Interior Detailed Engineering Cost Estimate Procedures

Effective: July 1, 2016

Interior Appraisal Manual
(July 1, 2016)

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Approved By:

Steve Kozuki June 27/2016

Steve Kozuki, Date
Director, Timber Pricing Branch

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1 Engineered Cost Estimates – Administration Procedures

1.1 Authority

These procedures have been approved by the Director of Timber Pricing Branch. The *Interior Appraisal Manual* (IAM) requires that these procedures, as updated from time to time, be followed for the submission of a detailed Engineered Cost Estimate (ECE) in an appraisal.

1.2 Purpose

The purpose of the Interior Detailed Engineering Cost Estimates Procedures (Procedures) is to identify the requirements for submission and review of all detailed ECE in the Interior. The Procedures are intended to provide for the consistent and efficient application of the IAM and review of ECE's.

1.3 References to the Interior Appraisal Manual (IAM)

These procedures are prepared to provide guidance around the application and preparation of ECE as provided for in the IAM. When a discrepancy is identified between the IAM and the Procedures, the IAM will prevail. If required, Regional Timber Pricing Staff will provide clarification in these situations.

1.4 Roles and Responsibilities of Licensee and Ministry of Forests, Lands, and Natural Resource Operations (Ministry) Staff

Licensees and BCTS staff will:

- Ensure their ECE submissions are reasonable, consistent with the IAM, and meet the requirements outlined in these procedures; and
- Provide additional supporting documentation where the aspects of the project are beyond the normal experience for the type of project in the district and/or as requested by Ministry staff, in order to complete the review of an ECE and determination of a stumpage rate.

District staff may:

- Verify the eligibility of each ECE project submitted;
- Review the submission for completeness and ensure that it provides sufficient detail and meets the standards in the Procedures;
- Review any and all submitted reports, assessments and designs;
- Review construction equipment rates, productivity rates, and all unit costs to ensure they are reasonable for the site conditions or based on local knowledge;
- Verify the calculations submitted;
- Provide advice on questions of project eligibility to the licensee, or if required, forward details to Regional Timber Pricing Staff for interpretation; and
- Provide a recommendation for acceptance of the ECE with the appraisal to the Regional Appraisal staff.

Regional Engineering Staff, when requested by District and/or Regional Timber Pricing Staff, will:

- Provide advice on engineering practices, site conditions, productivities, or specific engineering projects;
- Provide assistance in reviewing submitted ECEs;
- Provide advice to Timber Pricing Staff on the eligibility of complex structures; and
- Assist with the ongoing updates to these procedures as and when necessary.

Regional Timber Pricing Staff will:

- Review the submission for eligibility, consistency with the IAM, and consistency of district review;
- Review requests for, and approve equipment rates for any equipment not listed in Appendix I of the IAM;
- Provide or identify training needs for district staff;
- Provide a decision on application of the highest stumpage principle for determining a rate;
- Provide interpretation on the eligibility of a specific project as requested by District Staff; and
- Consider and determine changes to the list of eligible Special and Complex Structures as outlined in these Procedures.

1.5 Application of Highest Stumpage Appraisal Principle to ECEs

Licensees should ensure the cost effectiveness of their engineered development costs. Where the Ministry questions the project based on consistency with the Highest Stumpage test in the IAM, the licensee will provide a rationale for their project selection. This includes any mitigating reasons that may impact consistency with the IAM.

2 Submission Standards

2.1 Methods for Determining Detailed Engineering Cost Estimates

There are three (3) methods for determining ECEs:

1. Public Tendering,
2. Detailed Calculations, and
3. Tabular Values, where available.

Tabular bridges, tabular culverts, or stabilizing material formulas must be used for cost estimates unless the project qualifies for a detailed ECE, or a public tender as per the IAM.

2.1.1 Public Tenders (Arm's Length Competitive Bids)

The licensee has the option of submitting the results of a public tender as an ECE for a specific project or a portion of the project. Licensees will be required to show the process used to tender the project. Due consideration will be given to an arm's length competitive bid for any specific project, not including those items that are ineligible.

2.2 General ECE Submission Requirements

The following general submission requirements are applicable to all ECEs. More detailed submission requirements are included with the specific ECE items in these procedures. All required supporting information related to the submission must be included for the ECE to be accepted for review.

The general submission requirements include the following:

- A project summary containing:
  - ECE Item (section 4.3.6) under which the project/section(s) qualifies,
  - Description of project and/or section works in sufficient detail to confirm eligibility for inclusion in the ECE submission;
  - ECE project identified by road name or number, location, and crossing names for structures;
  - ECE project location shown and highlighted on the appraisal map; and
  - ECE cost base year (refer to the Cost Year located on the first page of the effective IAM)
- For detailed ECE calculations, equipment used, equipment rates, productivities, hours, labour costs, and material costs all by project phase, including freight, applicable tax, mob and de-mob costs;
- Where earthworks form part of the ECE item, provide volumes of material by soil type in bank cubic meters (m^3);
- Professional prescriptions or reports when prepared and form an integral part of the design or ECE;
- Where required, an economic life cycle comparison of road or structures;
- Where required, a copy of the Legal Survey;

- Justification must be provided for multiple handling of right-of-way timber when required (i.e. single heading construction); and
- For log culverts, stumpage paid ONLY when the timber has been scaled and billed. Cost of transportation from the mill yard to the site can be included. Stumpage will not be an acceptable cost on-site for materials derived from the road right-of-way.

Sources of equipment productivity include Chapter 3 of the 1993 *BC Ministry of Forests Engineering Manual*, manufacturer productivity guides, and the *North Area Productivity Estimating Guide* (January 27, 2010).

Equipment rates from the IAM Appendix I should be used where available. Alternatively, the Blue Book matching the IAM Cost Base may be used for equipment that is not listed in Appendix I. Cost estimates for materials may be sourced from local quotes.

2.3 Pre-submission Review (prior to ECAS submission)

ECEs may be submitted to and reviewed by district FLNRO staff in advance of the cutting authority appraisal being submitted. Once reviewed and accepted, the ECE should then be submitted along with the future appraisal submission. ECE project or cost eligibility is governed by the IAM in effect on the submission date of the cutting authority.

2.4 Road Management Items

Items normally covered under Road Management in the IAM, if specifically required as part of the ECE project/item, can be included in the ECE. Sufficient information should be submitted to justify the inclusion in the ECE of any items normally covered under Road Management in the IAM.

For example, grass seeding to mitigate erosion during and as part of an ECE project is a legitimate cost to include with construction. Grass seeding as a separate activity is considered part of the road management cost estimate. Grass seeding cannot be submitted as a stand-alone item.

2.5 Projects on Roads Tenured to a Different Licensee

Where the licensee (Licensee A) holding the road permit does not foresee harvesting in an area, and where a second licensee (Licensee B) does intend to conduct operations, Licensee B may claim an ECE for an upgrade or reconstruction ECE.

In the case of a second licensee submitting an ECE, a copy of the road use agreement or sufficient documentation must be included. The road use agreement or documentation must clearly show that permission has been given to Licensee B by Licensee A (road permit holder) to conduct the engineered development works. Licensee A will not be able to claim the costs of the works conducted by Licensee B (on Licensee A's behalf) on future cutting authorities.

2.6 Survey and Design Standards

The level of the survey completed should be consistent with the complexity of the project and the level of detail required for the calculation of volumes. For example, for road construction through rock (>50%), a higher level of survey is required than for reconstruction of tabular roads. For bridges and major culverts, the level of site survey is outlined in the *Stream Crossing Guidelines*.

Costs for grade staking or slope staking may be included where tight survey control is required or recommended by the designer.

2.7 Mobilization and Demobilization

Costs for mobilization and demobilization may be included in the ECE if the equipment is not required for adjacent tabular or other ECE development projects.

2.8 Forest Management Administration

The IAM includes activities which are considered to be part of Forest Management Administration costs, and are directly related to the supervision and administration of those activities. Additional items related to an ECE project, which are considered as forest management administration costs that should not be included in the ECE are:

- Emergency transportation vehicles and first aid attendants
- Stream assessments for the determination of stream class for operating areas
- Supervisor or monitoring by an R.P.Bio. or Environmental Monitor.
- General bridge supervisor (non-complex structures).
- Any environmental protection works except those specifically listed below.

