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August 21, 2014

**BY EMAIL**

To: Regional Executive Directors, Ministry of Forests, Lands & Natural Resource Operations

**Re: Amendment No. 2 to the 2014 Cruising Manual**

The purpose of the memo is to inform you that Amendment No.2 to the 2014 *Cruising Manual* becomes effective August 21, 2014.

The manual will be available on the internet at the following link:

<http://www.for.gov.bc.ca/hva/manuals/cruising.htm>

Please find a copy of the Amendment No. 2 highlights attached.

Comments or questions about this manual should be referred to Beth Eagles, Cruising Policy Forester, Timber Pricing Branch at (250) 387-8307 or Don Rorison, Cruising Projects Specialist, Timber Pricing Branch at (250) 356-7674.



Murray Stech  
Director  
Timber Pricing Branch

Attachment

pc: Dave Spinks, Regional Cruising Officer, Cariboo, Thompson/Okanagan & Kootenay/Boundary Regions  
Ron Alton, Cruising Specialist, Northeast, Omineca & Skeena Regions  
Ron Mecredy, Cruising & Waste Specialist, West Coast & South Coast Regions

## August 2014 Cruising Manual Changes (Amendment No. 2)

Section	Description
<b>Chapter 1 – Definitions</b>	New definitions have been added for the following terms: bole, mean difference of hits (MDH), orphan tree and single stem.
<b>2.3 – Sampling Error Objectives</b>	Typographical error corrected.
<b>2.4.1 – Standards for the Location of Plots Using a Grid</b>	Clarification that all possible sample points that can be established in the net merchantable area must be cruised, whether or not they were included in the original cruise plan.  New statement: If the cruise plan is designed to waive sampling error as per the requirements of Section <u>2.3.1</u> , the count to measure ratio requirement will be waived if the grid design is consistent with Section <u>2.4.1</u> and the grid spacing and trees per plot are consistent with Section <u>2.3.1</u> .
<b>2.5.3 – Cruising Patch Cut Silviculture Systems</b>	Change of wording from “appraisal allowance” to “appraisal cost estimate”.
<b>Figure 2.2</b>	The patch cut diagram has been updated to ensure two cruise plots are within each patch greater than or equal to 1 ha.
<b>Figure 2.3</b>	The Cruise Tally Sheet example has been changed to allow the dbh field in the header to indicate the actual dbh limit used, which is not necessarily the merchantability specifications. If the correct merchantability specifications are entered in the Map Area Statement of the compilation program, only the stems greater than the merchantability specifications will be compiled
<b>3.2.1 – Table 3-1</b>	Change in terminology from “mapping requirements” to just “requirements”.
<b>3.4 – Tree Data</b>	Damage Codes – Addition of ‘down tree’ terminology to standards for reappraisals due to insect damage.
<b>3.5 – Survey and Area Measurement Standards</b>	Standards for establishing cruise plots using GPS technology – Change in data requirement from standard deviation (SD) to Mean Difference of Hits in metres (MDH).
<b>4.3.1.5 – Plot Number or Letter</b>	Establishing cruise plots using GPS technology – Change in data requirement from standard deviation (SD) to Mean Difference of Hits in metres (MDH).
<b>Figure 4.8</b>	Minor change to diagram of proposed road built under cutting permit – road is truncated at boundary instead of continuing through block.

<b>5.2.4 – Special Compilation</b>	Update of wet and dry belt Douglas fir zone table to include additional biogeo zones and subzones.
<b>A.6.2.1 – Light Damage – Code A</b>	Wording has changed from declared mopped up by FLNR to being recorded by FLNR as not all fires are actioned.
<b>FS693</b>	Updated Cruise Plan form.
<b>Figure A.26</b>	Change to diagram clarifying that the scar and fork are in the second third of the tree (2), not in the first third (1).





## MANUAL REVISION TRANSMITTAL

<p>FOR FURTHER INFORMATION OR IF YOU HAVE A CHANGE OF ADDRESS, PLEASE CONTACT:</p> <p>Beth Eagles Cruising Policy Forester Timber Pricing Branch Ministry of Forests, Lands and Natural Resource Operations 1<sup>st</sup> Floor, 1520 Blanshard Street Victoria, BC V8W 3K1</p> <p>Phone: 250 – 387-8307 Email: Beth.Eagles@gov.bc.ca FAX: 250 - 387-8393</p>	<b>MANUAL TITLE</b> <i>Cruising Manual</i>	
	<b>AMENDMENT</b> Amendment No. 2	<b>ISSUE DATE</b> August 21, 2014
	<b>MANUAL CO-ORDINATOR</b>  Ashley Sasaki Publication/Administrative Co-ordinator	
	<b>AUTHORIZATION</b> Murray Stech Director, Timber Pricing Branch	

Please make the following changes to your copy of the above Ministry manual.

