPB was mandated by the Councils of ABCFP and APEGBC, in a Memorandum of Understanding originally signed in 1994, updated in 2006 and 2013, to make recommendations to their respective councils on matters related to the practice overlap between the professions.

APEGBC and ABCFP recognize that the professional practice activities described in this guideline are in an area of practice overlap as set out in the language of the respective Acts.

Under the *Foresters Act* Section 4(2)(e), it is the duty of the association “...to establish, monitor and enforce codes of conduct and standards of practice for its members”.

The *Foresters Act* includes, within the definition of the practice of professional forestry:  
“...*planning, locating and approving forest transportation systems including forest roads*”  
“...*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*”.



ABCFP's Bylaw 11.3.10 requires its *members* "to have proper regard in all work for the safety of others"; and Bylaw 12.7 requires that "members maintain safe work practices and consider the safety of workers and others in the practice of professional forestry".

ABCFP's Bylaw 12.2 requires that *members* have sufficiency of qualifications and knowledge to deal with the matter in question, and to provide professional work that is complete, correct, measurable or verifiable and can provide a rationale to support their work.

Under the *Engineers and Geoscientists Act*, APEGBC has the object... "to establish, maintain and enforce standards for the qualifications and practice of its members and licensees".

The *Engineers and Geoscientists Act* includes, within the definition of the practice of professional engineering:

"...reporting on, designing, or directing the construction of any works that require for their design, or the supervision of their construction, or the supervision of their maintenance, such experience and technical knowledge as are required by or under this Act...and without limitation includes.... reporting on, designing or directing the construction of public utilities, industrial works, railways, bridges, highways..... and all other engineering works".

APEGBC's Bylaw 14(b) requires its *members* to establish quality management processes for their practices. APEGBC's Code of Ethics requires APEGBC *members* and license holders to "hold paramount the safety, health and welfare of the public, the protection of the environment and promote health and safety within the workplace".

Government of British Columbia regulates forest management in B.C. on crown and private land separately. The *Foresters 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.

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

## 2.3 PROFESSIONAL CONDUCT

*Members* must exercise professional judgment when providing professional services associated with the *design*, construction, operation and deactivation of *crossings*, and as such, the application of these guidelines can vary depending on the circumstances. Notwithstanding the purpose and scope of these guidelines, the decision of *members* not to follow one or more aspects of these guidelines in a particular project does not necessarily mean that they have failed to meet the appropriate standard of practice in the performance of those professional services. Such judgments and decisions depend upon an evaluation of all facts and circumstances in a particular project. Any material deviation from these guidelines however, requires a written rationale.

The associations support the proposition that *members* should receive fair compensation for professional services, adequate to ensure that the professional service delivered can be carried out appropriately. Low fees are not a justification for services that do not meet the standards set out in these guidelines. *Members* may wish to discuss these guidelines with their clients or employers when receiving instructions for an assignment and reaching agreements regarding compensation. These guidelines may be used to

assist in establishing the scope of work and terms of a *members'* service with their client or employer.

When APEGBC *members* are involved in *crossings*, they must provide the following notification in accordance with APEGBC Bylaw 17(a) related to liability insurance: *“Before entering into an agreement to provide professional engineering or professional geoscience services to the public, a member, licensee or certificate holder must notify the client, in writing, whether or not professional liability insurance is held and whether that insurance is applicable to the services in questions. The note shall include a provision for an acknowledgement of the advice to be signed by the client.”*

APEGBC *members* must comply with the APEGBC Code of Ethics only practice in areas where they are appropriately trained and experienced, *“shall undertake and accept responsibility for professional assignments only when qualified by training or experience.”* Forest professionals have a responsibility *“to practice only in those fields where training and ability make the member professionally competent.”* In all cases, *members* must sign professional documents that they are responsible for in accordance with the bylaws and guidelines of their association.

## 2.4 SUPERVISION

ABCFP and APEGBC each describe the expectations of *members* when they supervise the professional services of others.

APEGBC *members* can delegate the completion of professional services to an assisting subordinate working under their direct supervision. Direct supervision in the *Engineers and Geoscientists Act* is defined as *“means the responsibility for the control and conduct of the engineering or geoscience work of a subordinate”*.

For ABCFP *members* there must be an ability to undertake the necessary due diligence in order to assume professional accountability for the “professional forestry” work done by a non-*member* under their supervision. The assumption of accountability by the *member* is based on the personal knowledge of the day-to-day “professional forestry” and job performance of the person being supervised.

## 2.5 ACKNOWLEDGEMENTS

We would like to acknowledge the following for having direct input into the preparation of this guideline.

- Joint Practice Board of ABCFP and APEGBC;
- The APEGBC’s Division of Engineers and Geoscientists in the Resource Sector;
- The ABCFP Professional Practice Committee; and
- Ministry of Forest Lands and Natural Resource Operations staff

## 3.0 ROLES AND RESPONSIBILITIES

### 3.1 TEAMWORK

Teamwork is essential to achieve the best outcome for a *crossing* project. The professional *members* of the team will generally consist of a *CRP*, a *POR* and one or more *specialists*.

### 3.2 RESPONSIBILITIES OF THE *CRP*

The *CRP* is responsible for planning and coordinating all the professional services for the *crossing* project as described below. The *CRP* can only take professional responsibility for those projects for which they have the necessary knowledge and experience.