The following items are considered to be in addition to forest management administration and may be submitted as part of an ECE:

- Traffic control where justified based on traffic (public and/or industrial), location and nature of the road works.
- Site surveys and the production of a geometric road design.
- Terrain Stability Field Assessment (TSFA) and reports (i.e. Measures to maintain slope stability) completed by a qualified registered professional where required for the ECE.
- Site specific Environmental Management Plans (when submitted with the ECE).
- Stream diversion or isolation works where required as part of the approvals by Ministry of Environment or Fisheries and Oceans Canada, or by a Professional Engineer as part of the design.

2.9 Ineligible Costs

The following items are not acceptable in an ECE (list is not complete – other items may be ineligible):

- Harvesting operations (i.e. Felling, skidding, yarding, bucking, sorting)
- Landing construction, rehabilitation and reconstruction (excluding end haul)
- Pest control
- All post logging treatments
- Contractor overhead and profit, fringe benefits
- Three metre knockdown
- Log and scatter
- Landing burning (includes fireguards)
- Roadside debris piling and disposal
- Skid and back spar trail construction and rehabilitation/slashing
- Slashing
- Spur roads for ground skidding of less than or equal to 100 m length

Item A: Road Construction - Long Term Primary Access Roads

A.1 IAM ECE Item

New construction of long term, primary access road sections, with a finished running surface greater than 6 m wide, and agreed to by district engineering staff.

A.2 Application

This section applies to new construction only, where the proponent has clearly demonstrated to the district that the access road meets the requirement for long-term access.

A.3 Submission Content

The proponent will provide the following data to support the ECE:

- Where necessary, geometric road design, including plans, profiles and cross sections. The design must include relevant design notes, and identify the natural ground profile, final grade lines, road width, drainage structures, cut and fill slopes and soil types;
- Volume calculations, by soil type;
- Mass haul volume reports and diagrams to a measurable scale, complete with balance lines, direction of haul, and identified waste and borrow areas;
- Summary report for all drainage structures;
- Locations of borrow pits, gravel pits, rock quarries and/or waste areas complete with estimated volumes;
- Reference to designs and/or specifications for other structures, such as railway crossings and pipeline crossings when these structures are within the section but costs may be applied under another item;
- Copies of any documentation of requirements from other agencies that are relevant to the new construction; and
- Intersection design or specifications, if applicable.

A.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE.

The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item B: Road Construction - Uphill Side Slopes exceeding 50 Percent

B.1 IAM ECE Item

Road construction where the uphill side slope exceed 50 percent.

B.2 Application

The following is applicable to this ECE item:

1. The natural ground uphill side slope will be taken from measurements at cross-section stations along the section length in accordance with the IAM;
2. The natural ground uphill side slopes must be greater than 50 percent to qualify for inclusion in the ECE section length.
3. Slope percent for a road section can be calculated from an acceptable road design software package.
4. The natural ground uphill side slope greater than 50 percent must intersect the road prism cut to be considered.

B.3 Submission Content

The proponent will provide the following information to support the ECE:

- Geometric road design, including plans, profiles and cross sections. The design must include relevant design notes, and identify the natural ground profile, final grade lines, road width, drainage structures, cut and fill slopes and soil types for the entire road length proposed as an ECE;
- Volume calculations, by soil type;
- Mass haul volume reports and diagrams to a measurable scale, complete with balance lines, direction of haul, and identified waste and borrow areas;
- Summary report for all drainage structures; and
- Location of borrow pits, gravel pits, rock quarries and/or waste sites;

Cross-sections must identify the various grade breaks for road design and must show the complete road prism. The natural ground uphill side slope will be determined from the geometric road design.

B.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE.

The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations, but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item C: Road Construction - Rock exceeding 50 Percent

C.1 IAM ECE Item

Road construction where the rock exceeds 50 percent.

C.2 Application

Percent Rock is measured as per the IAM and applies to both tabular and ECE road sections.

Where estimates of rock volume from acceptable commercial road design programs are available for sections, that information may be used to estimate the percent rock.

The following methods may be used to estimate the height or depth of rock contained within the proposed road right-of-way:

- Assessment along proposed alignment by qualified registered professional (preferred method);
- Estimating the overburden depth (requires visible surface rock);
- Using adjacent roads constructed in similar materials; or
- Digging soil pits and/or examining blowdown to determine the depth of overburden materials.

C.3 Submission Content

The proponent will provide the following information to support an ECE:

- Geometric road design, including plans, profiles and cross sections. The design must identify the ground profile, final grade lines, road width, drainage structures, cut and fill slopes and soil types;
- Volume calculations, by soil type; and
- Mass haul volume reports and diagrams to a measurable scale, complete with balance lines, direction of haul, and identified waste and borrow areas.

C.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE.

The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item D: Road Construction - Terrain Class IV or V

D.1 IAM ECE Item

Road construction within Terrain Class IV and V.

D.2 Application

An interpretation of Terrain Class IV and V is provided below from the *Land Management Handbook Number 18 (*Chatwin et. al., 1994):

Class IV terrain is:

- Expected to contain areas with a moderate to high likelihood of slope failures following conventional road construction. Wet season construction will significantly increase the potential for slope failure.
- Where there is a moderate likelihood of slope failure in logged areas.

Class V terrain is:

- Where there is a high likelihood that slope failure will follow logging or conventional road building.

The identification of Terrain Class IV and/or V terrain will be determined through a Terrain Stability Field Assessment. The Assessment should include recommended site-specific actions to reduce and/or manage the landslide hazards and risks resulting from the road construction or development. From the Assessment, a prescription should be completed that outlines specific design requirements which must be included in the geometric road design.

D.3 Submission Content for Terrain Class IV and V

The proponent will provide the following information to support an ECE for Terrain Class IV and V:

- Geometric road design, including plans, profiles and cross sections. The design must include relevant design notes, and identify the ground profile, final grade lines, road width, drainage structures, cut and fill slopes and soil types;
- Volume calculations, by soil type;
- Mass haul volume reports and diagrams to a measurable scale, complete with balance lines, direction of haul, and identified waste and borrow areas;
- For Terrain Class IV and V, professional terrain stability assessment which clearly outlines the limits of the Class IV and V terrain with respect to road location; and
- For Terrain Class ECEs, the prescription outlining the measures to maintain slope stability for the ECE section.

D.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE. The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item E: Road Construction - End Haul

E.1 IAM ECE Item

End haul construction (of roads and landings) requiring removal by truck of excavated material to a separate area to avoid side casting on steep and/or sensitive sites.

E.2 Application

The following applies to this item:

1. Requirement for the road to be constructed by trucking out the material from the road/landing cut;
2. Requirement to haul the excavated material to a separate area from the end haul road section;
3. Requirement to avoid side casting on steep and/or sensitive sites within the section length;
4. Steep terrain or steep sites are defined as having a natural downslope equal to or greater than 60% measured from the outside edge of the road prism or where the angle of repose of the soil precludes its use as fill material in the road section;
5. Sensitive sites are defined as sites where the sidecasting of the excavated soil material would cause a material adverse effect on forest resources or increase the risk of slope failure; and
6. Where it is not feasible to move the material by a conventional push, gravel trucks will be considered in the ECE. Where a significant volume of material is required to be moved, consideration should be given to using multiple trucks to increase the loading efficiency.

E.3 Submission Content

The proponent will provide the following information to support an ECE for end haul construction:

- Geometric road design, including plans, profiles and cross sections. The design must include relevant design notes, and identify the ground profile, final grade lines, road width, drainage structures, cut and fill slopes and soil types;
- Volume calculations, by soil type;
- Mass haul volume reports and diagrams to a measurable scale, complete with balance lines, direction of haul, and identified waste and borrow areas; and
- Average road grade and distance to a separate area from the road section or the designated spoil site(s).

E.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE. The ECE may include the costs to move and waste the endhauled material to the nearest feasible waste or spoil area. This may also include utilizing the endhaul material, if applicable, as general fill at another location in the road.

The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item F: Road Construction - Overland

F.1 IAM ECE Item

Overland construction to provide a roadbed by trucking in material for extensive filling; see page 81 of the *Forest Road Engineering Guidebook* for a more detailed description.