ACTION (Remove/Insert)	(VOL.) CHAPTER-SECTION-SUBJECT TABLE OF CONTENTS	PAGE(S)	COMMENTS
Remove Insert	Chapter 1	3-10	After Chapter 1 Tab
Remove Insert	Chapter 2	5-6 9-12 13-14 17-18	After Chapter 2 Tab
Remove Insert	Chapter 3	3-4 9-10 13-14	After Chapter 3 Tab
Remove Insert	Chapter 4	7-8 21-22	After Chapter 4 Tab
Remove Insert	Chapter 5	11-14	After Chapter 5 Tab
Remove Insert	Appendix	35-36 41-44 77-78	After Appendix Tab
INSERT	Letter from Minister and Transmittal Sheet		After Amendments Tab



## 1.1 Definitions

In this manual:

“**100% Cruise**” means a cruise in which every tree is measured. There are no samples or estimates;

“**Absolute Variation**” means the difference between two measurements or a standard and a measurement, disregarding the plus or minus sign (e.g., standard of 7 and measurement of 5 gives absolute variation of 2);

“**Accuracy**” means the nearness of a measurement to the actual value of the variable being measured;

“**BAF (Basal Area Factor)**” means the basal area ( $m^2$ ) per hectare that each "in" tree represents when using a prism or relascope. Prisms are sometimes classified as "diopter" size or inscribed with the BAF number. The size denotes the basal area factor (i.e., an 8 BAF prism which tallies 7 trees in a plot would give a basal area (in timber) of 56  $m^2$ /hectare);

“**BC Albers**” means a map projection that is one of the standard map projections used in British Columbia.

“**BCTS**” means BC Timber Sales;

“**Bias**” means a difference between the sampling result and the actual value due to errors in measurement, sampling procedure or calculations;

“**Bole**” means the trunk or main stem of the tree and excludes branches and candelabras. The bole of the tree includes merchantable and non-merchantable portions of the trunk of the tree.

“**Boring Height**” means the distance from the ground (high side) up the tree to where an age is taken with an increment borer. It is usually taken at breast height (1.3 m);

“**Breast Height**” means the location on a tree where its diameter (DBH) is measured. It is located exactly 1.3 m above "high side". If high side is lower than the point of germination (POG), breast height is 1.3 m above the POG;

“**Cardinal directions**” means North, South, East and West. All references to azimuths or bearings mean the “true” value. For a description of True North, please see [True North, Magnetic North and Grid North](#) in the Appendices;

“**CEP**” means Circular Error Probability, a measure of precision, defined as the radius of a circle, centered around the mean, which is expected to include 50% of the results.

“**Closure Error**” means the distance between the start and end of the traverse in a closed traverse, divided by the length of the traverse, and is usually expressed in percent;

“**Coast**” means the area subject to the [Coast Appraisal Manual](#);

“**Coefficient of Variation (CV)**” is a relative measure of variation, equal to the sample standard deviation expressed as a percentage of the sample mean  $\left(\frac{SD}{\bar{x}}\right)$ ;

“**Confidence**” means an expression of precision of sample estimates, usually assessed by confidence intervals such as 95 percent, a specified proportion of which contain the true population parameters;

“**Count Plot**” means a prism plot where only the number of "in" trees by species and plot slope is noted. No individual tree measurements are recorded;

“**Crown Class**” means one of the four crown classes, which are dominant, co-dominant, intermediate and overtopped (see [Figure 6.3 Crown Classes](#).);

“**Cruise Based**” means a cutting authority where under section 106 of the [Forest Act](#), the stumpage payable is calculated using information provided by a cruise of the timber conducted before the timber is cut;

“**Cutblock**” means an area that meets the cutblock requirements as specified in the [Coast](#) and [Interior Appraisal Manuals](#);

“**Cutting Authority Area**” means the area authorized to harvest Crown timber, as provided by the *Forest Act*;

“**Cutting Specifications**” mean the timber merchantability specifications as defined in the *Coast* and *Interior Appraisal Manuals*;