The *CRP* must:

- Plan and coordinate activities relating to the *crossing* project in the context of the overall development, and confirm that the necessary assessments for the project have been completed;
- Must determine the appropriate location for the *crossing*;
- Consider applicable professional obligations and governing legislation and ensure that the required approvals, licenses and permits have been obtained;
- Understand all generally accepted uncertainties inherent in the *crossing* project including assumptions made by the *POR* and/or *specialists*;
- Oversee and take professional responsibility for all planning and coordinating work;
- Understand the roles and responsibilities of all the people involved in the planning, *design* and construction of the *crossing* project;
- Utilize, *specialists* in the *design* and construction of a *crossing* where required;
- Consider information received and where appropriate provide this information to the *POR* and/or *specialists*;
- Consider the safety of those who will use the *crossing*;
- Consider other resources at risk such as, the environment, utilities, water supplies, water quality and quantity, sedimentation, and fish habitat that could potentially be caused by the *crossing*; and
- Have the *Crossing Assurance Statement* signed by the *POR/CRP*.

### 3.3 RESPONSIBILITIES OF THE *POR*

The process of *designing*, constructing and assuring a *crossing* relies on a framework that includes the following three professional documents:

1. *General arrangement drawing(s)*;
2. *As built/record drawings*; and
3. *Crossing Assurance Statement*.

These documents can only be prepared by a *member* who follows the published standards of practice for this work. The *Crossing Assurance Statement* can only be signed by the *POR/CRP*.

#### 3.3.1 *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, and fish habitat that could potentially be caused by the *crossing*;
- Take professional responsibility for the *general arrangement drawings*;
- Communicate to the *CRP* other impacts of the *design*, such as changes to the road alignment and environmental concerns; and
- Review *design* of fabricated components to determine whether they meet the intent of the *general arrangement drawings*.

### 3.3.2 Field Reviews

In order to determine whether the *crossing* has been constructed in conformance with the *general arrangement drawings* the *POR* must:

- Undertake sufficient field reviews during construction (and determine their timing and extent) so that the *POR* can take professional responsibility by confirming that the *crossing* is safe for the use intended. 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 their direct supervision such that they can take responsibility and provide a *Crossing Assurance Statement*.
- Revise the *design*, and document the revision, to address changed conditions encountered during construction,
- Prepare *as built/record drawings*,
- Prepare and obtain other relevant field and construction data related to the *crossing*, and
- Prepare a *Crossing Assurance Statement*.

## 3.4 RESPONSIBILITIES OF THE SPECIALIST

A *crossing* project may require the use of one or more *specialists*. The *specialist* will obtain relevant project information from the *CRP* or the *POR*, and carry out the specific duties and tasks that have been assigned to the *specialist* by the *CRP* or the *POR*.

## 4.0 PROFESSIONAL PRACTICE IN CROSSINGS

### 4.1 DEFINING A SIMPLE CROSSING

A *simple crossing* occurs where the following conditions are met:

#### 4.1.1 General Requirements

- Structural elements of *crossings* must be *designed* by a *professional engineer*, or provided in a *design aid* prepared by a *professional engineer*. This applies to both new structural elements and reused structural elements. Combining all of these elements in a *crossing* can be undertaken by a *forest professional* or *professional engineer*.

#### 4.1.2 Hydrology and Hydraulics

- The channel must be historically stable, and meet the *design* flow,
- The channel may be historically unstable where the *POR* has indicated on the plan that the *crossing* and/or the approaches are suitable for the period the *crossing* remains on the site.

#### 4.1.3 Approaches, Alignment and Gradient

- The native ground at the approaches must be stable,
- Excluding log structures, the road approach shall be aligned to assure that the *design* vehicle tracks straight on to and off of the *crossing* with minimal side tracking, and
- The maximum *crossing* grade shall be four percent, excluding log structures with gravel decks.

#### 4.1.4 Foundation Soils or Rock

It is assumed that the *foundation* soils or bedrock can safely support a *design bearing pressure* of 200 kPa or more, if it is composed of unweathered bedrock free of adverse jointing and discontinuities, dense glacial 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 that the requirements of subsection 4.1.5 are met, and the following conditions also apply:

- The normal groundwater table is a minimum of 1 m below the base of the footings if on soil,
- The bearing surface has less than a 5 percent slope in any direction,
- There is no evidence of 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 not to exceed 0.3 m,
- Only a modest thickness of granular fill is used to level the footing area and that the fill is compacted to a minimum of 95% of the standard proctor maximum dry density, the total thickness of the fill does not exceed 0.3 m 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 from place to place in BC and there can be a *design aid* to address the conditions e.g., single log sill structure. In some areas the soil or bedrock on which the *foundation* bears may not be able to support a *design bearing pressure* of 200 kPa 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:

- Be developed by a *professional engineer* and define the *design* and construction circumstances to which the *design aids* are to be used,
- Clearly define the specific soil and bedrock types and conditions and the *design bearing pressure* which is allowable in terms of what the soil or bedrock can safely support,
- Delineate the geographic area within which the *design aids* are to be used,
- Explain any limitations in the application of the *design aids* such as restrictions on site preparation techniques, *foundation* configurations or construction methods, and
- Indicate any field reviews required by the *professional engineer* to confirm the validity of the *design aids* and application.

See the table in Appendix B for sample span limitations for various bridge *superstructures* and some simple typical *foundation* types.