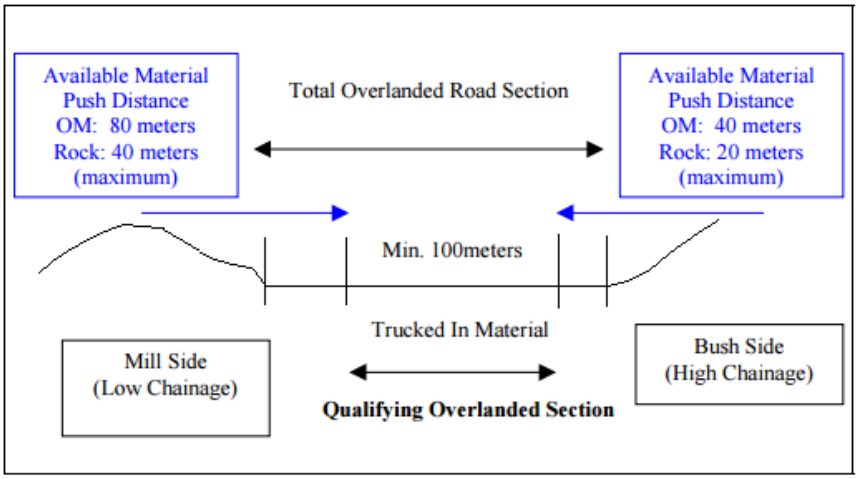
F.2 Application

The following applies to this item:

1. A requirement for the roadbed fill material to be trucked into the site; and
2. A requirement for extensive filling over undisturbed natural, thick organics and/or weak soils, or over shallow depressions on stable terrain with slopes less than 20%.

For road sections where the design includes a cut adjacent to an area of fill and these fill sections are within the average push range of crawler equipment; an ECE for overland construction is not permitted in the 'pushed' section. The qualifying ECE section is to be reduced by the volume of cut material available to the maximum push distance as described below. Average crawler equipment push distances are defined as:

	Low Chainage	High Chainage
Rock:	40 meters	20 meters
OM:	80 meters	40 meters



An ECE for overland construction may include costs for the following:

- Supply, transportation (truck), placement, spreading and compaction of fill material;
- Supply, transportation and installation of geo-synthetics;
- Installation of corduroy, puncheon and/or brush mats;
- Supply and installation of any culverts, if required; and
- Surfacing, if required and allowable. Where fill materials are considered suitable as surfacing material, no additional allowance for road surfacing is to be included with the ECE. If the fill material is not suitable as road surface material, the costs for road surfacing may be considered.

Overland construction does not apply to snow roads, including when snow is imported to the site.

F.3 Submission Content

The proponent should provide the following information to support an ECE for overlanding:

- Typical cross-sections and plan for overland section (including both the ECE and approaches);
- Volume calculations showing total volume required and any deductions for material pushed from adjacent road sections;
- A description of the underlying soil type or condition to justify the use of overlanding;
- The location of the designated borrow site(s); and
- Where the proponent proposes to utilize quarried rock for the fill material, the proponent must provide sufficient information to determine that the use of quarried material represents the least cost compared to importing organic material fill.

F.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE.

The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item G: Bridge Installations

G.1 IAM ECE Item

Bridges (including ice bridges) not included in the subgrade construction cost estimate, or represented in section 4.3.3.2 or 4.3.3.3 (tabular bridges). Eligible costs are described in section 4.3.6(10) of the IAM.

The *Detailed Regional Engineering Cost Estimate (ECE) Procedures* effective July 1, 2006, Item 6, may be used in the former Northern Interior Forest Region for generating, reviewing and approving detailed ECEs for installations of previously used structures on a new crossing or reinstallations of previously used structures on an existing crossing.

https://www.for.gov.bc.ca/ftp/rni/external/!publish/web/revenue/July12006ECE1.pdf

G.2 Application

The following applies to this item:

1. The supply and installation of new structures and the re-installation of a superstructure at a new site are both covered under this ECE item. The bridge structure type and span for a new structure should be based on the planned life span and designed standard of the road.
2. Removal costs for the purposes of re-installation of superstructure or substructure, including mob/demob to the new site, may be included (see G.4.1 below). These costs are applied when the structure is being proposed for re-installation at a new site, and not with the previous or initial installation. This is not considered deactivation but removal and transportation to a new site for installation.
3. General deactivation costs such as cleanup and rehabilitation of the site or the removal and disposal of other materials (not reused) are not allowed.
4. The construction of some log culverts is also included in this ECE section. This does not include single log abutment culverts with span lengths less than 3.5 metres, which are included in the tabular costs for subgrade construction.

G.3 Submission Content

The proponent will provide the following information to support the ECE:

- For the installation of a bridge, a site specific site plan and a general arrangement (conceptual design) which includes:
  - Sufficient information to review the suitability of the structure and the estimated cost, may include, but not be limited to:
    - High Water Mark (HWM) and Present Water Level (PWL);
    - Designed discharge;
    - Stream gradient, cross-section and velocity;
    - Stream bed materials;
    - Stream classification (note if default or classified);
    - Road centreline;
    - Natural ground profile, existing road profile (if applicable) and final road profile;
    - Bridge superstructure and substructure components;

- Extents and volumes and specifications for structural endfill and general bridge approach fills; and
- Extents, volume and class of rip rap.

For guidance and additional information regarding the completion of site surveys and bridge designs, both the Joint Practices Board's *Guidelines for Professional Services in the Forest Sector – Crossings* and Appendix E of the *Forest Service Bridge Design and Construction Manual* can be referenced.

G.3.1 Installation of previously used structures

All portable structures are required to be assigned a tracking number that is affixed to the structure at the time of initial installation. Any existing portable structures in use must also be assigned a tracking number and a list with the number and location submitted to the district.

G.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures.

Costs for the following items may be included in the ECE:

- Production of site specific site plan and general arrangement;
- Production of structural design drawings for new structures only;
- Purchase cost of bridge superstructure (only for new superstructures);
- Purchase cost of bridge substructure and associated components;
- Transportation (freight) for materials;
- For log culverts, costs for the production of logs into culvert material not including felling and skidding costs;
- Site preparation which may include the removal and disposal of existing bridge components (bridge replacement) and stripping and grubbing within the footprint of the endfill (new bridge);
- Superstructure installation;
- Substructure installation;
- For log culverts and log bridges, crib construction or sill log construction, where applicable;
- For bridges, supply, placement and compaction of structural endfills (volumes and materials as per design);
- For log culverts and log bridges, the supply, placement and compaction of structural endfill or backfill up to 15 metres from the crib;
- Development, supply and placement of rip rap or scour protection (volumes as per design);
- Identify location(s) of sources for select endfill and rock;
- For replacement of a culvert with a bridge, cost to re-establish the stream channel and stream bed;
- For bridges only, supply and installation of fenders, delineators, hazard markers and required signage;
- Supervision by a Professional Engineer (complex structures only);
- Certification by a Professional Engineer (as per Appendix 2);

- Installation and removal of a work bridge, where bridge construction equipment must cross the stream, and, the proponent shows that no in-stream crossing is feasible or permitted. This cost is not allowed if installation of the structure occurs, or should occur, commensurate with tabular road construction; and
- For the reinstallation of bridge components, costs may be included for the dismantling, transportation and re-installation at the new site for the reused components.

Costs for the following items will not be accepted in the ECE:

- General approach fills unless the bridge or log culvert length has been removed from the tabular road section.

G.5 Bridge Rentals

The cost estimate for the rental of bridge superstructures will be based on the current purchase price of the structure over the average lifespan of the superstructure. For portable bridges, the average lifespan will be taken as 15 years for the steel superstructure, 8 years for an untreated wooden deck or deck module, and 15 years for a treated deck or deck module. This would apply to all proponents that have the ability to purchase and re-use a portable superstructure, however, choose to rent a structure for other reasons.

Regional Timber Pricing Staff may accept a higher or market based rental price if he/she determines it would not be cost effective and/or feasible to purchase or re-use a portable structure and other construction options do not exist. A rationale must be provided by the licensee for the use of a rental bridge. It must include any mitigating reasons that may have implications on applying the least cost principle. The licensee must also provide supporting documentation (i.e. copies of quotes).

G.6 Supervision of Complex Structures by a Professional Engineer

The IAM allows a cost estimate for a Professional Engineer for the supervision of complex structures and the certification of bridges only. Complex and simple structures are defined in these Procedures and are outlined in Appendix 2 (Supervision and Certification Costs).

G.7 Certification of Bridges by a Professional Engineer

Costs for certification of a bridge will only be considered when completed by a Professional Engineer, regardless of the professional completing the design.

Item H: Bridge Maintenance or Upgrade

H.1 IAM ECE Item

Structural maintenance of bridges, substructure and cribwork.

