Guidelines for Professional Services in

the Forest Sector – Forest Roads

Professional Engineers and Geoscientists of BC

ASSOCIATION OF BC FOREST PROFESSIONALS

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FOREWARD

Forest *roads* are vital infrastructure for ongoing forest management. Most forest *roads* are primarily industrial *roads* but many are also a public benefit by providing access for recreation activities, to utilities and facilities (e.g., communications towers, weather stations, research and monitoring sites), and to remote communities or rural residences.

In consideration of the significant work undertaken from 2011 through 2013 towards the development of a Natural Resource Roads Act, this guideline will be reviewed 3 years after the date of initial publication.

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1 DEFINITIONS

The definitions in this section are specific to these guidelines.

ABCFP
Association of British Columbia Forest Professionals.

Access Planning
Activities that precede *road* layout. For forest *roads* these typically include identifying route corridors, selecting life expectancies of various *roads* types, and establishing intended *road* users and vehicle types.

APEGBC
Association of Professional Engineers and Geoscientists of British Columbia.

APEGBC Professional
Professional engineers, professional geoscientists, including limited licensees, licensed to practice by *APEGBC.*

Coordinating Member
Member of *ABCFP* or *APEGBC* who has lead and coordinating responsibility for professional work.

Field Review
Such reviews of the constructed works at the forest *road* site considered necessary, in the *member's* opinion, to ascertain whether or not the significant aspects of the works are in general compliance with the *road plan*, maintenance plan or deactivation plan; or reviews by the *forest professional* to verify whether or not the works have been carried out as planned, directed or advised.

Forest Professional
Member of *ABCFP* who is authorized to practice professional forestry.

Forest Road Activities
For the purpose of these guidelines, those activities carried out on the land by the *government*, tenure holder or permittee related to construction, maintenance, use and deactivation of forest *roads*.

Government
Regulatory authorities having jurisdiction over forest development on Provincial Crown land or private land. Such authorities include federal, provincial and local *governments*.

Licensee/Owner
An individual, company, or Provincial Crown agency that has the legal right to construct, maintain or deactivate forest *roads*. For the purpose of these guidelines, *Licensee* includes land owners in the case of forest development on private property.

Member
A Registered Professional Forester, Registered Forest Technologist or Special Permit Holder registered and in good standing with *ABCFP*; or a Professional Engineer, Professional Geoscientist, or holder of a Non-Resident or Limited License, licensed to practice by *APEGBC*.

Road
A route constructed or used primarily for the purpose of transporting logs by truck, and includes the following:

- forest service *roads*;
- *road*s on private managed forest land; or
- those *roads* covered by the *Industrial Roads Act* that are primarily used for the transportation of forest resources.

and any pits, quarries, landings or waste areas that are used in conjunction with the *roads*. A *road* does *not* include those routes constructed for winter use only, built of snow and ice without inclusion or excavation of subgrade soils.

Road Deactivation Plan
A document that contains professional work which provides *road* standards, design specifications, and other information to facilitate the deactivation of a *road*.

Road Maintenance Plan
A document that contains professional work which provides *road* standards, design specifications, and other information to facilitate the maintenance of a *road*.

Road Personnel
Persons who supervise or carry out construction, maintenance, or deactivation of forest *roads*. These individuals typically include *road* supervisors and machine operators.

Road Plan
A document that contains professional work which provides *road* standards, design specifications, and other information to facilitate the construction of a *road*.

Specialist
An individual that has specialized training and experience in a particular occupation, practice or branch of learning. Such individuals include, but are not limited to, *members* with special expertise (e.g., terrain stability; *road* suitability for vehicle configurations; or geotechnical, structural or rock slope engineers); Professional Biologists, Professional Agrologists, Archeologists, Hydrologists or others specializing in the management or valuation of forest resources. See also *terrain specialist*, below.

Terrain Specialist
A *Member* with appropriate levels of education, training and experience (skill sets), as defined in *Guidelines for Professional Services in the Forest Sector – Terrain Stability Assessments*, to conduct a *terrain stability assessment*.

Terrain Stability Assessment (TSA)
An assessment of landslide *hazard,* a *landslide hazard* analysis or a *landslide risk* analysis for terrain on or adjacent to a forest development which may be carried out. See *Guidelines for Professional Services in the Forest Sector –Terrain Stability Assessments*.

Terrain Stability Management Model
A system, process or procedure to manage terrain stability related to forest development. It can consist of a document, a map, a diagram; or some combination of these, and should provide guidance with respect to:

- when and where a *TSA* should be carried out;
- managing terrain stability;
- acceptable hazard or risk criteria for specified elements at risk;
- selecting forest development strategies that are consistent with identified hazards or risks; and
- establishing a consistent and logical decision-making process to analyze and document decisions concerning the management of terrain stability.

Refer to *ABCFP/APEGBC Guidelines for Management of Terrain Stability in the Forest Sector* (2008).

2 INTRODUCTION

Access planning[1] determines access needs and sets out transportation systems to meet planning objectives and is typically completed by *forest professionals* before undertaking the *forest road activities* described in these guidelines. *Access planning* typically includes:

- identifying route corridors;
- selecting life expectancies of various *road* types; and
- establishing intended *road* users and vehicle types

The life expectancy of a *road* depends on the purpose of the *road* and the duration of its planned operational use. For example, a *road* may be one of the following:

- *road* with a specific season of use, such as a winter *road*;
- *road* with a defined lifespan; or
- permanent *road*.

2.1 PURPOSE AND SCOPE OF GUIDELINES

Members of the Association of British Columbia Forest Professionals (*ABCFP*) and the Association of Professional Engineers and Geoscientists of British Columbia (*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 *member*s of *ABCFP* and *APEGBC* who have professional involvement in specific *forest road activities*.

The following related documents have also been issued by *ABCFP* and *APEGBC*:

- *Guidelines for Professional Services in the Forest Sector – Crossings* (March 2005/rev Sep 2008)
- *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 describe the professional practice associated with forest *roads* (see Section 4, Professional Practice in Forest *Roads*).

In these guidelines, "*road* users" refer to those using the *road* on behalf of the *Licensee*, for the development and transport of forest resources, including the transportation of equipment or crews.

The objective of these guidelines is to establish a standard of care by:

1. identifying professional tasks
2. identifying considerations that need to be addressed
3. identifying outputs in the form of deliverables

These guidelines can assist a *member* and his/her client or employer to establish the scope of work required to complete the identified *forest road activities*. Professional practice is a necessary component of *forest road activities*.

[1] Terms in italics are defined in Section 1.

In addition, these guidelines describe the skills and knowledge a competent *member* should have prior to undertaking the professional work identified in the *forest road activities* (Section 6).

Consistent with the *ABCFP/APEGBC* Joint Practice Board's terms of reference, these guidelines apply solely to *members* of *ABCFP* and *APEGBC*.

2.2 FRAMEWORK

Delivery of professional services relating to *forest road activities* 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*, R.S.B.C. 1996 c. 116 as amended;
- adherence to the *Foresters Act*, R.S.B.C. 2003 c. 19;
- fulfilling the 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 forest *road* project.

Government has granted *ABCFP* and *APEGBC* legislative authority to regulate *members* working in the forest sector. This authority includes determining which professional work *members* of the respective association can carry out, and developing practice standards. These guidelines have been prepared by the Joint Practice Board comprising *members* of *ABCFP* and *APEGBC*. The Joint Practice Board was mandated by the Councils of *ABCFP* and *APEGBC,* in a Memorandum of Understanding originally signed in 1994 and updated in 2006, 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 described in these guidelines are 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 13 requires a quality assurance program for professional forestry.