“**DBH (Diameter Breast Height)**” means the outside bark diameter of a tree measured at breast height;

“**Decay, Waste and Breakage (DWB)**” means factors to reduce the gross merchantable volume to a net merchantable volume and to approximate the volume depletion due to decay, firmwood waste and breakage due to harvesting;

“**DIB (Diameter Inside Bark)**” means the diameter of a tree, excluding bark;

“**Dioptr**” means a method of denoting prism "size". A value of one dioptr represents a right angled deflection of one unit per one hundred units in distance. The formula for converting dioptr size to BAF size (metric) is:

$$\text{BAF} = 10,000 / \left[ 1 + \left( \frac{200}{\text{dioptr}} \right)^2 \right]$$



“**Double Sampling**” means a method which incorporates a second sampling procedure where only some of the characteristics of the main sampling method are recorded. An example is measure and count plots established on a cut block;

“**Faller Selection**” means a timber falling technique that applies to selection logging in cutting authorities where the cut and leave trees are not marked and the faller decides which trees to cut or leave. The decision is based on the partial cut prescription and safety considerations;

“**Fixed Area Plot Sampling**” means a sampling method where a fixed amount of area is sampled in each plot within a stratum. All trees larger than the timber merchantability specifications are tallied if they are within the plot. All plots within a stratum must be the same size and shape;

“**Forest Inventory Zone**” means one of the 12 zones delineated by Forest Analysis and Inventory Branch of the Ministry of Forests, Lands and Natural Resource Operations.

“**GIS (Geographic Information System)**” means a system designed to capture, manage, analyze, store and present digital geographic data;

“**GMT**” means Greenwich Mean Time, a global time standard. For the most part it is synonymous with UTC, but does not have a precise definition at the sub-second level.

“**GPS (Global Positioning System)**” means a method of determining or relocating a ground position using the signal from several satellites simultaneously. A small portable computer evaluates the time for each signal to reach it and then computes a three dimensional location;

“**Grid system**” means a method used to locate cruise plots systematically along a grid, usually a predetermined management unit specific GIS grid or a local cutblock level grid.

“**HDOP**” means horizontal dilution of precision, which is a measure of the precision of GPS results related to the satellite positions. As HDOP decreases, the level of precision increases.

“**High Side**” means the position where the ground meets the tree adjacent to highest ground, ignoring any root flare, obstacles, vegetation, and loose matter that has accumulated at the base of the tree;

“**Interior**” means the area subject to the [Interior Appraisal Manual](#);

“**Licensee**” means the holder of the cutting authority;

“**Log Grade**” means those log grades that are identified in the [Scaling Regulations](#), [Cruise Compilation Grade Algorithms](#) or [CGNF Standards and Procedures for the Coast Forest Region](#), as appropriate;

“**Loss Factor**” means the method used to determine the net volume of a tree. The loss factors were determined as part of the provincial inventory system. Loss factors use a combination of tree maturity, pathological indicators and tree location (FIZ and PSYU or local factors) to determine the percentage of decay, waste and breakage that will be deducted from the gross merchantable volume equally from each log in a tree;

“**Major Species**” means a species that comprises 20 percent or more of total net merchantable volume in a timber type, cut block or cutting permit;

“**Mean**” means the sum of all measurement values divided by the number of measurements;

“**Mean Difference of Hits**” means the average of the absolute variations of each GPS hit or coordinate from the plot reference point (PRP), measured in metres.

“**Merchantable**” means a segment of a tree between 30cm stump height and a top diameter inside bark that is at least 3 metres in length and within the timber merchantability specifications as defined in the [Coast](#) and [Interior Appraisal Manuals](#);

“**MFLNRO**” means the Ministry of Forests, Lands and Natural Resource Operations;

“**Minor species**” means a species that comprises less than 20 percent of the total net merchantable volume in a timber type, cut block or cutting permit;

“**Orphan Tree**” means a tree of a certain species that occurs in a count plot but has not been tallied in a measure plot within the same timber type.

“**Partial Cutting**” means silviculture systems in which only some of the trees are felled during the harvesting phase. The selection method may specify "removal" or "leave" trees. Some examples of selection criteria are diameter, species, volume, age, height, disease or other damage. For the “partial cutting” criteria, please refer to chapter 4 of the *Interior Appraisal Manual*;

“**Pathological Indicators**” means conk, blind conk, scar, fork or crook, frost crack, mistletoe, rotten branch, and dead or broken top;

“**PDOP**” means positional (3D) dilution of precision, which is a measure of the precision of GPS results related to the satellite positions. As PDOP decreases, the level of precision increases.