#### 4.1.5 Substructure

- If constructed of log sills or log cribs, *substructures* must be four metres or less in height or if constructed of interlocking concrete blocks (with or without concrete footings) must be two metres or less in height (including sills and caps). Plans for *substructures* must be prepared using *design aids* for which a *professional engineer* has taken professional responsibility.
- Service Limit State loads, Combination 1 (CAN/CSA-S6), must impose 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* prepared by a *professional engineer*.
- The four-meter height limitation for log cribs is measured from the lowest point of the *substructure* 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.
- Increasing the *substructure* height greater than the values above (four metre high log cribs and sills or two metre high interlocking concrete blocks) by combining different *substructures* together is not permitted. For example a 3 m log crib with 1.5 m concrete lock blocks on top does not qualify as a *simple crossing*.
- If using log or timber sills, they are to be no smaller than 0.4 meters width at their narrowest.
- The base of the footings is setback at least 1.5 m horizontally from a two horizontal to one vertical plane extrapolated upwards from the toe of soil slopes or 1.5 m back from the crest of the slope, whichever is greater.

#### 4.1.6 Superstructures

*Superstructures* must

- Be *non-composite*,
- Be *single span* simply supported,
- Incorporate structural *designs* prepared by a *professional engineer*,
- Not require engineered installation procedures (for example specialized lifts or specialized launches),
- Not require *field splices*,
- Not require structural field welding or structural concrete grouting, and
- Be *non-skewed* (excluding log structures).



## 4.2 PROJECT DOCUMENTATION

The *CRP* is responsible for coordinating the documentation of the *crossing* project including site surveys, *specialist* reports, *general arrangement drawings*, field reviews, and the *Crossing Assurance Statement*.

## 4.3 DESIGN

The *POR* must communicate the project objectives to others in a clear, concise and detailed manner. This is usually accomplished through project drawings and supporting documents. The project drawings and specifications should provide sufficient information to facilitate the fabrication and installation of the *crossing*. A complete set of *design* documents includes the *general arrangement drawings* supplemented with detailed *superstructure* and *substructure* drawings, and other fabrication, material and construction specifications. Drawings detailing individual *crossing* components prepared by fabricators should be included as part of the project documentation.

*General arrangement drawings* are the result of the *design* process and should clearly depict the proposed components and configuration of the *crossing* in relation to the forest road, stream and stream banks. They should include a site plan, profile drawings and *crossing* elevations. The *general arrangement drawings* should contain references to all *design aids* used to facilitate their development. The *general arrangement drawings* must be signed and sealed by the *POR* in a manner recommended by the individual associations.

### 4.3.1 General Considerations

Bridge *design* and fabrication must be completed in accordance with accepted engineering practice including;

1. The appropriate application of the *Canadian Highway Bridge Design Code* (CAN/CSA S6) and the *Canadian Foundation Engineering Manual*,
2. FLNRO Forest Bridge Design and Construction Manual, Engineering Manual and associated documentation.

### 4.3.2 Development and Use of Crossing Design Aids

A *design aid* is a tool, prepared by a *professional engineer*, which will provide an unambiguous result tied to clear parameters, and can be applied to a site-specific situation. An example of a *design aid* is a log stringer *design* table specifying log stringer diameters, subject to species and other identified limitations, for particular spans for specific *design* loads. A manual such as the *FERIC Log Construction Handbook* is not considered a *design aid* because a manual cannot be applied to a specific situation; however, individual stringer tables within that manual may be *design aids* within the context of the entire document.

When preparing *design aids*, a *professional engineer* 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 specific material or site conditions, specific aspects requiring higher level oversight, materials or connection requirements),
- Assumptions made, codes referenced to, and where applicable the 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 a date when the *design aid* is no longer valid or applicable),

- The name of the *professional engineer* having professional responsibility for the *design aid*, and
- The signature and seal of the *professional engineer* having professional responsibility for the *design aid*.

When using a *design aid* a *POR* should;

- Obtain authorization from the *professional engineer* responsible for the *design aid* prior to using the *design aid*,
- Have discussed the *design aid* with the *professional engineer* to ensure that he/she understands the limitations of the *design aid*,
- 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 a *professional engineer*) when applicability of the *design aid* is in question or unforeseen circumstances make the *design aid* not applicable or questionable.

### 4.3.3 Hydrology, Hydraulics and Morphology

Hydrology and hydraulic factors are basic to the plan and *design* of a *crossing* and roadway, and can affect the road location. Inadequate consideration of hydraulic factors can result in problems, such as, increased maintenance costs, failure or unnecessarily expensive *crossings* and environmental damage. Physical changes at the *crossing* may have impacts at a considerable distance from the *crossing*, such as morphological changes that may affect the river, upstream and downstream. The *POR* must consider hydrology and hydraulic factors including determining an appropriate *design* flow and potential impacts of a *design* on the stream morphology when *designing* the *crossing*.

An appropriate *design* flow must be determined for the particular site. Determining *design* flow usually involves applying several different methods and then applying judgment to select an appropriate *design* value. The *POR* should compare flow discharge estimates derived from the site information with other data and theoretical derivations. The final selection of *design* flow should then be based on the *POR*'s, or *specialist*'s, judgment taking into account these derivations. Using a simplistic calculation such as "three times high water area" is not 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 the conveyance of debris, ice jams or other factors that might influence the channel, stream stability, and the *crossing*'s ability to convey the *design* flow.