Under the *Engineers and Geoscientists Act*, the association 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)(3) requires *APEGBC professionals* to establish quality management processes for their practices which shall include "documented field reviews by, or under the direct supervision of, members or licensees, of their domestic projects during implementation or construction". *APEGBC's* Code of Ethics requires professional *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 regulates forest management in BC on Crown and private land separately. The *Foresters Act* does not distinguish the practice of forestry by land ownership. *Forest road activities* 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, 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 forest *roads*, 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 does not necessarily mean that they have failed to meet the appropriate standard of practice in the performance of professional services. Such judgments and decisions depend upon an evaluation of all facts and circumstances in a particular project.

ABCFP and *APEGBC* support the principle that *members* should receive fair compensation for professional services; adequate to ensure that the professional services can be carried out appropriately. Inadequate compensation is 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 employer when receiving instructions for an assignment.

When *APEGBC professionals* are involved in *forest road activities*, they must provide the following notification in accordance with the *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."*

Members must only practice in areas where they are appropriately trained and experienced. *Professional engineers* and *professional geoscientists* "shall undertake and accept responsibility for professional assignments only when qualified by training or experience."[2] *Forest professionals* have a responsibility "to practice only in those fields where training and ability make the *member* professionally competent."[3]

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 and Direct Supervision

ABCFP and *APEGBC* each describe the expectations of professional practice when practicing *members* supervise and directly supervise others.

For *APEGBC members*, a *member* can delegate the completion of professional work to an assisting subordinate *member* or non-*member* working under their direct supervision. Direct supervision means taking responsibility for the control and conduct of the 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 the 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 Acknowledgments

These guidelines have been prepared by a Task Force of the Joint Practice Board of the *ABCFP* and *APEGBC*. The *ABCFP* and *APEGBC* acknowledge the efforts of members in the Task Force, Joint Practice Board and reviewers including WorkSafeBC staff in preparing these guidelines. Funding for the development of these guidelines was provided by the BC Ministry of Forests and Range.

Cover photo by Frank Kaempf, RPF.

[2] APEGBC Bylaw 14(a)

[3] ABCFP Bylaw 11.3.7

3 ROLES AND RESPONSIBILITIES

Roles and responsibilities for *members* will depend on the organizational structure of the *licensee*, the role of the *member* in that structure, and the complexity of the *road* design or terrain conditions. To ensure roles and responsibilities are properly assigned and understood, clear lines of communication shall be established which provide clarity regarding the respective roles and responsibilities of those involved in completing professional practice activities related to the construction, maintenance, use and deactivation of *roads*.

Therefore, a *coordinating member* is required to take professional responsibility for professional work associated with a *forest road activity*. This includes whether that *coordinating member* is the only professional involved or a professional who is managing a team.

A team consists of a *coordinating member* who is qualified to oversee and take responsibility for professional practice associated with the *forest road activities* plus other *members* and/or *specialists* who are required depending on the size and complexity of the project. (See Appendix 1, Examples of Roles and Responsibilities).

4 PROFESSIONAL PRACTICE IN FOREST *ROADS*

Professional practice associated with the design, construction, maintenance and deactivation of forest *roads* includes, but is not limited to:

1. *road* layout
2. *road* survey
3. *road* design
4. *road plans*
5. review of *road* construction for conformance to the *road plan*
6. inspection and maintenance plans for *road* use
7. *road deactivation plans*

As such these professional practice activities must be carried out by a *forest professional* or an *APEGBC professional*.

Prior to commencing the professional practice activities the *coordinating member* should identify the *road* layout, design and construction standards to be used, usually from published *road* design guidelines or client standards, to provide acceptable efficiency, stability and safety performance for the expected traffic over the intended *road* life. The design guideline most commonly referenced is the BC Ministry of Forests and Range (MFR) *Engineering Manual* (2009). The *Manual of Geometric Design Standards for Canadian Roads*, published by the Transportation Association of Canada (TAC) also provides design standards that can be used for forest *roads*.

Forest *road* design guidelines are normally developed for standard industrial vehicles (such as those indicated in the MFR *Engineering Manual*).

Factors to be considered in selecting design and construction standards include:

- intended *road* use;
- vehicle types (for example, as indicated in the MFR *Engineering Manual*);
- traffic volume;
- mix of traffic;
- travel speeds; and
- *road* maintenance and deactivation.

These standards will influence how to address various factors such as:

- planned *road* life;
- *road* complexity (See Appendix 3);
- sight distance, design *road* speed;
- *road* geometry;
    - vertical and horizontal curvature
    - maximum grades
    - *road* widths
    - typical cross-sections
- turnout size and spacing;
- intersections and/or *road* junctions;
- type and quality of *road* surface;

- seasonal *road* conditions; and
- traffic control systems.

For example, design guidelines typically require additional and/or larger turnouts if a *road* needs to accommodate large vehicles such as off-highway trucks or large lowbeds. If accommodating recreational or other public traffic in conjunction with industrial use is a specific design objective, then other provisions such as greater sight distance may also be required.

The *coordinating member* may adopt existing design and construction standards developed for previous projects, mandated by the client or published by other organizations. Where the *coordinating member* adopts existing design and construction standards, it is his/her responsibility to determine the applicability of the standards and make modifications to address specific constraints related to the work.

The *coordinating member* should document the design standard used and the rationale for selecting it.

4.1 *ROAD* LAYOUT

Road layout selects a specific *road* location that:

- optimizes operational needs;
- meets safety requirements;
- meets regulatory requirements for protection of other resources;
- satisfies risk management objectives; and
- meets objectives that may have been set through other planning processes (e.g., forest management plans, watershed management strategies or community forests).

The level of detail and the type of information required for *road* layout depends on the applicable design and construction standard used, the complexity of terrain, the size and complexity of stream crossings, and the consideration of other resource values or other users. Resource values to be considered in layout may be different, or addressed differently, for crown tenure, private forest land, community forests, community watersheds, or land within municipalities. Typically, *road* layout requires:

- office based review of proposed *road* alignment using aerial photography and terrain mapping;
- identification of physical features that may influence the *road* location or design; field reconnaissance to confirm a *road* alignment within the route corridor (or outside the corridor if issues are identified related to physical ground conditions or potential impacts on other resources along the proposed corridor);
- field marking of the *road* location;
- identifying and/or obtaining input from other *members*, *specialists* or *road personnel* to:
    - evaluate potential safety issues that are beyond the expertise of the *coordinating member* e.g. landslides, rockfalls, avalanches, karst features, danger trees
    - design earth retaining structures
    - assess terrain related concerns for *road* construction such as slope stability

hazards, gullies, fans, floodplains, erosion or avalanches
- identify fish habitat and other environmental constraints
- assess and if required design stream crossings
- identify other forest and non-forest resources e.g. archaeological sites.

Survey methods and instrumentation used for *road* layout must be appropriate for the accuracy and type of data required.

At the layout stage, adequate field markings and controls should be established to enable proceeding to the next phase. This could range between 'marking a location' to identifying field centerline and control point markings depending on the type and complexity of the terrain the *road* is traversing, resource values, design standards and *specialist* assessments.