“**Percent Reduction**” means a specified percentage reduction of the cruise volume which is targeted to be reserved from harvesting;

“**PRF (Plot Radius Factor)**” means a factor which multiplied by the DBH (cm) of a tree represents the appropriate plot radius (m) for the tree. In variable plot cruising, each tree has its own plot radius. This is a function of tree diameter (DBH) and prism BAF (m<sup>2</sup>/ha) size.

The PRF formula is:  $PRF = 0.5 / \sqrt{BAF}$

“**Plot Sampling**” means the estimation of volumes and grades by species within a cut block from sample plot measurements, and the determination of the sampling error associated with the plot estimates;

“**Precision**” means the closeness, to each other, of repeated measures of the same quantity, expressed as Sampling Error or Standard Error of the sample estimate;

“**PRP**” means plot reference point; a GPS waypoint located a short distance (e.g. 15 to 20 m) from the cruise plot. The bearing and distance to the cruise plot are calculated and measured from this point.

“**PSYU (Public Sustained Yield Unit)**” means a management area of Crown land, with similar forest attributes based on local samples. PSYU always overrides the tables determined by FIZ;

“**Residual tree**” means a tree which does not bear any of the following external indications of decay on or immediately adjacent to the bole of the tree: conk, blind conk, scar, fork or pronounced crook, frost crack, mistletoe trunk infection, rotten branches, dead or broken top.

“**Risk Group**” means a grouping by expected "risk" or probability of average decay, waste and breakage. A combination of tree class, pathological indicators, Forest Inventory Zone and PSYU determines the Risk Group of an individual tree for volume deduction.

“**RMS**” means root mean square and is calculated by taking the square root of the average of the squared errors. It is a measure of precision, meaning that there is a 63 to 68% probability that the results will be within the RMS distance.

“**Sampling Error %**” means an expression of the accuracy of the sampling of the cruise, calculated as a percent of an estimated mean to a desired probability;

“**Scale Based**” means the stumpage payable is based on a scale of the timber harvested from the cutting authority in accordance with Part 6 of the [Forest Act](#);

“**Single Stem**” means the removal of individual trees based on specific tree level criteria, regardless of harvest method. It includes helicopter single standing stem selection as defined in the [Coast Appraisal Manual](#). Single stem removal, for the purposes of this manual, does not include the removal of trees based on spatial distribution or for silvicultural purposes, such as commercial thinning.

“**Site Class**” means a set of 4 site quality classes (good, medium, poor, low) which characterize the potential growth capacity of the minerals and moisture in the soil, as measured in tree height (metres) attained at the breast height age of 50 years;

“**Standard Deviation (SD)**” means the square root of variance. It characterizes dispersion of individuals about the mean and gives some idea whether most of the individuals in a population are close to the mean or spread out;

“**Standard Error (SE)**” means an expression of how close the sample mean is to the true mean. Two standard errors (2 SE) means there is a 95% chance that the true mean is within the sampling error of the cruise.

“**Stratification**” means the process of delineating strata boundaries within a subpopulation, where each stratum has unique characteristics such as species composition, height, stand volume or age;

“**Stratum**” means a specified portion of a sub-population area for which separate volumes and sampling statistics are calculated. A sub-population may be made up of one or many strata. Strata are commonly known as timber types;

“**Strip Line**” means a ribboned line located through the forest and tied to the boundary at one or both ends. Cruise plots are located at regular intervals along each strip;

“**Stubbed**” means the practice of harvesting or removing a portion of the tree so that part of the bole (stem) above stump height remains.

“**Stumpage Rate**” means a charge levied by the Crown determined in accordance with the policies and procedures approved for the forest region by the minister;

“**Suspect tree**” means a tree which bears one or more of the following external indications of decay on or immediately adjacent to the bole of the tree: conk, blind conk, scar, fork or pronounced crook, frost crack, mistletoe trunk infection, rotten branches, dead or broken top.