### 4.3.4 Crossing Alignment in Consideration of Stream and Road Alignment and Grades

Approach road planning must address issues related to sight lines, *design* speed, slope stability, and drainage as well as minimize impacts to the stream. The *POR* must consider riparian impacts. The alignment of a *crossing* and road prism relative to a stream can influence stream hydraulics. To accommodate hydraulic and attendant erosion issues, *crossing* design configuration characteristics and dimensions of the alignment may have to be altered. The *POR* must determine a cost-effective accommodation of design vehicle requirements. The *crossing* general arrangement



design dimensions and configuration must consider the expected stream behaviours while minimizing impact to the environment.

Approaches 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*. The approaches include the vertical and horizontal road alignment, curve radius and widening considerations and turnouts, surface drainage and related safety issues such as visibility and signage. The approaches and adjacent road alignment must be considered in the overall plan and installation of the *crossing*.

A *crossing* and its approaches 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. Modifications include widened roadways and/or flared ends to allow vehicles to track onto and off the *crossing*.

#### 4.3.5 Foundations and Substructures

Structural *design* of *substructures* is limited to *professional engineers* who have the appropriate skills and knowledge. This does not preclude a *forest professional* from utilizing *design aids* prepared by a *professional engineer*.

Site conditions which 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 address the extent of the lateral earth pressures, drainage characteristics of the backfill, degree of compaction and the stability of the retained fill.

The *designing* and placement of *crossing substructures* or *engineered culverts* is governed by the observed and anticipated site conditions. Natural channel banks and escarpments should be assessed to identify any potentially unstable slopes 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 life of the *crossing*.

#### 4.3.6 Superstructures

Structural *design* of *superstructures* is limited to *professional engineers* who have the appropriate skills and knowledge. This does not preclude a *forest professional* from utilizing *design aids* prepared by a *professional engineer*.

The detailed *design* of a *superstructure* should be guided by a conceptual *crossing* drawing and should be undertaken as part of the overall *crossing* location and plan. The *POR* should determine whether the *design* of the *superstructure* has accommodated the overall objectives of the *crossing*, such as anticipated loads and structural requirements, life span of the structure, availability of materials and equipment, environmental risks, road alignment, sediment control, etc.

A *professional engineer*, with the appropriate training and experience in *superstructure design*, shall be responsible for the following:

- Preparation of drawings and *design aids* for all *superstructures*, including log stringer *superstructures*, and

- Assessment of portable *superstructures* prior to use where significant damage or deterioration has been identified.

### 4.3.7 General Arrangement Drawings and Documentation

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 generally required within the *general arrangement drawing*.

#### 4.3.7.1 General

- Title block information to be present on each sheet of the drawing set.
- Drawing Name: The *general arrangement drawing* title must clearly and uniquely describe the *crossing*.
- Names of the *CRP* and *POR* who *designed* the *crossing* and the professional reviewer.
- *Design* date.
- Site survey date and what individual or company completed the survey.
- Revisions 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.
- Title block information as described above.
- Owner/client name.
- *Design* company name (as required).
- Background *design* information.
- *Design* standards used.
- *Design* vehicle for loading and design vehicle horizontal constraints (tracking) including clearances.
- Reference *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.
- The 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.
- The *POR* may provide a recommendation for the frequency of routine maintenance inspections. Any specialized items requiring specific or special monitoring should be identified by the *POR* for subsequent inspections.

#### 4.3.7.2 Site Preparation and Installation

- Notes for foundation excavation requirements specific to the anticipated subsurface conditions and the *substructure* type must reference information regarding worker safety, slopes, drainage, and work process.

- Riprap gradation, estimated quantity required, quality and/or rock type, and 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, estimated quantities, and placement and compaction requirements.
- Description and specifications for erection including connections of components.
- List of activities that will require field review by the *POR* or their designate.
- Address sediment and erosion control.
- Requirements for working in and around the stream and riparian area.
- 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).

#### 4.3.7.3 Plan View(s)

- 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 required road widening, clearances, and curve offsets from the *crossing* for the horizontal *design* vehicle traveling in both directions.
- For an example of typical drawing requirements refer to *Forest Service Bridge Design and Construction Manual, Appendix E, Bridge and Major Culvert Site Plan Specifications*.

#### 4.3.7.4 Profile Views

- 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, show constructed stream bottom and/or the expected long term stream bottom profile.
- 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 typical drawing requirements refer to *Forest Service Bridge Design and Construction Manual, Appendix E, Bridge and Major Culvert Site Plan Specifications*.

## 4.4 CONSTRUCTION AND FIELD REVIEWS

The construction of a *crossing* may include the following:

- 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 guardrails and guard logs,
- Assembly and embedding of *culvert* sections, and
- Approach structures and signage.

Where the *POR* is a *professional engineer*, they must determine that the requirements of Bylaw 14(b)(4), field reviews, have been carried out on the project during construction. In meeting the intent of the bylaw, the 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 his/her direct supervision so that he or she can sign and seal the necessary *Crossing Assurance Statement*.

Where the *POR* is a *forest professional*, he or she must determine that the requirements under the definition of the “practice of professional forestry” in Section (d) of the *Foresters Act* “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 achieved so that he or she can provide the necessary *Crossing Assurance Statement*.