The *coordinating member* may need to update the *road* layout based on the field reconnaissance and recommendations made by other *members, specialist* or *road personnel.*

4.2 *ROAD* SURVEY

The purpose of the survey is to confirm the *road* layout and provide sufficient information to the *road* designers, and *road personnel* responsible for *road* construction. The *coordinating member* should choose the survey methods and instrumentation based on the accuracy and type of data required to facilitate the planning and design of the *road*. While the use of a field traverse is typically acceptable, more detailed information may be required where:

- the *road* location is critical e.g., to avoid encroachment on resource features or private property, or at approaches to stream crossings;
- information is required to facilitate geometric design or design through unstable terrain;
- control of *road* geometry is necessary to achieve stable cuts, fills or specialized designs;
- control of vertical or horizontal alignment is critical to meet design criteria for grade or curvature limitations, such as in steep or irregular terrain;
- material movements must be accurately controlled/measured during construction; or
- regulatory requirements exist.

Survey methods and instrumentation used must be appropriate for the accuracy and type of design data required. Even where detailed surveys are not essential to achieve the intended *road* standard, these steps may be beneficial or necessary for contracting, regulatory or quality control practices.

4.3 *ROAD* DESIGN

The purpose of *road* design is to produce design specifications for *road* construction by determining the optimum *road* geometry that will accommodate the design vehicle configuration for load and alignment, and traffic volume, and provide for user safety,

while protecting the environment and limiting impacts on other resources and minimizing the cost of construction, transportation, maintenance, and deactivation.

The *road* design should reflect the selected design and construction standards. Where the design does not meet the requirements of the selected design and construction standard, the *coordinating member* should modify the design and construction standard or adopt additional measures to protect workers during construction, *road* users and resource and habitat features.

Examples include:

- Accepting increased ditch maintenance from ravelling or sloughing cuts in order to reduce excavation volumes.
- Constructing cut slopes steeper than the angle of repose if the design incorporates suitable safety protocol to protect workers during construction and industrial *road* users.

The design documents should identify and describe mitigation measures where the design does not conform to the adopted design and construction standards.

A *road* design typically includes the following, though not all design information is applicable in all cases:

- a description of the *road* standard and assumptions made in design;
- any special conditions specific to the use of certain *road* sections; for example, seasonal or weather limitations beyond the normal range of *road* conditions;
- the expected performance of the various *road* sections;
- cross-sections displaying *road* width, cut and fill slopes and surfacing depth;
- plan and profile views displaying vertical and horizontal alignment, and:
  - location of field reference points (for example, private property boundaries)
  - location, type and size of drainage structures
  - locations of special design sections (for example, retaining structures)
  - locations and dimensions of turnouts
  - locations of landings, pits, quarries and spoil sites
  - sites of specific concern for construction; for example, potentially unstable terrain, fish streams, karst features
  - locations of nonconventional construction sections such as endhaul sections
  - clearing width
- excavation and embankment volumes;
- probable material type (soil, rock, organic overburden, etc.);
- mass haul diagrams;
- surfacing requirements, where applicable; and
- locations of signs, fences and roadside barriers.

4.3.1 Drainage

The *road* design should incorporate drainage measures appropriate for local climate and hydrologic conditions, ground conditions, and adjacent terrain to:

- maintain the load bearing capacity of the *road* structure and integrity of the driving surface;

- maintain natural drainage courses; an
- limit the potential for soil erosion, sediment transport or instability resulting from altered hill slope drainage.

4.3.2 Clearing Width

While setting clearing widths typically requires balancing objectives for limiting the extent of forest disturbance with those for accommodating the adopted design and construction standard, the clearing width must provide for safe work conditions during construction as well as safety following construction for *road* users or for workers carrying out activities adjacent to the *road*. Clearing widths may need to accommodate other issues such as:

- sufficient width to construct the proposed *road*;
- storage of spoil material (such as organic overburden where this can be done without compromising stability);
- temporary storage of logs from right of way clearing;
- landings, pits, quarries and spoil sites;
- access to installations requiring maintenance; or
- snow removal and snow storage.

Where possible, the *road* design should also provide access to elements requiring ongoing maintenance such as debris racks, deflection berms, catchment basins, spillways or settling ponds.

4.3.3 Geometric *Road* Design

The *coordinating member* can rely on standard operating procedures (SOPs), schematic cross-sections and standard construction practices, in preparing a geometric *road* design.

A geometric *road* design is typically required where:

- the *road* passes through steep, complex[4] or unstable terrain;
- there is higher risk to downslope values;
- control of *road* geometry is necessary to achieve stable cuts or fills or specialized designs;
- control of vertical or horizontal alignment is required to meet design criteria for grade or curvature limitations, such as in steep or irregular terrain;
- material movements must be accurately tracked during construction; or
- regulatory requirements exist.

The *coordinating member* may prepare the geometric design using an appropriate computer application. Where the *road* design is prepared using a computer application, the *coordinating member* must review the design to ensure that it is reasonable, correct, suitable for the ground conditions and constructible.

4.3.4 Design and Assessment by other *Members* and *Specialists*

The *coordinating member* may need to draw upon other *members* and *specialists* for their expertise to assist with the development of the *road* design. Examples include:

[4], *Guidelines for Professional Services in the Forest Sector – Terrain Stability Assessments*. August 2010.

- evaluating potential safety issues that are beyond the expertise of the *coordinating member*; for example: landslides, rockfalls, avalanches, karst features, danger trees;
- assessing terrain related concerns for *road* construction such as slope stability hazards, gullies, fans, floodplains, erosion or avalanches;
- identifying fish habitat and sensitivity;
- identifying other forest and non-forest resources (e.g. archaeological sites) and if necessary, addressing their sensitivity in the *road plan*;
- structural elements such as retaining walls;
- fords or fish stream culverts;
- bridges, including approach alignments;
- engineered fills or cut slope treatments;
- construction techniques such as overlanding or full bench excavation and endhaul;
- engineered rock cuts;
- measures to protect fan or floodplain stability;
- specialized erosion protection; and
- measures to protect resource and wildlife habitat features.

The *coordinating member* may use *specialist* input to revise *road* locations, to incorporate special design measures, to use special construction techniques, or to develop specific measures that are to be employed during or following construction to protect the environment or address worker or user safety.

4.4 *ROAD PLANS* - DOCUMENTATION OF THE *ROAD* DESIGN

The *coordinating member* is responsible for coordinating the documentation of the *road* design including the design and construction standards, *road* layout, survey and geometric *road* design for the purpose of providing sufficient information and instruction to enable construction of the *road* in conformity to the *road plan*, and where necessary specific information and instructions required for future maintenance and deactivation.

The extent of the documentation is a function of risk and complexity where risk is the likelihood of a detrimental effect to the environment or people, and complexity is a measure of the activities required to implement the plan. For example, a *road plan* for a basic *road* section can be prepared following *road* layout; whereas, *road plan* for a complex *road* section is prepared after completing more detailed surveys and design. In either case, it is up to the *member*, exercising appropriate professional judgment to determine the level of detail required. The following provides guidelines for the development of an acceptable *road plan*.