H.2 Application

The following apply to this item:

1. Structural maintenance is the repair and/or replacement of a structural component or load bearing member of a bridge or the structural components of a major culvert.
2. Structural maintenance is limited to repair of, or replacement with, similar or comparable materials that meet the original design standard. Where structural changes are proposed that increase the design load rating or enhance the physical properties of a structure, those changes are considered an upgrade which is also administered under this item.
3. Structural maintenance includes:
    - Replacement of rip rap when volume exceed $50m^3$, and is specified by a qualified registered professional;
    - Repair or replacement of structural back-fill or endfill;
    - Repair or replacement of structural plates, for multi-plate structures;
    - Repair or replacement of structural components for non-structural plate structures, this includes replacement of failed (collapsed) pipe sections;
    - Repair or replacement of cross-ties;
    - Repair or replacement of log or timber cribs;
    - Repair or replacement of panels on ACROW® bridges;
    - Repair or replacement of foundation and/or bearing components;
    - Repair or replacement of concrete deck panels or structural steel deck panels, where repair is required on more than 10% of the deck area;
    - Any structural steel repairs as designed and recommended by a Professional Engineer, to maintain the current design loading;
    - Removal and re-installation of fill when done in conjunction with structural works; and
    - Replacement of timber decking, only where done in conjunction with cross-tie replacement.
4. Upgrade of structures includes:
    - Installation of new rip rap when volume exceed 50 cu. meters, and is specified by a qualified registered professional;
    - To increase the design loading replacement of cross-ties with a larger dimension;
    - Replacement of timber decks with concrete deck panels or structural steel deck panels, which result in an increase in either design life or design loading;
    - Any structural steel works as designed by a Professional Engineer, to increase the design loading;
    - Lengthening of existing major culverts, where justified;
    - Removal and re-installation of fill when done in conjunction with structural works; and

- Replacement of timber decking, only where done in conjunction with cross-tie replacement.

5. Structural maintenance and upgrade of structures does not include these items:

   - Replacement or repair of timber decking, unless associated with repair or replacement of structural components;
   - Repair, removal or replacement of gravel on gravel decked structures;
   - Repair or replacement of asphalt or concrete topping on bridge decks or approaches;
   - Replacement or repair of curb rails, risers or connectors;
   - Replacement or repair of approach guard rail systems (for example, fender logs or concrete no-posts);
   - Placement of less than $50m^3$ of rip rap; and
   - The repair or replacement of signs.

6. For maintenance and upgrade projects not explicitly stated in either of the above lists, the work should be referred to the Regional Timber Pricing Coordinator and Bridge Engineer for a decision as to whether the project qualifies for an ECE under this item.

7. Projects under this item will not be accepted where the required regular maintenance has not been undertaken or where a failure is caused by improper installation or use.

8. The requirement to replace or repair a structural component must be documented in an inspection by a qualified bridge inspector.

9. Where replacement of or upgrade to concrete deck panels or structural steel panels are proposed, the project details must be referred to the MFR for pre-approval.

10. The Regional Bridge Engineer, prior to the commencement of works, must approve all structural maintenance and upgrades on Forest Service Road bridges and major culverts. Where required by the Regional Bridge Engineer, the work may require design and/or supervision by a Professional Engineer. The costs associated with the survey, design and supervision in this situation will be allowed as part of the structural maintenance ECE.

11. Structural maintenance and structural upgrades should be carried out under the supervision of and follow a design prepared by a Professional Engineer (refer to Appendix 2). Where the services of a Professional Engineer are required for the design, supervision and/or certification of structural repairs, the fees for services will be accepted as part of the ECE.

12. H.3Submission Content

The proponent should provide the following information to support the ECE for structural maintenance or upgrade:

- Copy of the most recent documented inspection by a qualified bridge inspector indicating the condition of the structure;
- For structural repairs, specific details regarding the individual structural component requiring repair or replacement;
- Copy of drawings for repair, replacement or upgrade for those components requiring a design by a Professional Engineer; and
- When requested, copies of previous inspection reports with information regarding maintenance history of bridge component being repaired, replaced or upgraded.

H.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The ECE may contain all costs associated with the professional design, repair, replacement and upgrade of structural components and certification of the structural works. Supervision costs will only be included for works that are considered complex (refer to Appendix 2).

The allowable costs for an ECE for structural maintenance or upgrade of a bridge may include some or all of the cost components that are allowable for a new bridge construction. For the structural maintenance or upgrade of a major culvert, the cost components may include some or all of those listed for new construction of a major culvert.

Item I: Road Reactivation

I.1 IAM ECE Item

Road Reactivation activities necessary to re-open a road where there were no prior road management obligations.

I.2 Application

No prior road management obligations means where road management obligations never existed, or where the licensee has been relieved of their obligations (e.g. cancelled tenure or was never tenured by the applicant).

I.3 Submission Content

The proponent should submit sufficient information to substantiate the submitted ECE.

This may include a geometric road design, including plans, profiles and cross sections, for road sections requiring major reactivation.

I.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures.

All costs required to reactivate the road to the current standard are eligible for inclusion in the ECE.

The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item J: Road Reconstruction

J.1 IAM ECE Item

Reconstruction of roads and pertinent structures required to return the subgrade or structure to the standard that existed at the time of original construction. Cost estimates for reconstruction are not to exceed the tabular cost for new construction under similar conditions.

J.2 Application

The following apply to this item:

1. Reconstruction is defined as the re-establishment of the road prism to repair damage to the road resulting from natural forces or restoring the road carrying capacity to meet the design vehicle loads.
2. Reconstruction may be undertaken where an existing road is not capable of sustaining the design vehicle loads or where the operational function of the road has been lost. The operational function of a road may be impaired through either a major event (storm) or through the deterioration of the road or structure over time when maintenance obligations did not apply. Regardless of road maintenance agreements, the permit holder is responsible for the maintenance obligations for their permitted roads.
3. Reconstruction will not apply if there is a change in the physical road standard, such as an increase in the effective running surface width. A change in the road standard, such as increasing road width or realignment, is considered an upgrade and is administered under Item K of the Procedures.
4. The ECE for reconstruction resulting from natural forces, will reflect only those phase costs directly associated with the reconstruction. Unless justified, no costs will be reviewed for any work that is listed in section 4.4 of the IAM for Road Management.

J.3 Submission Content

The proponent should submit sufficient information to substantiate the submitted ECE. This may include a geometric road design, including plans, profiles and cross sections, for road sections requiring major reconstruction.

J.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures.

An ECE for road reconstruction may not exceed the value of new construction (tabular) under similar conditions. To determine the maximum allowable ECE value, the appropriate road group equation from section 4.3.2.3 of the IAM is calculated using the appropriate construction variables.

An ECE for subgrade reconstruction of a permitted road under this section may include all phases of construction and when justified, may include costs for work covered under Section 4.4 of the IAM for Road Management.

J.4.1 ECE Calculation for Reconstruction of a Non-Tenured Road

Where a licensee did not have road management (maintenance) responsibilities prior to the reconstruction works, the ECE should be submitted under Road Reactivation.

Item K: Road Upgrade

K.1 IAM ECE Item

Upgrade of roads and pertinent structures resulting in changes to the standard of the existing road and/or structure, including changes to the width of the running surface, horizontal and vertical realignment, additional culverts, lengthening of existing pullouts or adding additional pullouts where not required by the road standard or use of the road at the time of original construction. Blasting, or major switch back realignment is not restricted by the minimum 0.100 km section length requirement.

K.2 Application

The following applies to this item:

1. Upgrade of stand-alone structures such as bridges, major culverts and special structures are to be submitted under the applicable item in section 4.3.6 of the IAM.
2. The upgrade of a road may occur for several reasons, including:
    a. Development planning requires that the road access additional timber volumes, with the additional volume or longer haul distance necessitating a change to the physical standard of the road;
    b. Safety improvements, resulting in a change to the width, horizontal or vertical alignment, to address changes to the volume of traffic using the road, to address a known documented safety issue, or changes due to utilization of modern truck haul configurations.
3. Eligible costs may include additional culverts, larger culverts (when supported by a rationale e.g. hydrologist report, increased flows, etc.), lengthening or adding pullouts where not required by the road standard or use at the time of original construction, blasting, or major switchback realignment.
4. Blasting and switchback realignment are not constrained by the minimum 0.100km section length.
5. For a section that qualifies for road upgrade, items from the road management costs (section 4.4 of the IAM) may only be included where no maintenance obligations existed prior to the upgrade work being completed (refer to Section 2.4).