“**Tie Point**” means a specific point on the ground whose location is readily identifiable on a digital image, aerial photograph or map. (eg. road intersection, corner of a field or swamp, field located traversed or GPS station);

“**Timber Supply Area**” means large contiguous areas of Crown land on which an annual allowable cut is calculated;

“**Tree Class**” means a series of classes (nine) signifying age/maturity, presence of pathological indicators, and live/dead classification. This classification, in combination with pathological indicators and age in 10's, determines the appropriate risk group for volume deduction;

“**UTC**” means Coordinated Universal Time, the primary global time standard. It is defined more precisely than GMT as it is defined to the sub-second level.

“**UTM**” means Universal Transverse Mercator coordinate system, a two dimensional coordinate system that divides the earth into 60 zones.

“**Variable Plot Sampling**” means a method of plot sampling where the trees to be tallied are based on their size and not the frequency or density of trees in the stand. Each tree has its own plot radius and can be assessed with an angle gauge (eg. Prism or relascope);

“**Variance**” is the mean of squared deviations of observations about a sample mean. (These deviations or differences from the mean are called residuals);

“**Variation**” is the difference, plus or minus, between two measurements or a standard and a measurement (e.g., standard of 7 and measurement of 5 gives variation of -2);

“**Waste**” is waste as defined in the [Provincial Logging Residue and Waste Measurement Procedures Manual](#).

## 1.2 Terms of Reference

The [Forest Act](#), Section 103 to 108 and regulations provide the statutory authority for the determination of stumpage rates for crown timber.

The *Forest Act*, Section 105, requires adherence to the policies and procedures approved for the forest regions by the Minister of Forests, Lands and Natural Resource Operations. The policies and procedures are used in the [Coast Appraisal Manual](#) and [Interior Appraisal Manual](#), for determining stumpage rates charged for Crown timber.

The *Coast Appraisal Manual* and *Interior Appraisal Manual* specify that cruise data must be gathered and compiled according to procedures established in the [Cruising Manual](#) and the [Cruise Compilation Manual](#). The [Cruising Manual](#) and [Cruise Compilation Manual](#) are approved by the Director, Timber Pricing Branch.

### 1.2.1 Calculation Conventions

Each calculation will be calculated to the nearest tenth. This is consistent with the data precision level of the compilation reports.

The rounding rules to be used in this manual are the same as those in the *Cruise Compilation Manual* (see Appendix 16 of the *Cruise Compilation Manual*). (ie. digits 0-4 are rounded down and 5-9 are rounded up).

For example, meeting a check cruise standard:

- $10.03 = 10.0$  and does not exceed 10.0%
- $10.05 = 10.1$  and exceeds 10.0%

For example, meeting a minimum threshold:

- $34.99 = 35.0$  and meets the 35.0% threshold
- $34.94 = 34.9$  and does not meet the 35.0% threshold

## 2.3 Sampling Error Objectives

Unless otherwise specified, sampling error objectives are based on full measure and count plots and are based on the total stand net merchantable volume prior to any partial harvest reductions.

The following standards apply to both clearcut and partial retention harvest systems.

The minimum requirement for the establishment of a full measure plot is as follows:

- i. cutting authorities < 250 ha: a 200 meter grid or 4.0 hectares per plot (per timber type).
- ii. cutting authorities > 250 ha: a 250 meter grid or 6.25 hectares per plot (per timber type).

For coastal cruises, a ratio of three (3.0) count plots to one (1.0) full measure plot cannot be exceeded on the cruise plan even if sampling error is achieved.

For cruises where cruise grades will be used in the appraisal, the minimum tree count must be met even if the sampling error requirement has been achieved.

For coastal cruises where cruise grades will not be used in the appraisal and for all interior cruises, there is no required minimum number of trees per plot when the sampling error requirement is achieved.

The minimum tree count requirements include tree classes 1, 2, 3, 5, 7, 8, 9 and not tree classes 4 and 6.

There is no need to change count plots to measure plots in the field if measure plots are dropped due to boundary influence in the field, provided the correct measure/count ratio is identified on the cruise plan and the minimum number of measure plots per type has been achieved (see Section [2.4.2](#)).

### 2.3.1 Scale Based Cutting Authorities

- Unless otherwise stated, the scale-based cutting authority sampling error objective is 15.0% at 2 SE based on the total stand net merchantable volume prior to any partial harvest reductions.
- Rights of Way cruises must:
  - i. Meet the 15.0% sampling error requirement using fixed or variable radius plots, or

- ii. Establish a full measure variable plot every 100 metres along the right of way centre line. The first plot should be located at 50 metres (half the interplot distance) from the start of the centre line.