A *road plan* may include:

- a list of documents that make up the *road plan*;
- a map showing the *road* location with key control points;
- project specific *road* design and construction standards or reference to an appropriate design and construction standard;
- any special conditions on use of certain *road* sections; for example, seasonal or weather limitations beyond normal operating conditions;

- assumed or documented ground conditions;
- cross-sections displaying *road* width, cut and fill slopes and surfacing depth;
- plan and profile views displaying vertical and horizontal alignment, and:
  - location of field reference points (for example, private property boundaries)
  - location, type and size of drainage structures
  - locations of special design sections (for example, retaining structures)
  - locations and dimensions of turnouts
  - locations of landings, pits, quarries and spoil sites
  - sites of specific concern for construction; for example, potentially unstable terrain, fish streams, karst features
  - locations of nonconventional construction sections such as endhaul sections
  - clearing width
- excavation and embankment volumes;
- probable material type (soil, rock, organic overburden etc);
- mass haul diagrams;
- surfacing requirements, where applicable;
- locations of signs, fences and roadside barriers;
- *specialist* assessments, recommendations or designs (e.g. *TSAs*, crossing designs and engineered structures);
- identification of required *field reviews* (e.g. confirmation of assumed ground conditions, reviews to ensure conformance to *specialist* assessments, recommendations or designs);
- notification requirements required by others such as regulatory agencies or other parties;
- descriptions of any field surveys to be done before or during construction;
- communication of assumed ground conditions and protocol if unexpected ground conditions are encountered;
- instructions for worker safety for safe *road* construction procedures as required by applicable Occupational Health Safety Regulations or as required to mitigate other potential hazards;
- instructions for specific construction procedures required to implement any aspects of the design; for example, traffic control measures and timing of the works;
- written procedures or references to SOPs that are intended to be followed during construction;
- locations of sensitive features and instructions for any special procedures around sensitive features, including construction methods, scheduling constraints and timing windows;
- instructions for creating access specifically for maintaining structures after construction is completed; and
- instructions for future maintenance.

Design details for special design sections may be incorporated into the general design, or may be provided as separate documents. In either case, each *member* must sign and seal the work that he/she is responsible for as required by the by-laws of his/her Association.

The level of detail in a particular *road plan* should reflect the complexity of the terrain, the standard of *road* design, the presence of other resource features (for example, fish streams), and the level of control needed on the *road* location.

A *member* may rely on SOP's to achieve the intended standard of construction and to address safe work procedures. If so, the *member* must check that the SOP's are appropriate for the site conditions and for the *road* design.

In the simplest case, a *road plan* could consist of an annotated map that delineates the *road* location by a line and indicates *road* width and specific features such as stream culverts and landings. The centreline of a basic *road* is typically field marked by flagging. In contrast, a complex *road* in difficult terrain could have a detailed geometric design with:

- *specialist* designs incorporated;
- special construction methods required;
- restrictions for environmental and safety concerns;
- construction survey controls required; and
- a requirement for frequent *field reviews* and a high level of supervision during construction.

A *road plan* is considered professional work and must be sealed by the *coordinating member,* to confirm that:

- The *road* standard is appropriate for the intended *road* type, *road* life, and use.
- The *road* layout and design has been reviewed by the *coordinating member* and is appropriate.
- *Specialist* assessments or designs have been obtained where needed, and that *specialist* recommendations have been incorporated as appropriate into the design; or that the *specialist* designs are provided as separate documents, and provide suitable direction for *road* construction.

4.5 REVIEW OF *ROAD* CONSTRUCTION FOR CONFORMANCE TO *ROAD PLAN*

This section provides guidance for *coordinating member*s who are responsible for confirming that the completed works are in general conformance with the *road plan*. Before site work commences, the *coordinating member* should ensure the *licensee* understands the steps required in order for the *coordinating member* to be accountable for the review of *road* construction for conformance to the *road plan*; in particular, the need for adequate *field reviews*.

A *coordinating member* may delegate *field reviews* to another individual acting under his/her direct supervision.

If the *coordinating member* for construction did not prepare the *road plan*, the *coordinating member* must confirm that the *road plan* has been sealed by a *member*, and exercise professional judgment to determine that there are no changed site conditions which could affect safety or the suitability of the *road plan*.

In preparation for carrying out a review of the works to confirm general conformance with the *road plan*, the *coordinating member* should:

- Identify what *field reviews* are required and what notification should be given to allow the *field reviews* to be carried out. If the *road plan* includes *specialist* designs or incorporates recommendations from a *TSA*, there may also be a need for *field reviews* by *terrain specialists* or design *specialists*.
- Note special instructions related to safety during construction and bring these to the attention of the *licensee*.
- Identify what field surveys may be needed before or during construction (e.g., re-establishing centreline, or slope staking).
- Clarify with the *licensee* any special reporting or quality assurance requirements. The *licensee* may have systems in place (e.g., an Environmental Management System) that require additional *field reviews* to be carried out and specific documentation to be completed.

Forest *road* construction may range from in-block spur *roads* to major arterial haul *roads*. The complexity and constructive effort, and consequently the level of *field review* and construction documentation, will vary accordingly.

Other responsibilities related to *road* construction that may be undertaken by a *member* are project management, quality control, quality assurance, contract administration or construction supervision. It is important to clarify the roles and responsibilities of each *member* including the *coordinating member*, and their reporting relationships, at the outset of the project.

If the *coordinating member* becomes aware of changed conditions during construction, the *coordinating member* for construction would either:

(a) Take responsibility for any changes needed to the *road plan*. This may involve obtaining input from other *members* or *specialists* to re-assess the changed conditions.

OR

(b) Contact the *coordinating member* who prepared the *road plan*, inform him/her of the changed conditions, and obtain instructions on what changes may be needed to the *road plan*. In this case, the original *coordinating member* would take responsibility for the changes, including preparing an updated *road plan*.

It is preferable to contact the original *coordinating member* who prepared the *road plan* but this may not always be practical.

If modifications are made during construction, the *coordinating member* for construction should document the changes, and indicate the reasons for the changes and their implications on the safety of *road* users, impacts to other resources, the planning objectives, intended use of the *road*, and costs. The *coordinating member* should immediately communicate to the *licensee* any changes that could affect the *coordinating member*'*s* ability to prepare a construction conformance statement.

Examples of changed conditions or modifications that may affect the *road plan* include:

- Changes in ground conditions (material characteristics or drainage) that require changes to the *road* design.
- Identification of sensitive features or resources at risk that were not previously known (e.g., fish presence in a stream shown on the plan to be non-fish bearing; or previously unidentified archaeological sites).

4.5.1 Construction Conformance Statement

Following construction, the *coordinating member* prepares a construction conformance statement to confirm that the completed works generally conform to the intent of the *road plan* and that an appropriate level of professional services has been provided. The statement may vary depending on the complexity of the *road plan*, the *member's* role within the *road plan*, and the *licensee's* documentation requirements.

As a minimum, the construction conformance statement contains the following information:

- A statement indicating that the completed works are in general conformance with the *road plan*.
- If changes were made to the *road plan* during construction that have implications on *road* performance or potential impacts to other resources, then a record of those changes together with the rationale should be retained on record.

Construction conformance statements can take various forms. For a simple *road plan*, the construction conformance statement could be the original *road plan* with annotations verifying work completed and showing any changes. A construction conformance statement could also be a letter, memo, *field review* report or certificate of general conformance containing the above content. Construction conformance statement documentation may also include reports of *field reviews* by *specialists*; for example, from *terrain specialists* confirming that ground conditions were as anticipated in the *TSA*. In particular, if the *road plan* includes sections with *specialist* engineering designs, or if *specialist* engineering designs are provided separately for specific *road* sections, these sections should have construction conformance statements prepared by the *specialists*.

Construction conformance statements should be completed prior to intended use.

In all cases, the construction conformance statement must be signed and sealed by the *coordinating member* consistent with association bylaws regarding sealing professional documents.