K.3 Submission Content

The proponent will submit sufficient information to substantiate the submitted ECE for the upgrade of roads. This information may include, but is not limited to:

- Rationale for the road upgrade, including all benefits that will be derived from the work;
- A geometric road design including plans, profiles and cross-sections (where required). The design must include relevant design notes, and identify the ground profile, final grade lines, road width, drainage structures, cut and fill slopes and soil types for the entire road length proposed as an ECE;
- Volume calculations and mass haul diagrams; and
- Location of borrow pits, gravel pits, rock quarries and/or waste sites.

K.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE (where required).

The ECE may contain all phases of construction, including road survey, layout and design, grubbing and stripping, subgrade construction, drainage construction and surfacing. It is not constrained by the road group construction equations but it must use the IAM subgrade variable definitions, tabular culvert costs for those sizes used in the ECE, and the IAM equipment and labour rates. Right of way logging activities do not form part of the ECE.

Item L: Road Surfacing - Placement of Stabilizing Material

L.1 IAM ECE Item

Placement of stabilizing material to an existing road with uninterrupted road section lengths of 0.3 km or more; regardless if the road was previously stabilized.

L.2 Application

The following applies to this item:

1. Each 300 meter section must be continuous or uninterrupted; otherwise it qualifies as road management under section 4.4 of the IAM.
2. This section applies to access roads that were initially surfaced and where the surface material has been lost due to extensive wear and tear or where stabilizing material was not previously used.
3. This ECE item does not include the replacement or recovery of gravel that should have been retained on the road surface through normal surface maintenance. Recovery of gravel from ditches is not considered replacement of gravel regardless of length. This situation is considered maintenance, as ditch cleaning and spot gravelling is not eligible where the licensee is responsible for road management.
4. The re-application of surface binding agents (e.g. CaCl, MgCl) to protect the integrity of existing surface material.

L.3 Submission Content

The proponent should provide the following information to support an ECE for replacement of running surface:

- Location of and haul distance to material sources.

L.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures.

Section 4.3.4 of the IAM may also be used to calculate the cost estimate.

Item M: Culvert Installations

M.1 IAM ECE Item

Culverts greater than 1.8 meters in diameter, or culverts greater than 30 meters in length regardless of diameter. The cost estimate includes all costs of transporting the culvert to the jobsite and all costs of installation of the culvert to the final subgrade stage.

M.2 Application

The following applies to this item:

- This section applies to culverts greater than 1800mm in diameter or equivalent to a corrugated steel pipe greater than 1800mm in diameter. This provides for the use of elliptical pipe culverts with an end area greater than an 1800 mm (2.54 m^2) round culvert.

M.3 Submission Content

The proponent must provide the following information, but not limited to, to support the ECE:

- A site specific site plan and general arrangement (for culverts greater than 1800mm) which includes:
  - Sufficient information to review the suitability of the culvert and the estimated cost of the structure:
    - Plan view and profile view of the watercourse;
    - High Water Mark (HWM) and Present Water Level (PWL);
    - Design discharge;
    - Stream gradient, cross-section and velocity;
    - Stream bed materials;
    - Stream classification (note if default or classified);
    - Road centreline;
    - Natural ground profile, existing road profile (if applicable) and final road profile;
    - Culvert dimensions and type;
    - Extents and volumes for foundation material and structural fill envelope;
    - Road subgrade volumes to the top of subgrade based on fill lines and extent of structural fill envelope; and
    - Extents, volume and class of rip rap.

M.4 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be volume based (bank m^3) for the earthworks portion, including rip rap, with the volume calculations shown on the site plan or general arrangement submitted with the ECE.

The ECE may include all costs associated with the design, purchase, transportation and installation of the culvert to the final sub-grade stage. Costs for the following items may be included in an ECE:

- Production of a site specific site plan and general arrangement;
- Purchase cost of culvert components;
- Transportation (freight) for materials;
- Mobilization and demobilization of specialized equipment;
- Site preparation;
- Temporary creek diversion, if required;
- Supply, placement and compaction of foundation (volume as per design);
- Supply, placement and compaction of structural fill envelope (volume as per design);
- Supply and placement of general fill for road subgrade (volume as per design);
- Development, supply and placement of rip rap or scour protection (volumes as per design);
- Identify location(s) of sources for select endfill and rock;
- For embedded culverts, the cost to re-establish the stream channel and stream bed through the pipe;
- Supply and installation of any roadside barriers, hazard markers or required signage; and
- Supervision by a Professional Engineer (complex structures only).

Item N: Road Surfacing - Placement of Specialized Materials

N.1 IAM ECE Item

Placement of stabilizing material to a new or existing road where geo fabric, corduroy, crushed and/or rock/gravel is used.

N.2 Application

The following applies to this item:

1. Additional stabilization is the placement of gravel or broken rock, corduroy or geo-synthetics in the road subgrade to provide stable support for a running surface for logging equipment using the road during the harvesting of tributary timber.
2. When the subgrade materials developed during construction are insufficient then additional stabilizing material must be trucked in from select borrow pits.

N.3 Submission Content

The proponent should provide the following information to support an ECE for additional stabilization materials:

- Rationale for the use of special materials for stabilization;
- Location of material sources;
- Depth and volume of material to be applied to the sections which are indicated on a map;
- Representative cross-section to support volume calculations; and
- Construction equipment employed, with estimated hours and rates.

Where the proponent applies for an ECE under this item, they are obligated to demonstrate that the materials developed, or that will be developed during sub-grade construction, and materials available in select pits (including quarries) are inadequate to stabilize the subgrade to meet the designed vehicle loads, without the use of special materials or processing.

N.4 ECE Calculation

An ECE for additional stabilization may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The ECE will be volume based (bank m^3) and the volume calculations based on the representative cross-sections submitted with the ECE.

The detailed ECE calculation may include all phase costs, except for supervision, including:

- Supply, transportation and installation of geo-synthetics or corduroy;
- Loading, hauling, placing and compaction of processed materials; and
- Pit development for ballasting.

Item O: Road Surfacing - Portable Platforms

O.1 IAM ECE Item

Placement of a portable platform to be used as a structural roadway.

O.2 Application

Temporary placement of a portable platform on top of the road subgrade to provide stable support for a running surface for logging equipment and log hauling equipment using the road during the harvesting of tributary timber.

O.3 Submission Content

The proponent should provide the following information to support an ECE for the placement of a portable platform to be used as a structural roadway:

- Rationale for the use of the portable platform;
- Cost estimate for the rental or purchase cost of the structural components;
- Cost estimate for the mobilization and demobilization of specialized equipment;
- Construction equipment and labour employed, with estimated hours and rates;
- Road sections where the portable platform will be used indicated on a map.

Where the proponent applies for an ECE under this item, they are obligated to demonstrate that the materials developed, or that will be developed during sub-grade construction, and materials available in select pits (including quarries) are inadequate to stabilize the subgrade to meet the designed vehicle loads, without the use of a portable platform.

O.4 ECE Calculation

The ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures.

The ECE may include costs for the following:

- Rental or purchase cost of the structural components,
- Transportation (freight) for materials;
- Mobilization and demobilization of specialized equipment;
- Labour and equipment costs for installation, removal, and cleaning of the structural components;
- Supply and installation of any roadside barriers, hazard markers or required signage; and
- If new road construction, then the tabular subgrade cost estimate from section 4.3.2.3 of the IAM.

If the access mats are being re-used, were previously already purchased, and the purchase cost has already been included in an appraisal from another cutting authority, then the purchase cost is not included in the ECE.

Item P: Special Structures

P.1 IAM ECE Item

Retaining walls, railway crossings and other special structures (such as multiple culverts, baffled culverts, arched culverts and other structures determined by the Timber Pricing Co-coordinator).

P.2 Application

The following applies to this item:

1. In addition to retaining walls and railway crossings, the costs for the design and construction of other special structures may be applicable under this item.
2. The current list of other approved special structures is below. This list may be updated from time to time by the regional timber pricing coordinators.
    - Arched Culverts (Bottomless Culverts)
    - Corrugated box culverts
    - Structural plate arch culverts
    - Structural plate pipe arch structures
    - Culverts manufactured with baffles
    - Culverts to be installed with either cast-in-place headwalls, pre-cast headwalls, reinforced geotechnical soil headwalls, or corrugated steel plate headwalls
    - Reinforced geotechnical soil systems for retaining walls and road embankments
    - Embedded culverts that meet the requirements of the *Fish Stream Crossing Guidebook*
    - New surfacing (asphalt or concrete) of bridge decks and approaches where pre-approved by the Regional Bridge Engineer. Does not include replacement or repair of previous surfacing materials.
    - Resurfacing projects using high fines, crushed gravel and calcium chloride (initial application concurrent with construction).
3. Special structures do not include those structures specifically identified in tabular cost estimates, section 4.3.2 in the IAM for example; culverts with an equivalent diameter up to 950mm, cattle guards, fencing and pipeline crossings.
4. Where the proponent proposes a change or addition to the list of Other Special Structures, the proponent must provide a rationale to the Regional Timber Pricing Coordinator for consideration under this ECE.