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 the following construction activities;

- Layout,
- Foundation,
- Component assembly,
- Erosion control measures, and
- Approaches.

Prior to opening a *crossing* for use and after construction of a *crossing*, the *POR* must sign and seal the *Crossing Assurance Statement*. The *Crossing Assurance Statement* is attached as Appendix A.

## 4.5 AS BUILT/RECORD DRAWINGS AND OTHER DOCUMENTATION

*As built/record drawings* record the *crossing* that was constructed and the state of any relevant conditions that existed at the time of construction. *As built/record drawings* are required by legislation. The *as built/record drawing* does not imply that the drawings show exactly what was built or constructed. Nor does it suggest a level of certification or impose inappropriate responsibility.

Upon completion of bridge construction, the *POR* would prepare *as built/record drawings* and documents to document what was constructed or implemented at the *crossing*. The types of documented information would vary, but can include measurements, elevations, sizes or notes marked on the approved construction documents, including any significant

amendments or modifications to the bridge *design*. Once the documentation is completed the *POR* signs and seals the *as-built/record drawings* and documents in a manner recommended by the individual associations.

The types of changes recorded on *as built/record drawings* and documents can include:

- Actual log stringer, curb, needle beam and crib log dimensions (span lengths and diameters);
- Any changes to fabricated materials;
- Actual footing base elevation, deck elevation, and alignment location;
- Confirmation of scour protection requirements;
- Fabrication plant inspection reports, including mill test certificates and concrete test results; and
- Any other pertinent fabrication, field, and construction data.

## 4.6 INSPECTIONS

A detailed discussion of routine maintenance inspections is beyond the scope of these guidelines. Professional guidance regarding bridge inspections will be covered at a later date.

## 5.0 QUALITY MANAGEMENT

Quality management for *members* requires the implementation of suitable protocols to ensure the completion of appropriate quality assurance and quality control reviews. The purpose for completing quality management is to ensure that the work completed is technically correct and complies with applicable codes, standards and regulatory requirements. Quality management is required on all professional work related to *crossings* prepared by *members*.

### 5.1 APEGBC QUALITY MANAGEMENT BYLAWS AND ABCFP STANDARDS OF PROFESSIONAL PRACTICE

For *APEGBC members* and holders of non-resident or limited licenses a QA/QC program must, as a minimum, satisfy the requirements of *APEGBC* Quality Management Bylaws 14(b)(1), (2), (3) and (4) with regards to:

- Retention of complete project documentation for a minimum of 10 years;
- Documented checks of engineer and geoscience work;
- Documented field reviews of the constructed work at the *crossing* site considered necessary, in the *member's* opinion, to ascertain whether or not the significant aspects of the work are considered in general compliance with the plans and supporting documents;
- Documented independent reviews of the *designs* of structural protective works that require the engagement of a *professional engineer* having the appropriate training and experience.

For *ABCFP members* and special permit holders or certificate holders entitled to practice in this area; the Standards of Professional Practice contain competence and due diligence direction to ensure quality of professional work. Competence requires professional practice to include the essential elements of knowledge, completeness/correctness, professional care, and measurement/verification of work (*ABCFP* Bylaw 12.2). *ABCFP members* exercise due diligence in professional practice by being prudent and doing all work with constant and careful attention. An *ABCFP member* can exercise due diligence in professional practice by satisfying himself or herself of the following (*ABCFP* Bylaw 12.5):

- All relevant legal requirements have been met;
- The *member* has a clear understanding of client or employer objectives and how they relate to other values or interests which are relevant to the work or may impact it;
- The *member* is personally familiar with all relevant characteristics of the area affected by the work;
- All appropriate background information has been gathered and incorporated;
- The *member* has consulted with all appropriate experts or *specialists* for those areas for which the *member* is not qualified to practice or express an opinion;
- When external advice is sought from a *specialist*, that *specialist* is qualified and competent to give that advice and the advice given makes sense based on the *member's* own personal knowledge;
- When data is collected by another person, that person is qualified and competent to collect that data and the data collected makes sense based on the *member's* own personal knowledge;
- Sufficient data was collected as per required standards;
- The *member* has made a proper assessment of risks and outcomes.



## 5.2 SUPPORTING RATIONALE

A key component of a *member's* quality management program is having a documented rationale to support his/her professional documents. In general, supporting rationale in the context of *crossings* relates to the documented *design* standards/criteria, other supplementary data upon which the professional documents are based.

The *member* must be able to provide supporting rationale for the professional documents that they have prepared.

## 5.3 INDEPENDENT PEER REVIEW

Where the *member* considers it appropriate, 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 having not been involved in the development of any stages of the original plan. Independent peer reviews can be performed by *members* within the same firm that generated the original professional documents, provided that an independent perspective is maintained.

The level of peer review should be based on the professional judgment of the *member*. 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 *member's* training and experience.

The independent peer review process should be appropriately documented and as a minimum include a sealed letter or report included in the plan, that includes the following:

- Limitations and qualifications with regards to the review, and
- Results of the review.

For both internal and external peer reviews, the name of the reviewing *member* should be identified in his/her report.