An example of a suitable construction conformance statement is included in Appendix 2.

4.5.2 Drawings of Completed Works

The construction conformance statement can include or be accompanied by drawings that document the completed works. These can vary from annotations or revisions shown on the original *road plan* documents through the completion of post-construction surveys and preparation of record drawings.

4.6 INSPECTIONS AND MAINTENANCE PLANS FOR *ROAD* USE

In this document, *road* realignments are treated as *road* construction; all other activities to maintain the structure and function of an existing *road*, including reactivating existing *roads*, are considered maintenance.

Where *road plans* and construction sign-off records are available, these documents may indicate what *road* use objectives were included in design, and may identify sections with specific maintenance considerations. However, *road* use often changes over time and the present use may be different than the original *road* use contemplated in design. Further, many existing forest *roads* in BC were built before specific *road* design and construction standards were established, and records of design and construction often do not exist. On these *roads* in particular, management of safety and environmental concerns relies on maintenance systems.

A *member*'s role in *road* use and maintenance will depend on the *licensee's road* obligations, and the role of the *member* within the *licensee's* organizational structure. For example, a *member* may be retained or employed by a *licensee* to prepare a maintenance plan for an individual *road* or *road* segment, or to be responsible for ongoing maintenance of a forest *road* network.

A maintenance plan prescribes remedial measures required to maintain *road* integrity and meet objectives for user safety and environmental concerns. It may be for remedial works at a specific *road* section, along an entire *road*, or possibly for several *roads*. Where a *member* prepares a maintenance plan, the plan should consider the original or amended planning objectives, including intended *road* use, existing *road* conditions, and safety and environmental considerations that the maintenance plan is based on. A maintenance plan may consist of general guidelines (i.e. SOP's for activities such as, but not limited to, surface grading and *road* site brush removal). However, more detailed specific instructions for *road* sections may be required where there is a significant risk of detrimental effects to the environment or people.

Where a *member* is retained or employed by a *licensee* to be responsible for maintenance of a forest *road* network, the *member* should develop a system for conducting inspections and carrying out work needed to maintain the integrity of the *roads*, and to address safety and environmental concerns.

In either the *maintenance plan* or maintenance of a forest *road* network, it is up to the *member* to determine the level of detail required.

An acceptable *road maintenance plan* should consider:

- identifying the current or expected *road* use and the purpose of maintenance; for example:
  - for industrial use only
  - accommodating other public use as well as industrial use
  - managing environmental integrity on inactive *roads* (for example, wilderness *roads* on crown land)

- setting objectives for *road* maintenance appropriate for *road* integrity, user safety, and hazard to downslope or downstream elements at risk;
- setting hazard and risk criteria in order to prioritize *road* inspection schedules and maintenance work;
- setting the frequency and scope of inspection schedules commensurate with the potential for unsafe conditions or environmental hazards;
- setting conditions of *road* use;
- Recognizing where *member* or *specialist* input is needed to prepare plans for specific remedial work. This may include requirements for *field reviews* and professional signoff on completed work similar to that for *road* construction.
- Providing for the implementation of remedial work on a priority basis flowing from inspections and *road maintenance plans*.
- Tracking work that has been completed and work that remains outstanding.

If *road* use objectives change, or if a *road* receiving industrial use only is to become a multi-use *road*, then the *member* responsible for *road* maintenance should assess the *road* to determine if it is suitable for the changed *road* use objectives. The *member* may need to indicate conditions of *road* use; to prepare a *road maintenance plan* for safety improvements; or possibly to identify where reconstruction or realignment may be needed (in which case a *road plan* is required).

Where a maintenance plan requires incorporating other *members*' or *specialists*' input, there may be a need for a *coordinating member,* who would have the same responsibilities as for *road* construction.

Examples of maintenance work that would normally require the attention of a *member* or *specialist* include:

- stabilization of failing cut or fill slopes;
- repairs to or replacement of engineered structures and stream crossing structures;
- replacement of drainage structures under high fills;
- *road* widening on steep slopes; and
- evaluating suitability of *road* grades or surface conditions, particularly in inclement weather, for specific vehicle configurations.

An example of a *road maintenance plan* that requires the attention of a *member* or *specialist* is one that is prepared before hauling commences on a steep grade section and may include evaluating the suitability of *road* grades or surface conditions for specific vehicle configurations.

A maintenance plan that incorporates professional work should indicate where and when *field reviews* are recommended to confirm that the work is being completed as intended. As with *road* construction, the *member* should inform the *licensee* of the steps required for the *member* to confirm that the completed works are in general conformance with the *road maintenance plan*. These steps would include identifying the need for adequate *field reviews* being carried out at the appropriate times. The *member* should clarify this with the *licensee* before work commences.

Sign-off of works completed under a *road maintenance plan* that requires the attention of a *member* or *specialist* should be done as described in Section 4.5.1 for *road* construction in order for the *member* to be professionally accountable for confirming that the completed works are in general conformance with the *road maintenance plan*.

4.7 *ROAD DEACTIVATION PLANS*

In these guidelines, deactivation means permanent deactivation of the *road*. Other measures on *roads* that are to be retained are considered maintenance. Deactivation is carried out to mitigate stability and erosion hazards for *roads* no longer required. It typically involves stabilizing the *road* prism, removing drainage structures, and limiting erosion.

Depending on the complexity of terrain and the *road* condition, deactivation can range from simply removing culverts to complete reclamation of the *road*, including full fill retrieval. If there are silvicultural objectives, the deactivated *road* may be rehabilitated to promote reforestation or revegetation (e.g., by *road* decompaction, fill recontouring or spreading of windrowed organic material over the surface).

The decision to deactivate may be an outcome from planning, from a *road plan* or from an evaluation of risk. A *member* may be involved in determining the need for deactivation, by analyzing items such as risk, cost-benefit considerations and silvicultural objectives. The typical role of a *member* in deactivation is to provide direction as to what measures are required. In deciding what measures are required, or the level of expertise required, the *member* should consider the level of hazard, the risk to downslope values, and the complexity of terrain and *road* conditions.

Where a *road deactivation plan* requires incorporating other *members'* or *specialists'* input, there may be a need for a *coordinating member* who would have the same responsibilities as for *road* construction.

For straightforward low-risk conditions, the extent of a *member*'s responsibilities may be to develop SOP's that match practices to be followed with existing *road* conditions.

In more complex or higher risk cases where the applications of SOP's are not adequate, a *member* would normally prepare a *road deactivation plan* and do *field reviews* of the work (or delegate *field reviews*) as appropriate during or following the site work. A *road deactivation plan* needs to contain sufficient information so that the measures to be carried out are clearly understood by the *road personnel* carrying out the work, including references to field markings where needed. A *road deactivation plan* could range from simple maps or references to field markings to detailed prescriptions with drawings and survey controls. In complex or difficult terrain, the *road deactivation plan* or portions of the plan may need to be completed by a *specialist* (see *Guidelines for Professional Services in the Forest Sector - Terrain Stability Assessments*).

Examples of deactivation works that would normally require the attention of a *member* or *specialist* include:

- removal of structures such as bridges, cribs or retaining walls;
- removal of drainage structures under large fills;
- removal of drainage structures where the work could have an impact on other resources such as fish habitat or water quality for a community water supply;
- stabilizing fills on steep slopes; and
- *road* sections on or above steep slopes where drainage management is important for stability of slopes below the *road*

A detailed *road deactivation plan* may include:

- a station by station description of conditions and mitigation measures prescribed;
- a map showing the locations of the measures prescribed;
- identification of site conditions that may be a concern for worker safety;
- identification of special concerns that affect the timing or conduct of the work; and
- recommendations for equipment or special work procedures necessary to complete the work.