P.3 Railway Crossings

For railway crossings, the ECE will include the costs for the installation of the crossing, however, the cost for the road subgrade will be included in the tabular subgrade cost estimate (section 4.3.2.3 of the IAM) unless it qualifies under another ECE item. The ECE may include costs for the following:

- Production of a site plan and crossing design where required by the rail authority;
- Purchase cost of structure crossing components, including signs;
- Transportation (freight) for materials;
- Safety personnel as required for the rail authority; and
- Installation of the crossing components.

P.4 Reinforced Soil Systems for Retaining Structures and Road Embankments

The ECE for retaining walls and reinforced soil systems may include costs associated with the design, purchase, transportation and installation of the structure to the final sub-grade stage. The ECE may include costs for the following:

- Purchase cost of structure components;
- Transportation (freight) for materials;
- Mobilization and demobilization of specialized equipment;
- Supply, placement and compaction of foundation and structural fill (volumes as per design);
- Labour and equipment costs for installation of structure components;
- Supply, placement of general fill for road subgrade (volume as per design);
- Supply and installation of any roadside barriers, hazard markers or required signage; and
- Supervision by a Professional Engineer (complex structures only).

P.5 Other Special Structures

The ECE for the remaining Special Structures in P.2.(2) above may include all costs associated with the design, purchase, transportation and installation of the structure to the final subgrade stage. The ECE may include costs for the following:

- Purchase cost of structure components;
- Transportation (freight) for materials;
- Temporary creek diversion, if required;
- Supply, placement and compaction of foundation (volume as per design);
- Supply, placement and compaction of structural fill envelope (volume as per design);
- Supply and placement of general fill for road subgrade (volume as per design);
- Supply and placement of rip rap or scour protection (volumes as per design);
- Supply and installation of any roadside barriers, hazard markers or required signage; and
- Supervision by a Professional Engineer (complex structures only).

P.6 Submission Content

The proponent should provide the following information to support an ECE for special structures:

- For retaining walls and reinforced geotechnical soil systems, a geometric road design and a detailed design for the proposed structure;
- For railway crossings, copies of any crossing plan, any documentation from the rail authority including certification, and invoices for work by rail authority;
- For stream crossing structures, a site plan and general arrangement (see ECE Item K for content requirements);
- For all embedded culverts regardless of culvert diameter, a detailed design indicating level of embedment and volumes of materials required to meet *Fish Stream Crossing Guidebook*;
- Volume calculations by soil types;
- Mass haul volume reports and diagrams to a measurable scale, complete with balance lines, direction of haul, and identified waste and borrow areas, if applicable;

- List of required materials and components; and
- Any professional prescription completed which substantiates the requirement for a special structure.

P.7 ECE Calculation

An ECE may be determined either by a detailed ECE calculation or through a public tender as outlined in Section 2.1 of the Procedures. The detailed ECE will be volume based (bank m^3) for the earthworks portion(s) with the volume calculations shown on the design submitted with the ECE.

Item Q: Road Construction - Road Group 1

Q.1 IAM ECE Item

New subgrade construction and ballast cost estimate in Road Group 1 are determined using the methodology outlined in the *Interior Detailed Engineering Cost Estimate Procedures*.

Q.2 Application

New Road Subgrade Construction

Where the physical dimensions and conditions of the new road subgrade construction fall within the tabular limits set out in section 5.3.3 of the *Coast Appraisal Manual* (CAM), a tabular cost estimate will be made using the applicable bankheight tables, formulas and procedures in the CAM.

Tabular road subgrade construction cost estimates in the CAM do not include pipe culverts (including those under 0.95 m diameter and all single log abutment culverts up to 3.4 m).

Where the physical dimensions and conditions of the new road subgrade construction do not fall within the tabular limits set out in section 5.3.3 of the CAM, a non-tabular cost estimate may be used for the kinds of new road subgrade construction listed in subsection 5.3.1.1(4)(a). The detailed ECE procedures outlined in this document must be followed (i.e. not the methodology and procedures in the CAM and the *Detailed Engineered Cost Estimates for Coast Appraisals*).

Culverts

All pipe culverts must use the IAM methodology and procedures for a cost estimate in an appraisal.

All single log abutment culverts with spans less than 3.5 meters must use the CAM section 5.3.3.2.3 (2) for a cost estimate in an appraisal.

Bridges

All non-log bridges must use the IAM methodology and procedures for a cost estimate in an appraisal.

All log bridges must use the CAM section 5.3.3.2 for a cost estimate in an appraisal.

Ballast

Where trucking of ballast material is required for a section of tabular road and the source of the ballast is greater than 3.2 kilometers away, the methodology and procedures in CAM appendix VIII.3 and VIII.4 may be used for a cost estimate in an appraisal.

Capping

Where capping is required as defined in CAM Appendix VIII.5, refer in this case to the *Detailed Engineering Estimates for Coast Stumpage Appraisal*, (February 1, 2001, and amended Sept. 1, 2002), Surfacing, and Capping.

Q.3 Submission Content

The licensee is to submit a completed Tabular Roads (Bankheight Method) Field Data Entry Sheet (Bankheight data field entry sheet Apr 19 2006 v 2.xls) which can be accessed at the following link.

https://www.for.gov.bc.ca/ftp/rni/external/!publish/web/revenue/Bankheight%20data%20field%20entry%20sheet%20Apr%2019%202006%20v%202%20.xls.

Alternatively this spreadsheet can be found on the Northern Interior Forest Region (NIFR) website under Revenue and Timber Pricing, Forms and Procedures (www.for.gov.bc.ca/rni/NIFR_Revenue/index.htm).

Q.4 ECE Calculation

In addition to the Tabular Roads (Bankheight Method) Field Data Entry Sheet, a Tabular Roads (Bankheight Method) recording/costing spreadsheet is to be submitted (Bankheight cost calculation sheet, revised April 19, 2006.xls) which can be accessed at the following link.

https://www.for.gov.bc.ca/ftp/rni/external/!publish/web/revenue/Bankheight%20cost%20calculation%20sheet%20revised%20April%2019,%202006.xls

Alternatively this spreadsheet can be found on the NIFR website under Revenue and Timber Pricing, Forms and Procedures (www.for.gov.bc.ca/rni/NIFR_Revenue/index.htm).

Note: The Bankheight cost calculation spreadsheet was built for internal use only. The Ministry is not responsible for any errors in the cost submission.

Item R: Forwarding Roads

R.1 IAM ECE Item

The costs of designing and construction a forwarding road, where the Regional Timber Pricing Coordinator is satisfied that when included in an appraisal, it will result in that appraisal producing the highest stumpage rate. A forwarding road is not a trail but a road built to a designed standard which includes stripping, grubbing, stumping and primary excavation to establish subgrade that is used for transporting crews and equipment and forwarding timber but not for hauling logs.

R.2 Application

Where terrain or site conditions do not require a detailed design, tabular estimates are acceptable.

R.3 Submission Content

The proponent will provide the following information to support an ECE, where required:

- Geometric road design, including plans, profiles and cross sections. The design must include relevant design notes, and identify the ground profile, final grade lines, road width, drainage structures, cut and fill slopes and soil types;
- Volume calculations, by soil type;
- Mass haul volume reports and diagrams to a measurable scale, complete with balance lines, direction of haul, and identified waste and borrow areas;
- Geotechnical reports and designs if required; and
- Least cost rationale.

R.4 ECE Calculation

The ECE may be determined by either a detailed ECE calculation or through a public tender as outlined in section 2.1 of the Procedures. The ECE will be calculated based on the volumes included in the geometric road design submitted with the ECE.

APPENDICES

Appendix 1: Definitions

Arm's length: Of or relating to dealings between two parties who are not related or not on close terms and who are presumed to have roughly equal bargaining power; not involving a confidential relationship. An arm's length transaction does not create fiduciary duties between the parties.

Abutment Height: Measurement taken as the difference in elevation from the underside of the footing to the underside of the girder or stingers.

All-Steel Portable Bridges: Constructed entirely of steel utilizing both steel box girders and a steel deck. Decks usually come with a coating to allow for traffic-ability. The ministry doesn't accept the use of all-steel portable bridges on its Forest Service Roads used for industrial purposes.