## 6.0 SKILL SETS FOR A POR IN CROSSINGS

The *POR* of a *crossing* project functions in a technical capacity. As a result, guidance beyond that found in Section 3 is provided below for the skill sets required of the *POR*. Professional competence in a subject area typically arises from a combination of the following in order to achieve the required knowledge and field experience;

- Formal study such as university courses; [technical program of study] or equivalent knowledge gained from a combination of short courses, workshops, and self-study,
- Work experience under the mentored direction of a qualified professional, and
- Continuing professional development – keeping abreast of emerging literature, research and studies.

With respect to the *POR*, work experience is a requirement. This would include experience in the preparation of professional documents and associated work related to *crossings* under the mentored direction of a qualified professional.

### 6.1 POR SKILL SETS FOR SIMPLE CROSSINGS

A *POR* for a *simple crossing* must be able to demonstrate competence in the following.

1. Site survey;
  - a. Documentation of field conditions,
  - b. Completion of topographic survey,
  - c. Site plan (compilation of data), and
  - d. Field referencing for re-establishment of survey controls.
2. Consideration of design flow;
  - a. Hydrology - calculating design flow,
  - b. Hydraulics - calculation of velocity and water elevation,
  - c. Stream morphology and stability,
  - d. Debris sources and potential, and
  - e. Erosion/scour protection.
3. Understanding the effect that debris and bed load has on freeboard requirements.
4. Foundation support;
  - a. Recognize soil types,
  - b. Interpretation of terrain,
  - c. Knowledge and understanding of various earth retention systems - lock block, crib, ballast wall, and
  - d. Understand the effects that additional loads from earth retention system and *foundations* have on the embankment stability.
5. Approach alignments and grades;
  - a. Geometric road design,
  - b. *Crossing* general arrangement *design*,
  - c. Understand differences in tracking of various vehicle configurations, and
  - d. Road safety - (stopping distance, max/min grades, sightlines, vehicle containment on the bridge and approaches).
6. Load determination and distribution
  - a. Understand how different loads and vehicle configurations affect bridges, and
  - b. Identify the critical vehicle configuration - what is your design load.



7. Understanding of the various bridge structure types, components and connections, available for use in *crossings* and their application and limitations.
8. Layout, construction, and the preparation of *Crossing Assurance Statements*.
9. Knowledge of guidance available in guidebooks and professional guidelines applicable to *crossings*;
  - 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. Current *FLNRO Engineering Manual*,
  - h. Current *FLNRO Forest Service Road Bridge Design and Construction Manual*, and
  - i. Current FLNRO standard drawings.
10. Protection of the environment as to the *design* and construction of the *crossing*.

## 6.2 POR SKILL SETS FOR COMPLEX CROSSINGS

In addition to the requirements for a *simple crossing*, the *POR* for a *complex crossing* must have the following:

- Undergraduate level course work or equivalent in;
  - structural analysis and design,
  - soil mechanics and foundation design,
  - geotechnical engineering, and
  - hydraulics and hydrology.
- 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.

## APPENDIX A - CROSSING ASSURANCE STATEMENTS

Examples of *Crossing Assurance Statements* for the *CRP* for the *crossing* project and the *POR* for the *crossing*.

## 1) CRP CROSSING ASSURANCE STATEMENT

*(Modified from the FLNRO document Simple Stream Crossings - Guidelines for BCTS Coordinating Registered Professionals December 2013)*

*(To be retained by the CRP and placed on file for the life of the crossing)*

### **CRP**

The *CRP* is a registered *forest professional* or a *professional engineer* who is a *member*. The *CRP* is responsible for planning and coordinating all the professional services for the *crossing* project including the *design*, field reviews, *as built/record drawings* and *Crossing Assurance Statement*. The *CRP* must direct those activities with sufficient oversight and supervision such that they can take overall responsibility and accountability for the project.

## Coordinating Registered Professional Crossing Assurance Statement

(submitted with record drawings and documents after construction)

<b>SITE NO.</b> <b>STRUCTURE NO.</b>	<b>LOCATION</b>	<b>ROAD NAME</b>
<b>FOREST DISTRICT</b>	<b>STREAM CROSSING NAME</b>	<b>PROJECT NO.</b> (as applicable)
<b>CROSSING TYPE (CHECK ONE)</b> <input type="checkbox"/> Bridge <input type="checkbox"/> Major Culvert	<b>SIMPLE CROSSING?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No	<b>IS STRUCTURAL FIELD WELDING OR STRUCTURAL FIELD GROUTING REQUIRED?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>DESCRIPTION OF PROJECT COVERED BY THIS STATEMENT</b>		<b>LIST OF APPROVED DESIGN DRAWINGS:</b> Drawing and Revision No./Name of Designer/Date

This is to advise that I am the responsible *CRP* for the above described *crossing* and I am a:

- Professional engineer* (PEng), registered with the Association of Professional Engineers and Geoscientists of BC (APEGBC)
- Forest professional* registered with the Association of British Columbia Forest Professionals (ABCFFP)

1. I am directly responsible for the planning and coordination of all professional services for this *crossing* project including; planning/design, and field reviews\*. I have taken the appropriate steps as required under the Legislation for my profession, the *Guidelines for Professional Services in the Forest Sector – Crossings* as applicable to the project, and by good practice in order to sign and seal this *CRP Crossing Assurance Statement*.
2. I hereby give my assurance\*\* that, in my professional opinion, the *crossing design* has been carried out by an appropriately qualified professional or by an appropriately qualified individual through the use of appropriate *design aids* prepared by a *professional engineer*, and the *design* has incorporated the necessary *specialist* assessments.
3. I am responsible for coordination of the *design* and field reviews recommended by the *POR*.