A *road deactivation plan* that includes professional work should indicate where *field reviews* should be carried out during or following the work, to confirm that the work is being completed as intended and so that a *member* may sign off the completed work. As with *road* construction, the *member* should inform the *licensee* of the steps required for the *member* to sign off and be accountable for the completed work, particularly the need for adequate *field reviews* at the appropriate times. The *member* should clarify this with the *licensee* before the site work commences. It is up to the *member* to determine the level of detail required in the *road deactivation plan*.

Sign-off of works completed under a *road deactivation plan* should be done as described in Section 4.5.1 for *road* construction, in order for the *member* to be professionally accountable for confirming that the completed works are in general conformance with the deactivation plan.

5 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 *forest road activities* prepared by *members*.

5.1 *APEGBC* QUALITY MANAGEMENT BYLAWS AND *ABCFP* STANDARDS OF PROFESSIONAL PRACTICE BYLAWS RELATED TO QUALITY CONTROL

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 engineering and geoscience work;
- documented independent reviews of the designs of structural protective works that require the engagement of a professional engineer having the appropriate training and experience; and
- documented *field reviews* of the constructed work at the forest *road* project 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.

For *ABCFP* registered *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 three essential elements, knowledge, completeness and correctness, and professional care (*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; and
- 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 plan. In general, supporting rationale in the forest *road* context relates to the documented design standards/criteria, geometric design, other supplementary data upon which the plan is based and the application of particular forest *road* construction techniques.

The *member* must be able to provide supporting rationale for his/her plans.

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 forest *road* 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 plan 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 terrain; 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 SKILL SETS FOR PROFESSIONAL PRACTICE IN FOREST *ROADS*

This section describes the skills and knowledge required for a *member* or *coordinating member* involved in *forest road activities*. It does not address skill sets for *specialist* services such as civil or geotechnical engineering design, although special designs done by professional engineers qualified in these services may be part of the content of a plan.

Depending upon the complexity of a *road* project, the range of required knowledge and skills is often achieved by drawing upon *members* and *specialists* with the appropriate level of expertise.

Professional competence in a subject area typically arises from a combination of the following in order to achieve ***core***, ***general*** and ***region-specific*** levels of knowledge and field experience as described below:

- formal study such as university courses; or equivalent knowledge gained from a combination of short courses, workshops and self study;
- work experience, usually with mentoring by a senior professional; and
- continuing professional development – keeping abreast of emerging literature, research and studies

Core Knowledge:

For activities related to forest *roads*, a *member* must have professional levels of working knowledge in the following such that the *member* can interpret, employ and analyze site specific information and prepare or assess outputs as applicable to the specific task being undertaken:

- forest *road* and drainage design;
- forest *access planning*;
- harvesting and silvicultural systems;
- route surveying; and
- forest *road* construction methods

General Familiarity:

A *member* should be able to recognize, question and appraise the following, as applicable to the specific task being undertaken:

- interpretation of terrain conditions relevant to slope stability and *road* performance;
- soil and rock strength and other properties relevant to *road* performance;
- surface hydrology and hydraulics;
- BC Terrain Classification System/terrain stability mapping classification for forestry;
- GIS/CADD/cartography/digital information sources;
- guidebooks and professional guidelines applicable to:
    - fish stream identification;
    - fish stream crossings;
    - major crossings;
    - forest *road* engineering;
    - terrain stability management and assessment;
    - riparian management;

- gully assessment;
- *road* deactivation; and
- other relevant manuals.

Region Specific Familiarity:

A *member* should be able to identify, evaluate and use the following items on a region or area-specific basis, as applicable to the specific task being undertaken:

- appropriate methods of forest *road* construction/*licensee* SOPs;
- common harvesting and silvicultural systems;
- factors affecting workability/stability/performance of *road* fills and cutslopes;
- types and limitations of rock drilling and blasting techniques;
- climate, meteorology and hydrology conditions;
- types and causes of landslides associated with forest *roads*;
- typical landform characteristics and terrain response to *road* construction and performance and natural hazards; and
- relevant regulatory requirements for forest *road* design, construction or assessments for *road* integrity, environmental impact or worker and *road* user safety.

Field Experience:

A *member* should have sufficient experience specifically related to the complexity of the forest *road* project and as applicable to the specific task being undertaken, such that the *member's* primary work experience and responsibilities during that period would be in one or more of:

- field layout;
- design;
- construction;
- maintenance; and
- deactivation

The experience would include:

- a range of ground conditions and design complexity; and
- time spent with grade foremen and machine operators on work in forest *road* construction, maintenance and deactivation.

The *member's* experience should include working under the supervision or mentorship of a *member* seasoned in this area of practice.

Example Outcomes:

The following represents example outcomes that a competent *member or coordinating member* would be able to accomplish or generate for each of the *forest road activities*. These are summaries of selected tasks associated with various *road* activities. Refer to the appropriate sections in this document for fuller descriptions.

ACTIVITY	EXAMPLES OF OUTCOMES
Road layout	Carrying out field reconnaissance to lay out a *road* within a route corridor, reflecting: • applicable *road* design standards; • the complexity of terrain; • the size and complexity of stream crossings; and • the consideration of other resource values.
Road design	Preparing a geometric *road* design that: • incorporates cut and fill slopes appropriate for the site specific soils and conditions; • describes the expected performance of the various *road* sections, as part of risk management objectives; • describes any measures needed to address worker or user safety in consideration of the expected performance; and • reflects the equipment expected to be used for construction.
Road plan	Preparing a *road plan* that may incorporate: • *specialist* designs; • special construction methods; • restrictions for environmental and safety concerns; • construction survey controls; and • a requirement for frequent *field reviews* and a high level of supervision during construction.
Road construction	• Doing *field reviews* during *road* construction, documenting and communicating changed conditions, their implications for user safety and other impacts, and the need to amend the *road plan* accordingly. • After *road* construction, confirming that the works have been completed according to the intent of the *road plan* or with approved revisions.
Road use and maintenance	Where a *member* is retained or employed by a *licensee* to be responsible for maintenance of forest *roads*: • preparing SOPs and *road*-specific systems for conducting inspections and carrying out work or initiating reviews by *specialists* related to activities; and • carrying out work or initiating reviews by *specialists* to evaluate the suitability of an existing *road* section (*road* grades, surface conditions, etc.) for particular vehicle configurations and *road* surface conditions
Road deactivation	Where professional input is required: • develop SOP's that match practices to be followed with the existing *road* conditions; or • prepare a *road deactivation plan* and do *field reviews* of the work (or delegate *field reviews*) as appropriate during or following the site work considering the level of hazard, the risk to downslope values, and the complexity of terrain and *road* conditions

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APPENDIX 1 EXAMPLES OF ROLES AND RESPONSIBILITIES

It is important that the *licensee* understands the steps required to enable a *member* to be accountable for completed works; in particular, signing off on the applicable plan, and undertaking adequate *field reviews* during the site work.

Following are examples of the respective roles and responsibilities of those involved in *forest road activities.*

A *licensee* may employ or retain a *coordinating member* whose duties include planning through construction of forest *roads*. In these or similar cases, the *coordinating member* typically leads a team that may include other *members, specialists* and non-professionals.