Where timber on road rights of way within a cutblock is removed under a road permit (R.P.) after the block is cruised, the cruise plots that are within the area of the R.P. shall be included in the cruise compilation for the cutting permit and the area of the R.P. will be removed from the cruise compilation.

Rights of way areas not removed under a road permit must be included in the net merchantable area and must be sampled.

- Single Stem – the options are:
  - i. 100% cruise of the cut trees,
  - ii. Achieve at least a 15.0% sampling error on the cut trees at 2 SE using variable radius plots, or
  - iii. Sample using at least 2 variable radius measure plots/ha and at least 2.0 cut trees/plot.

**The sampling error requirement will be waived if the following conditions have been met:**

**1. For cutting authorities of 20.0 ha or larger in size:**

- a. A 100 metre by 100 metre systematic grid has been established and a maximum of 1.0 count plot to 1.0 full measure plot has not been exceeded and an average of at least 4.0 trees per plot has been met.
- b. A 70 metre by 70 metre systematic grid has been established and a maximum of 1.0 count plot to 1.0 full measure plot has not been exceeded and an average of at least 2.0 trees per plot has been met.
- c. A 50 metre by 50 metre systematic grid has been established and a maximum of 1.0 count plot to 1.0 full measure plot has not been exceeded and an average of at least 1.0 tree per plot has been met.

**2. For cutting authorities less than 20.0 ha in size:**

- a. A 100 metre by 100 metre, systematic grid of full measure plots has been established and an average of at least 4.0 trees per plot has been met.
- b. A 70 metre by 70 metre, systematic grid of full measure plots has been established and an average of at least 2.0 trees per plot has been met.



All possible sample points that can be established in the net merchantable area must be cruised, **whether or not they were included in the original cruise plan**. All plots must originate from the net merchantable area.

Plots cannot be moved within a timber type polygon, except as required in Section [2.4.2](#) to achieve the minimum number of plots in a timber type polygon.

The grid may be square or staggered, however the option selected must be used consistently in each cutblock.

The cruise grid will be considered acceptable if the count to measure distribution is systematic and unbiased, and if the grid is established consistent with the above requirements. **If the cruise plan is designed to waive sampling error as per the requirements of Section [2.3.1](#) or [2.3.3\(2\)](#), the count to measure ratio requirement will be waived if the grid design is consistent with Section [2.4.1](#) and the grid spacing and trees per plot are consistent with Section [2.3.1](#).**