In some cases the *CRP* and the *POR* are the same professional. In such instances the *CRP* must also sign the *Professional of Record Crossing Assurance Statement*.

<b>SIGNATURE OF CRP (PROFESSIONAL ENGINEER OR PROFESSIONAL FORESTER OR REGISTERED FOREST TECHNOLOGIST)</b>		<i>(please affix professional seal here)</i>
<b>Name of CRP</b> <i>(please print)</i>	<b>DATE SIGNED</b> YYYY   MM   DD	
<b>Employer's Name and Address</b> <i>(please print)</i>		
<b>Phone No.</b>	<b>E-Mail Address</b>	

\* "Field reviews" means reviews conducted at the site [and/or at fabrication location(s)] of the implementation or construction of the engineering work by a PEng or RPF as appropriate or his/her subordinate acting under his/her direct supervision, that the PEng or RPF in his/her professional discretion considers 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 engineering *design* documents prepared for the work.

\*\* "Assurance" means that a PEng or RPF as appropriate, has undertaken the *design* and field reviews, that in his/her professional judgment, are considered necessary to ascertain whether the significant aspects of the *crossing* project are in general conformance with appropriate practice.

\*\*\* "*professional of record*" is a PEng or RPF with the closest level of direct professional responsibility for the engineering *design* and any related engineering *design* documents produced, and whose professional seal appears on the documents; a test of "direct professional responsibility" is the ability of that professional to alter or revise the engineering content in the master engineering *design* documents.

## 2) POR CROSSING ASSURANCE STATEMENT

(Modified from the FLNRO document *Simple Stream Crossings - Guidelines for BCTS Coordinating Registered Professionals* December 2013)

(To be retained by the POR as professional document retention. To be retained by the CRP and placed on file for the life of the crossing.)

### **Professional of Record (POR)**

A professional engineer or a forest professional responsible for the design of the crossing which includes all of the following:

- Preparation of the *General Arrangement Drawing*
- Completion of Field Reviews
- Completion of the *Professional of Record Crossing Assurance Statement* including preparation of *as built/record drawings*

**Professional of Record**  
**Crossing Assurance Statement**  
*Construction of Bridges, Major Culverts, and Other Structures*  
*(submitted with record drawings and documents after construction)*

<b>SITE No.</b> <b>STRUCTURE No.</b>	<b>LOCATION</b>	<b>ROAD NAME</b>
<b>FOREST DISTRICT</b>	<b>STREAM CROSSING NAME</b>	<b>PROJECT No.</b> (as applicable)
<b>CROSSING TYPE (CHECK ONE)</b> <input type="checkbox"/> Bridge <input type="checkbox"/> Major Culvert	<b>SIMPLE CROSSING?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No	<b>IS STRUCTURAL FIELD WELDING OR STRUCTURAL FIELD GROUTING REQUIRED?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>DESCRIPTION OF PROJECT COVERED BY THIS STATEMENT</b>		<b>LIST OF APPROVED DESIGN DRAWINGS:</b> Drawing and Revision No./Name of Designer/Date

This is to advise that I am the *POR* for the above *crossing* and I am a:

- Professional engineer* (PEng), registered with the Association of Professional Engineers and Geoscientists of BC (APEGBC)  
 *Forest professional* registered with the Association of British Columbia Forest Professionals (ABCFFP)

1. I have completed the necessary tasks and documentation in preparing the *crossing design* and confirm that is appropriate for the use intended.
2. I have completed the necessary tasks for conducting sufficient field reviews\* at appropriate times during the construction work and preparing *as built/record drawings* for this project directly, or directed these activities with sufficient oversight and supervision such that I can take overall responsibility and accountability for these activities in respect of this *crossing*. I have taken the appropriate steps as required under the Legislation for my profession, the *Guidelines For Professional Services In The Forest Sector – Crossings* as applicable to the project, and by good practice in order to sign and seal this Statement.
3. Based on the results of the field reviews, I hereby give my assurance\*\* that, in my professional opinion:
  - the implementation or construction of 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), including all revisions;
  - where structural field welding was required, the welding was completed by a Division 3 or better CWB certified welding firm (**Note:** PEng sign-off of Statement is required to confirm this requirement).
4. I confirm that any implemented or constructed modifications from the work shown in engineering *design* documents have been approved by the professional responsible for *crossing design*, and significant modifications have been documented and marked on the attached *as built/record drawings* and documents.

<b>SIGNATURE OF PROFESSIONAL ENGINEER OR REGISTERED PROFESSIONAL FORESTER</b>		<i>(please affix professional seal here)</i>
<b>Name of Professional Engineer or Registered Forester or Registered Forest Technologist</b> <i>(please print)</i>	<b>DATE SIGNED</b> YYYY   MM   DD	
<b>Employer's Name and Address</b> <i>(please print)</i>		
<b>Phone No.</b>	<b>E-Mail Address</b>	

\* "Field reviews" means reviews conducted at the site [and/or at fabrication location(s)] of the implementation or construction of the engineering work by a PEng or RPF as appropriate or his/her subordinate acting under his/her direct supervision, that the PEng or RPF in his/her professional discretion considers 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 engineering *design* documents prepared for the work.