In other cases, a *member* may be retained by the *licensee* or the *coordinating member* only for specific tasks, such as layout of a new forest *road*, or preparing a *road maintenance* or *road deactivation plan* for an existing forest *road*.

In all cases it is important that all parties clearly understand each of their roles and responsibilities related to the *forest road activities* that are being undertaken.

A *member*'s role could be one or more of the following:

- all *forest road activities* involving *road* layout, survey and design with the end product being a *road plan* ready to hand off to others for construction;
- specific aspects of a *road plan* as part of a team;
- all *forest road activities* from *road plan* through to and including construction; or
- *field review* and sign-off of *road* construction done under a *road plan* prepared by another *member*.

In order to fulfill *members*' obligations for professional accountability in these roles these guidelines require a *coordinating member*'s sign-off at two key stages:

- completion of the *road plan*; and
- completion of construction to confirm that the *road* was constructed in general conformance with the *road plan* and providing explanations of any changes from the *road plan*.

Similarly, for a *member* to be accountable for completed maintenance or deactivation works, professional sign-off is required for:

- completion of the *road maintenance* or *road deactivation plan;* and
- completion of maintenance or deactivation works done under the plan.

Refer to Sections 4.6 and 4.7.

Team Approach

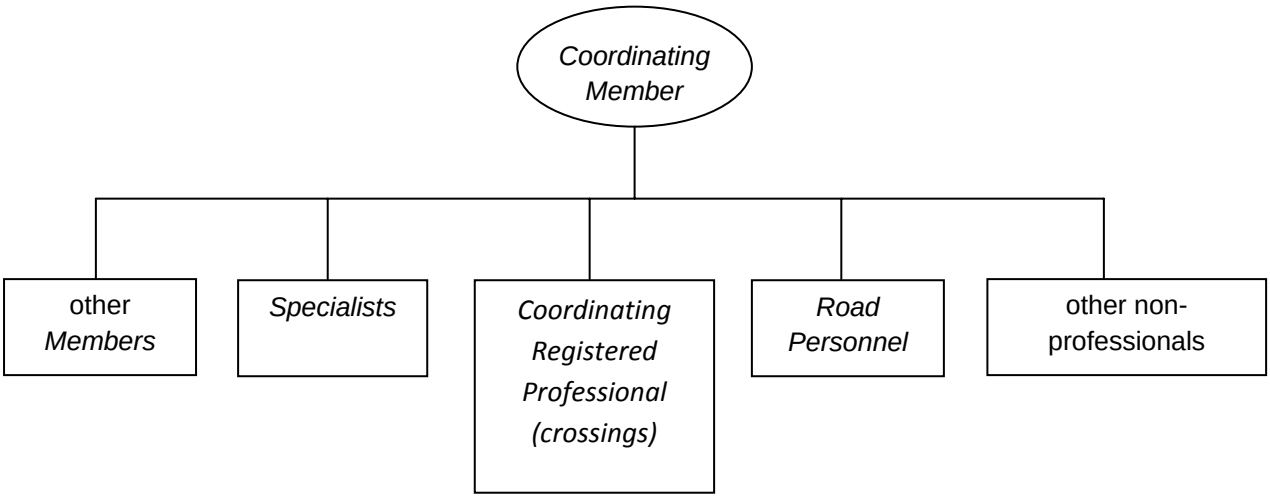
For a basic *road* (see Appendix 3), the *coordinating member* may undertake directly all tasks from layout through to and possibly including construction signoff.

Where more complex design is required or more challenging terrain conditions exist, professional practice may best be accomplished through a team approach (Figure 1). A team

would be led by a *coordinating member*. A *coordinating member* must have sufficient knowledge and experience to understand and coordinate all aspects of a *road plan*, and to make use of other team *members* as appropriate. Other team *members* might include: other *members, specialists* and *road personnel*. If a crossing structure is within the extent of the *road plan*, the team could also include a coordinating registered professional (see *Guidelines for Professional Services in the Forest Sector – Crossings)*.

Effective and timely communication among all team *members* is important in order to meet the objectives of the *forest road* project.

Figure 1. Example of team led by *Coordinating Member*



Coordinating Member

The *coordinating member* is responsible for the *road plan* (Section 4.3). This responsibility typically includes:

- informing the *licensee* of the steps required in order for a *member* to be responsible for the constructed works;
- maintaining communication with the *licensee* and among other team *members*;
- coordinating specific tasks including field layout, *specialist* assessments, surveys and design;
- retaining qualified *specialist*s to carry out assessments or design that are beyond the *coordinating member*'s area of expertise;
- incorporating *specialist* recommendations into design;
- checking that provisions of the *terrain stability management model* pertaining to *roads* are followed, if a *model* is in place;
- preparing and signing the *road plan;* and
- ensuring quality assurance and quality control *(*Section 5*)*

A *coordinating member* must be familiar with commonly accepted forest *road* design guidelines for different *road* types and categories of *road* uses.

The *coordinating member* is also responsible for *field reviews* and signoff of *road* construction (Section 4.5), though this may be a different individual than the one who prepared the *road plan*. It is preferable for the same *member* to have this role for both phases, but this may not always be practical.

The *coordinating member* may delegate tasks to others who work under his/her direct supervision (Section 2.4); or may rely on the work of other *members* who have the skill sets necessary to complete a task and take professional responsibility for it (Section 6).

The *coordinating member* should provide sufficient detail to *specialist*s or other team *members* commensurate with their level of expertise and the working relationships. For example, a *coordinating member* who oversees his/her own staff may provide less specific direction or detail because the staff *member* is familiar with standards and techniques normally used in the organization; whereas, if providing direction to a contractor consultant, more detailed information may be necessary.

When seeking advice from a *specialist*, the *coordinating member* is responsible for checking that the *specialist* is qualified and competent to give that advice and the advice given makes sense based on the *coordinating member*'s own personal knowledge.

The *coordinating member* responsible for *road* construction should establish a communication protocol with *road personnel* that provides for the *coordinating member* to be notified as soon as *road personnel* become aware of conditions different than expected in the *road plan* so that appropriate action can be taken (Section 4.5).

For *road maintenance* or *road deactivation plans* requiring other *members*' or *specialists*' involvement, a *coordinating member* may have a similar role to that for *road* construction. (Sections 4.6 and 4.7).

Other *Members*

The involvement of *members* is essential in many phases of *forest road activities*. Even where *members* are not the *coordinating member* they usually play a critical and supporting role. They typically complete *road* layout, carry out *road* surveys and designs, and record field observations that help determine whether a *TSA* is required.

Road Personnel

Road personnel can often provide input on local site and terrain conditions, such as bedrock hardness or soil behaviour, that is valuable for layout, geometric design and costs. As implementers, *road personnel* need to fully understand the assumptions and objectives in a *road plan*. They are the first to observe and encounter ground conditions on site. If ground conditions (reflecting material type, drainage conditions or slope stability assumptions) are different than those anticipated in the *road plan*, timely communication by *road personnel* to the *coordinating member* responsible for the *road* activity is essential. The *road plan*, or other related plans such as stream crossing plans, may need to be changed. Changed conditions can also affect worker or user safety, environmental impacts and project budgets.