Chainage: Low chainage is on the Point of Commencement (POC) direction, start of the road. High chainage is on the Point of Termination (POT) direction, end of the road.

Composite Bridge: Constructed of steel or concrete girders with steel or concrete decks. Visually, they look much like a non-composite bridge, except that the girders will likely have less cross-sectional area for a given span. In a composite bridge, the deck is continuous with individual panels welded or grouted to each other. In addition, the deck is intimately connected to the girders. Only Professional Engineers are permitted to design composite bridges.

Concrete Slab Girder Bridge: Constructed using reinforced concrete slabs or girders. They are usually solid and rectangular in cross section. Due to problems with cracking and weight, they are usually limited to short spans of 12 metres or less.

ECE Cost Base: For planned projects, use the Cost Base of the IAM in effect at the time of submission; if the project is completed prior to submission, use the Cost Base of the IAM in effect at the time the majority of the work was completed on the project; for reappraisals, if the reappraisal effective date is the day after the original effective date, use the same Cost Base of the IAM that was in effect at the time of the original submission.

Geo-synthetics: Includes woven and non-woven geofabric, geogrid and geoweb.

Log Culverts: Constructed using log stringers on either a single log sill or log crib. Log culverts are constructed with a minimum 300mm depth of gravel over the stringers that form the running surface. Designs usually utilize pre-existing tables developed by a Professional Engineer.

Log Bridges: Constructed using log stringers on log cribs or a single sill log. Log bridges differ from log culverts in that no gravel or fill is placed over the stringers to form a running surface. Log bridges may utilize either in-place timber deck on cross-ties or modular deck panels. Designs usually utilize pre-existing tables developed by a Professional Engineer.

Non-composite Bridge: A bridge constructed with steel girders with either timber or concrete decks. In the case of a concrete deck, the deck can be bolted, clipped or grouted to the girders. The deck on a non-composite bridge does not act as a load-sharing member; the vehicle loading is completely supported by the girders.

Other Materials (OM): includes all soil types which do not require drilling, blasting or ripping, or the use of special equipment for excavation. Instead, material is excavated using equipment such as crawler tractors, hydraulic excavators, scrapers and rubber-tired loaders.

Permanent Bridge: Bridge structure that has a planned installation period of at least 15 years.

Pre-stressed Concrete Box Girders: Rectangular in cross-section with a hollow rectangular shape in the center. These girders are pre-stressed in a shop and are lighter than concrete slabs of equal span because of the reduced cross-section. These girders can be up to 18 meters in length.

Pre-stressed Concrete I-girders: Pre-stressed concrete girders in a similar shape as steel I-beams. A bridge constructed with pre-stressed I-girders is always considered composite. They are used for larger spans and long-term structures.

Portable Bridges: Bridge superstructure designed and fabricated to be re-installed more than once. May be used in temporary or permanent installations based on planned service life. May include a professionally designed portable bridge to be installed over top of an existing, stable log crib.

Post-tensioned Bridge Components: Post-tensioning is the same principle as pre-stressing. The post-tensioning is usually done in the field, where a series of concrete components are required to be joined together longitudinally. The components are set in place and cables are then inserted through pockets longitudinally and tensioned. Once tensioned, grout is inserted into the pockets and allowed to cure. Once cured, the cables are released of tension and the system has been post-tensioned.

Pre-stressed Bridge Components: For pre-stressed components, the reinforcing steel is put under tension before the concrete is poured. After the concrete is cured, the tension on the steel is released and the tension portion of the concrete is under compression.

Seasonal Bridge: Bridge structure installed for less than one year and generally not designed to pass a Q100 flood event. Includes bridges built with snow fills, single log sills or log bundles.

Single Heading Construction: When pilot trail construction is <u>not</u> practical due to conditions such as shallow soil to bedrock and/or lack of timber to support pilot trail. Justification of single heading construction must be provided.

Temporary Bridge: Bridge structure that has a planned installation period of less than 15 years.

Work Bridge: Temporary crossing installed to allow for the movement of bridge construction equipment necessary to complete the installation of a temporary or permanent bridge.

Appendix 2: Supervision and Certification Costs

Supervision of Construction

The IAM provides for inclusion of costs related to supervision by a Professional Engineer of complex structures construction. Structures that qualify for consideration as complex are listed below (Structures Considered Complex for the Purposes of Inclusion of Costs of Supervision by Professional Engineers in ECEs and appraisals).

The list below is not exhaustive. For an interpretation of whether a structure is considered complex, please contact the Regional Timber Pricing Coordinator.

Structures Considered Complex for the Purposes of Inclusion of Costs of Supervision by Professional Engineers in ECEs and appraisals:

- Composite concrete bridges.
- Multiple span bridges: simple span and continuous.
- Major culverts (>1800mm in diameter or with flows >6m^3/sec).
  Density testing of the compacted structural backfill must be completed using standardized testing methods. The results of these tests, including testing methodology, must be retained and available for certification. The extent of structural backfill and the specifications (including minimum density requirements) must be shown on the design drawings.
- Non-composite bridges with spans greater than 24 metres (bearing to bearing) and/or an abutment height (above ground) greater than 5.4 metres.
- Bridges comprised of pre-stressed and post-tensioned concrete beams and girders.
- Any structure that incorporates a bolted or welded field splice in the girders.
- Any structure placed on piles, or not identified in the Simple Structures listed below.
- Any structure not identified as a Simple Structure (in the Procedures).
- Complex road structures are limited to road sections that require a Qualified Registered Professional for a design. This would be limited to retaining walls, reinforced earth/soil systems, or special construction methods for areas where a Terrain Stability Assessment is required. Gravel or rock berm walls do not fall under the definition of a retaining wall or elaborate construction as these are usually a slope stabilizing solution.

The general supervision of simple structures in not an allowable cost estimate in an ECE; regardless of whether the supervision is by a professional or non-professional. The list below includes structures, which are considered to be simple, therefore not eligible for supervision cost estimate in ECEs and appraisals.

This is not to imply that supervision of simple structures is not required. The distinctions between simple and complex structures are made solely to determine eligibility for inclusion of costs for supervision within ECEs and appraisals.

The list below is not exhaustive. For an interpretation of whether a structure is considered simple, please contact the Regional Timber Pricing Coordinator.

Structures, which are considered simple, and therefore ineligible for inclusion of supervision costs in ECEs and appraisals:

- Tabular structures, including culverts ≤1800mm in diameter or <6m^3/sec design flow.
- Single span non-composite structures up to and including 24 metres in length (bearing to bearing) for both wood and concrete decks.
- Non pre-stressed concrete slab bridges.
- Abutment systems constructed of any of the following:
  - Lock block walls up to two courses high under the pile cap or girders,
  - Log cribs up to 5.4 metres high,
  - Bin wall structures up to 1.6m in height,
  - Pre-cast concrete footings with steel pipe columns,
- Log, mud sills or concrete sleepers.
- Placement of additional stabilizing on a road subgrade.

Definitions of Supervision and Certification Cost Estimates

Supervision:

The IAM allows a cost estimate for a Professional Engineer for the supervision of complex structures and the certification/assurance of bridges only.

Supervision of a structure includes the general supervision of the construction for those structures or components that are identified as complex in the list above (List of Structures Considered Complex for the Purposes of Inclusion of Costs of Supervision by Professional Engineers in ECEs and appraisals). Visits by a Professional Engineer for certification are to verify those critical aspects of the construction are in general conformance to the design. This would include inspection of subsurface components such as footings, structural fill, bridge components, bridge elevation and alignment, and construction of the bridge.

The supervision of complex structures is not constrained to a maximum number of days, but will be based on the project size, project components and complexity. The number of days allowed for supervision will be for only those portions of the project that requires supervision by a Professional Engineer as opposed to general project supervision. If requested by district or regional staff, the proponent must provide documentation to justify the number of days estimated for supervision or certification.

Bridge Certification:

Certification of bridges at the time of fabrication is an eligible ECE item. For bridges which are designed for re-use, this cost estimate would be included on the first installation, as part of the bridge purchase cost, and not included on re-use.

Certification/Assurance of installed bridges by a Professional Engineer is restricted by the IAM to a maximum of three field trips unless otherwise approved by the Regional Timber Pricing Coordinator (or when approved in writing, by the Regional Bridge Engineer). Request for additional field trips should be made through the District Engineering Officer who will forward the request to the Regional Timber Pricing Coordinator. The length and number of trips should coincide with the project phases that must be viewed by a Professional Engineer to certify the bridge to the design. The certification cost estimate may include additional office time for the completion of the report or as-built drawings as dictated by the project.