\*\* "Assurance" means that a PEng or RPF as appropriate has undertaken the field reviews, that in his/her professional judgment, are considered necessary to ascertain whether the significant aspects of the project are in general conformance with the engineering *design* documents.

\*\*\* "*Professional of Record (POR)*" is a PEng or RPF with the closest level of direct professional responsibility for the engineering *design* and any related engineering *design* documents produced, and whose professional seal appears on the documents; a test of "direct professional responsibility" is the ability of that professional to alter or revise the engineering content in the master engineering *design* documents.

## APPENDIX B - MAXIMUM BRIDGE SPAN FOR MAXIMUM 200 KPA

(Modified from the FLNRO document *Simple Stream Crossings - Guidelines for BCTS Coordinating Registered Professionals* December 2013)

### Maximum Bridge Spans (metres) for Maximum 200 KPa Foundation *Bearing Pressure*

Bridge Type	Abutment Configuration	Maximum Span for Specified Design Vehicle Configuration (metres) Factor of Safety = 1.2 (DL+LL)		
		Highway	Off-Highway	
		BCL-625	L100	L165
<b>All Steel Portable</b>	Single row lock-blocks	20	14	>200KPa
	Two rows high lock-blocks	20	16	>200KPa
	400 Wide Timber/Log Sill	>200KPa	>200KPa	>200KPa
	600 Wide Timber/Log Sill	14	>200KPa	>200KPa
	800 Wide Timber/Log Sill	20	12	>200KPa
<b>Timber Deck on Steel Girders</b>	Single row lock-blocks	28	15	>200KPa
	Two rows high lock-blocks	23	13	>200KPa
	400 Wide Timber/Log Sill	>200KPa	>200KPa	>200KPa
	600 Wide Timber/Log Sill	14	>200KPa	>200KPa
	800 Wide Timber/Log Sill	23.5	12.5	>200KPa
<b>Concrete Deck on Steel Girders</b>	Single row lock-blocks	19.5	12.5	>200KPa
	Two rows high lock-blocks	16	11	>200KPa
	400 Wide Timber/Log Sill	>200KPa	>200KPa	>200KPa
	600 Wide Timber/Log Sill	11.5	>200KPa	>200KPa
<b>Concrete Slabs</b>	Single Row lock-blocks	13.5	9	>200KPa
	Two rows high lock-blocks	11.5	>200KPa	>200KPa
	400 Wide Timber/Log Sill	>200KPa	>200KPa	>200KPa
	600 Wide Timber/Log Sill	>200KPa	>200KPa	>200KPa
	800 Wide Timber/Log Sill	11.5	>200KPa	>200KPa

The guideline provides a limitation on foundation pressures to no more than 200 kPa. For most *crossings*, this will restrict the span of the *simple crossing* bridge to one where the combined live and dead loading on the span will result in a *bearing pressure* of less than 200 kPa. Individuals assuming the responsibility as a *POR* for a *crossing* should have a working understanding of bridge *bearing pressure* determination and limitations and where the *POR* is directly conducting this work must be competent in the determination of *design bearing pressure* and capacity.

The above table provides illustrative span limitations for various bridge *superstructures* and some simple typical foundation types. This table must not be construed as a comprehensive listing or a *design aid*. The table is only intended for sample and illustrative purposes and is not a *design aid*.

Assumptions in the table include:

- Allowable bearing Capacity of Soil = 200kPa
- Timber/Log Sill Bearing area:
  - 1) 400 x 4500 = 1.8 m<sup>2</sup>
  - 2) 600 x 4500 = 2.7 m<sup>2</sup>
  - 3) 800 x 4500 = 3.6 m<sup>2</sup>
- Lock Block Abutment Bearing Area = 750 x 6000 = 4.5m<sup>2</sup>

## APPENDIX C - LEGISLATIVE AND REGULATORY FRAMEWORK

(Modified from the Forest Practices Board Report, Bridge Planning Design and Construction, Special Investigation Report 38, March 2014)

Crossing planning, *design* and construction on resource roads are governed by legislation and because they contain the practice of professional forestry and the practice of engineering and geoscience they are overseen by *professional engineers* and *forest professionals*.

The *Forest and Range Practices Act* (FRPA), the *Forest Planning and Practices Regulation* (FPPR) and the *Woodlot Licence Planning and Practices Regulation* (WLPPR) specify certain requirements for the planning, *design* and construction of *crossings*. In general, these requirements are aimed at ensuring *crossings* are safe for industrial users and that forest resources such as water, soil and fish are protected.

Other legislations and regulations also apply to the planning, *design* and construction for *crossings* on Crown land, e.g., the *Workers Compensation Act* and the Occupational Health and Safety Regulations.

The combination of requirements ensures *crossings* are safe for industrial users and for the protection of forest resources.

Some of the FPPR requirements related to *crossings* include:

- S.39 – natural surface drainage patterns must be maintained
- S.55 – the stream channel and banks must be protected
- S.56 – fish passage must be maintained
- S.57 – activities must not harm fish or damage habitat
- S.72 – bridges must be safe for industrial users
- S.73 – bridges must be *designed* to meet or exceed applicable standards
- S.74 – bridges must be *designed* to pass the highest expected peak flows
- S. 75 - Structural Defects
- S.76 - *culvert* materials standards
- S.77 - certain records and as-built/record drawings must be retained