Specialists

*Specialist*s are required when aspects of a *forest road activity* are beyond the expertise of the *member* responsible for the activity. A *specialist* may be a *member* in a specialized discipline or one with special knowledge or expertise in a particular subject area (such as a *terrain specialist*); or may be another type of professional. Terrain stability, geotechnical or retaining structure designs, archaeological inventories and fisheries management are a few examples of *specialist* services. In these guidelines, evaluating *road* suitability for vehicle configurations is also considered a *specialist* assessment.

*Specialist*s typically provide important input into a specific element of the *road* activity or project. In other instances where the *road* activity or project is complex, a *specialist* may have an expanded role, which may include project supervision.

APPENDIX 2 EXAMPLE OF CONFORMANCE CERTIFICATE

CERTIFICATE OF GENERAL CONFORMANCE

To be completed by the Coordinating Member on completion of road construction, maintenance works or deactivation.

Road section identification	**Title and date of *Road Plan*, *Road Deactivation Plan* or *Road Maintenance Plan***

Road Construction, Maintenance Works or Road Deactivation:

I confirm that:

- *field reviews** of this *road* section have been conducted by me or under my direct supervision; AND,
- the completed works are in general conformance with

☐ the above noted Plan dated _____ OR

☐ the Plan with amendments described in Schedule A attached *(attach documentation)*

Name of *Coordinating Member*: _____

Professional designation: _____

Signature, seal and date

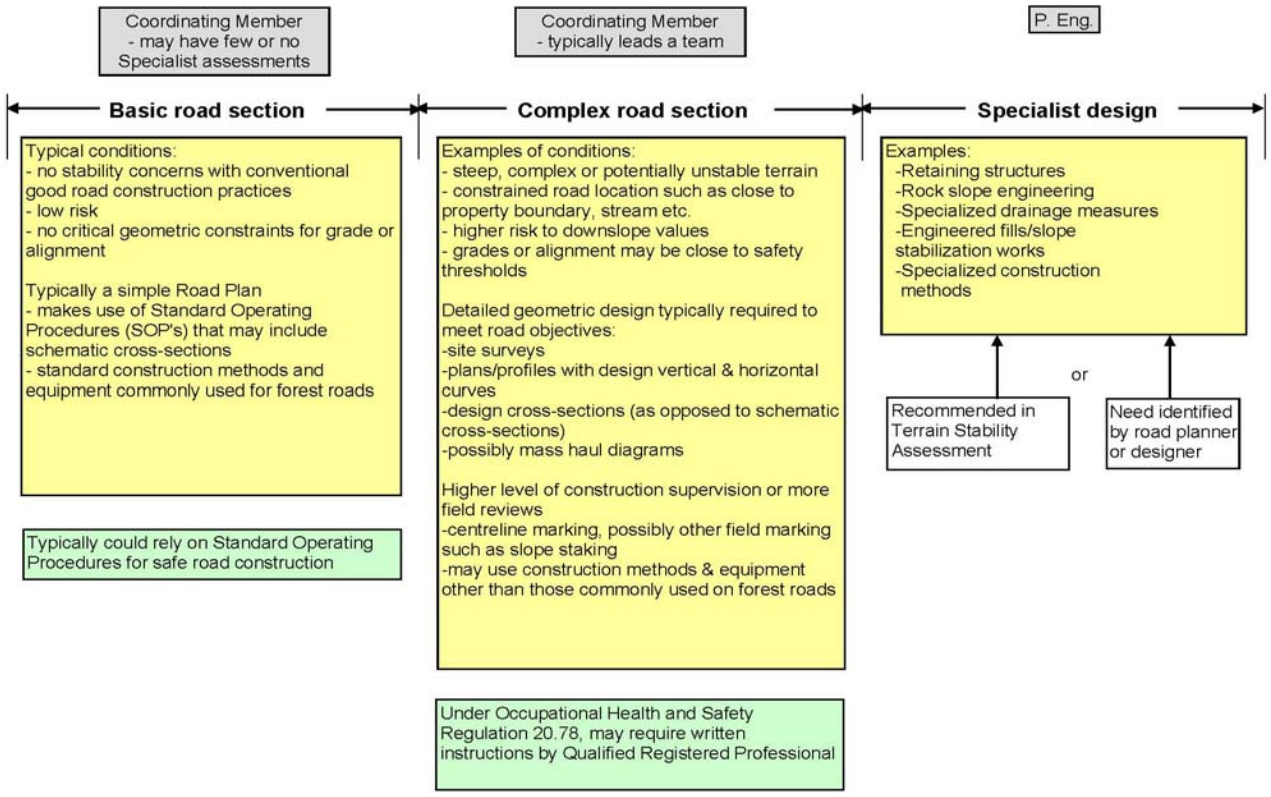
**Field reviews* means such reviews of the constructed works at the forest *road* project site considered necessary, in the *member's* opinion, to ascertain whether or not the significant aspects of the works are considered in general compliance with the *Road Plan, Road Maintenance Plan* or *Road Deactivation Plan*.

APPENDIX 3 FOREST *ROAD* COMPLEXITY

The level of detail and the type of information required for professional work related to forest *roads* depends on the complexity of the applicable *road* design, terrain, stream crossings, other resource values or other users. Forest *road* complexity may be different, or addressed differently, for Crown tenure, private forest land, community forests, community watersheds, or land within municipalities.

Road sections of varying complexity are typically identified in the layout stage (Figure 2).

Figure 2 -- Categories of Road Design



1. Basic *Road* Section

A basic *road* section is typically one with low risk, no critical geometric constraints, and in terrain with no stability concerns for conventional *road* construction practices. Construction can be done using standard construction equipment commonly used for forest *roads* and following SOP's. A basic *road* section may require few or no *specialist* assessments.

2. Complex *Road* Section

A complex *road* section may be on steep, complex or unstable terrain; may pose a higher risk to downslope values; may have an alignment constrained by proximity to property boundaries, streams or other features; or may have alignments or steep

grades approaching safety thresholds. Detailed geometric design is typically required in order to construct the *road* to the intended standard.

If alignment or vertical grades are approaching critical design limits such that geometric design and good construction control is required to meet design objectives, then the *road* section is a complex *road* section despite being on terrain with no stability concerns for conventional *road* construction practices.

(Note: geometric design may not be required to achieve design objectives for a *road*; however, it may be beneficial in order to optimize material movements and construction costs.)

A complex section may need to address issues such as terrain stability, visual objectives, fish streams, wildlife or cultural features, karst features, water quality for community water supply or other water users; and may need to have specific grade or crossing control points carefully established on the ground.

A complex *road* section may warrant more *field reviews* or a higher level of construction supervision, and may use construction methods or equipment other than those commonly used on basic forest *roads*.

3. Field Marking

At the layout stage, adequate field markings and controls should be established to enable proceeding to the next phase. This could range from marking a location for a basic *road*, to field centerline and control point markings for complex *roads*.

Complex *road* sections may need more detailed field markings for greater control of location and grade; or to incorporate *specialist* assessments. For complex *road* sections the next phase would typically be geometric design (Section 4.3).

4. *Specialist* Input

Typically, *specialist* input might include:

- evaluating potential safety issues that are beyond the expertise of the *coordinating member;* for example: landslides, rockfalls, avalanches, karst features, danger trees;
- designing structural elements such as retaining structures;
- assessing terrain related concerns for *road* construction such as slope stability hazards, gullies, fans, floodplains, erosion or avalanches;
- identifying fish habitat and sensitivity;
- assessments for or design of crossings; or
- identifying other resources (e.g. archaeological sites) or their sensitivity if required to be addressed in the *road plan.*