Appendix 3: Calculation of Slope Percent for an ECE Road Section

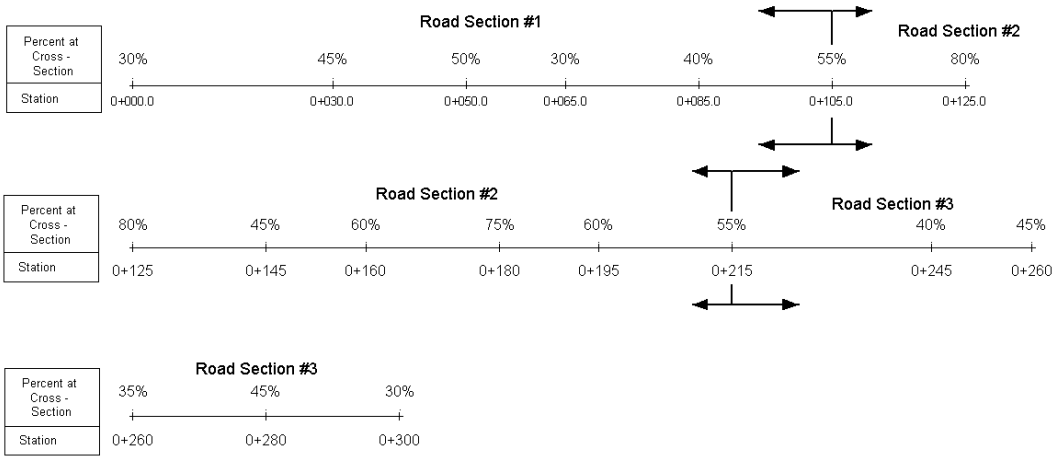
Slope percent for an ECE road section is calculated by the formula:

$$\text{Percent (\%)} = \frac{[X_1 (10 + 0.5d_1) + X_2 (0.5d_1 + 0.5d_2) + \ldots + X_{(n-1)} (0.5d_{(n-1)} + 0.5d_n) + X_n (0.5d_n + 10)]}{D}$$

Where:
D is the ECE road section length
d is the distance between cross-sections
d_1 is the distance from the first cross-section to the next
X is the slope % at each cross-section along the road
X_1 is the slope % at the first qualifying cross-section.

As shown in Figure A-3-1, the section length will be comprised of only those cross-sections that meet the slope criteria. The start and end of the ECE section is half the distance to the preceding or following cross-section to a maximum of 10 metres. This is based on an industry standard of a maximum spacing of 20 metres between cross-sections in rock or steep terrain.

Figure A-3-1. Example for determination of qualifying cross-sections for uphill side slope.



In Figure A-3-1, the ECE section starts at 0+095 and ends at 0+225. The tabular road sections include from 0+000 to 0+095, and from 0+225 to 0+300. The following sample calculation calculates the average side slope percent for the qualifying road section (Road Section #2).

Example Calculation of Side Slope Percent (%) for Road Section #2

= [55% (10 + 0.5*20) + 80% (0.5*20+0.5*20) + 45% (0.5*20+0.5*15) +
60% (0.5*15+0.5*20) + 75% (0.5*20+0.5*15) + 60% (0.5*15+0.5*20) +
55% (0.5*20 +10)] ÷ 130

= [55% (20m) + 80% (20m) + 45% (17.5m) + 60% (17.5m) + 75% (17.5m) +
60% (17.5m) + 55% (20m)] ÷ 130m

= 80m ÷ 130m

= 62%

Appendix 4: Calculation of Rock Percent for a Road Section

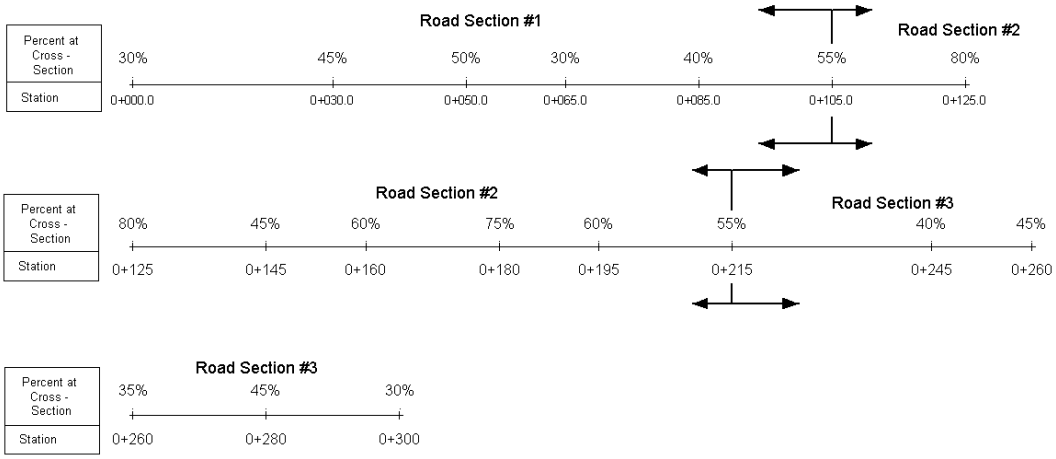
Rock percent for a road section is calculated by the formula:

$$\text{Percent (\%)} = \frac{[X_1 (10 + 0.5d_1) + X_2 (0.5d_1 + 0.5d_2) + \ldots + X_{(n-1)} (0.5d_{(n-1)} + 0.5d_n) + X_n (0.5d_n + 10)]}{D}$$

Where:
D is the ECE road section length
d is the distance between cross-sections
d_1 is the distance from the first cross-section to the next
X is the rock % at each cross-section along the road
X_1 is the rock % at the first qualifying cross-section.

As shown in Figure A-4-1, the section length will be comprised of only those cross-sections that meet the slope criteria. The start and end of the ECE section is half the distance to the preceding or following cross-section to a maximum of 10 metres. This is based on an industry standard of a maximum spacing of 20 metres between cross-sections in rock or steep terrain.

Figure A-4-1. Example for determination of qualifying cross-sections for rock percent



In Figure A-4-1, the ECE section starts at 0+095 and ends at 0+225. The tabular road sections include from 0+000 to 0+095, and from 0+225 to 0+300. The following sample calculation calculates the average rock percent for the qualifying road section (Road Section #2). As the ditch depth may impact whether a section qualifies for an ECE, the ditch depth used to calculate rock height should not exceed 0.5m as measured from the top of sub-grade.

Example Calculation of Percent Rock (%) for Road Section #2

= [55% (10 + 0.5*20) + 80% (0.5*20+0.5*20) + 45% (0.5*20+0.5*15) +
60% (0.5*15+0.5*20) + 75% (0.5*20+0.5*15) + 60% (0.5*15+0.5*20) +
55% (0.5*20 +10)] ÷ 130

= [55% (20m) + 80% (20m) + 45% (17.5m) + 60% (17.5m) + 75% (17.5m) +
60% (17.5m) + 55% (20m)] ÷ 130m

= 80m ÷ 130m

= 62%

Appendix 5: References

Chapter 3, 1993 *Engineering Manual*

https://spc-flnr.gov.bc.ca/sir_rtp/RSI%20DirectionGuidelinesInterpretationProcedures/Forms/AllItems.aspx?RootFolder=%2Fsir%5Frtp%2FRSI%20DirectionGuidelinesInterpretationProcedures%2FIAM%20Sec%204%2E3%2DDevelopment%20Cost%2FECE

North Area Productivity Guide

http://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/interior-timber-pricing

North Area Detailed Engineering Procedures (in effect for used bridge installs only)

https://www.for.gov.bc.ca/ftp/rni/external/!publish/web/revenue/July12006ECE1.pdf

Forest Road Engineering Guidebook

https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/road/fre.pdf

Guidelines for Professional Services in the Forest Sector – Forest Roads

https://www.apeg.bc.ca/getmedia/b76d39fb-f39c-4939-8bc7-2c48013c4895/APEGBC-Guidelines-Professional-Services-Forest-Roads.pdf.aspx

Guidelines for Professional Services in the Forest Sector – Crossings V.2

https://www.apeg.bc.ca/getmedia/97dcbad3-5482-416a-9bc0-55b3c662e71a/APEGBC-Guidelines-for-Forest-Sector-Crossings.pdf.aspx

Land Management Handbook Number 18

https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/Lmh18.pdf

Brushing/Ditching template

http://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/interior-timber-pricing