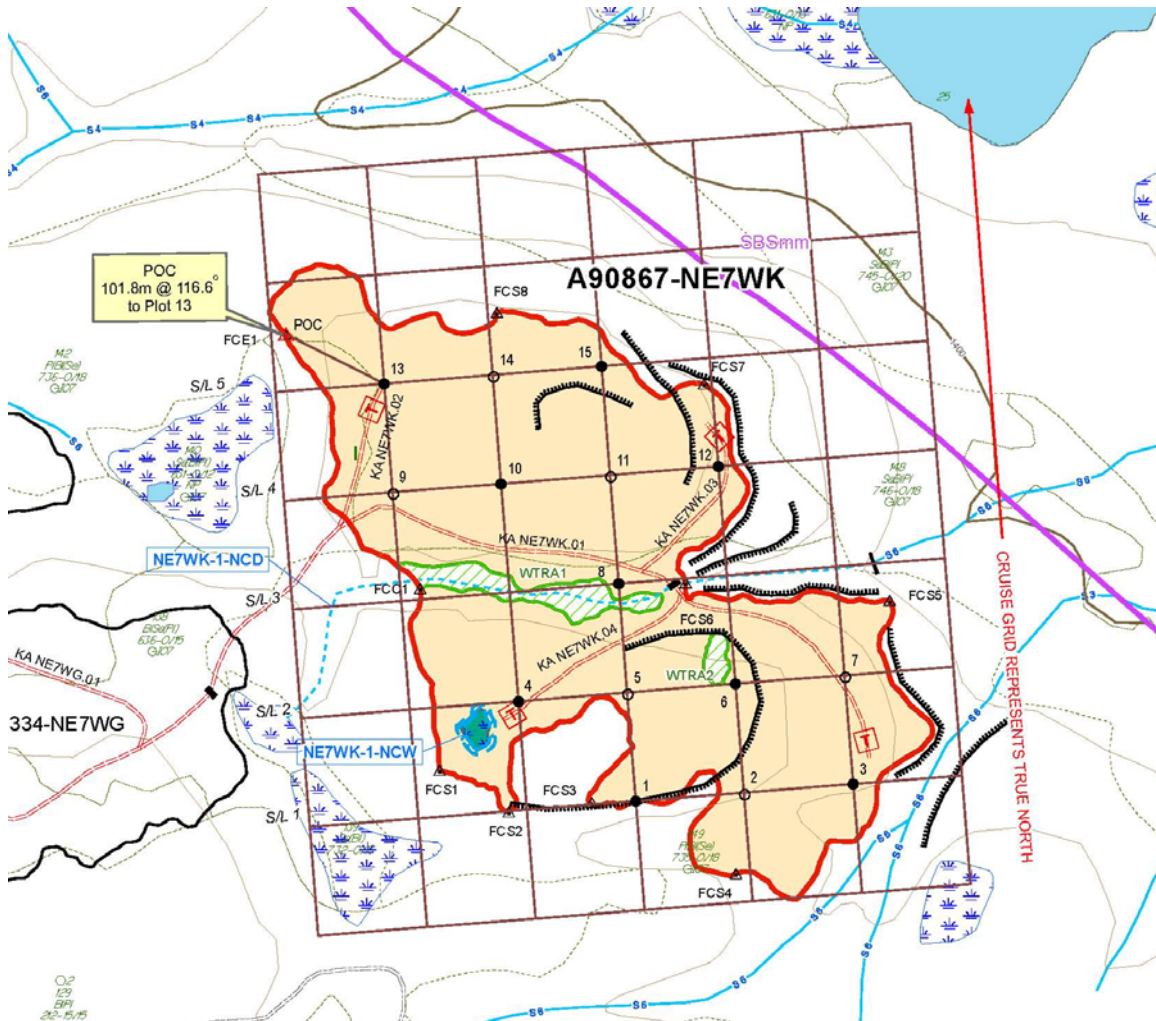


Figure 2.1 Example of Local Grid Design.

\* **Please note** – This example of a local grid is oriented to true north instead of map north. For a detailed explanation of the difference in these terms, please see [True North, Magnetic North and Grid North](#) in the Appendices. Some districts may prefer for cruise maps to be submitted with grids oriented to grid north – please refer to district or regional contacts for further information.

## 2.4.2 Standards for the Location of Additional Plots to Meet Section 2.2 Requirements

The following sections describe the situations and procedures to establish additional plots where the grid design does not meet the minimum one or two full measure plot per timber type polygon standard specified in Section [2.2](#).

### 2.4.2.1 Office Cruise Plan Procedure

Within the timber type, reduce the grid interval (using the same grid system) on the cruise plan by increments of 10 metres until the largest grid spacing that will meet the minimum plot establishment standards is achieved.

### 2.4.2.2 Field Procedure

In the event that in the field, plots fall outside the timber type polygon, then use the procedure in the following table to establish the plot(s) inside the timber type polygon:

Sequence	Location	Sequence	Location	Sequence	Location	Sequence	Location
1	1/2 Grid North	2	1/2 Grid East	3	1/2 Grid South	4	1/2 Grid West
5	1/4 Grid North	6	1/4 Grid East	7	1/4 Grid South	8	1/4 Grid West
9	1/8 Grid North	10	1/8 Grid East	11	1/8 Grid South	12	1/8 Grid West
13	1/16 Grid North	14	1/16 Grid East	15	1/16 Grid South	16	1/16 Grid West

The procedure will be applied from the planned plot locations that fell outside the timber type polygon in the field. This procedure is used to obtain the required number of plots in the timber type polygon. If the plot cannot be established inside the timber type polygon using this procedure, attempt to establish the plot using this procedure with NE, NW, SE or SW bearings.

## 2.4.3 Standards for the Location of Additional Plots to Meet Sampling Error

Where plots must be added to an existing cruise to meet the sampling error requirement, they must be added in a systematic random manner. It is recommended to target the timber type (s) with the greatest variability. Determine the number of plots required

using the coefficient of variation statistic for the timber types from the compilation (See [Coefficient of Variation](#) in the Appendices).

The following procedures will be used where additional plots must be added to an existing cruise to meet the sampling error standard:

1. New Grid Design

- a. Determine a new grid design that will meet the new sample size requirements, using the same cruise grid orientation.
- b. If using a local grid, over-lay the new grid by positioning the new plot grid over top of the original plot grid at the point of intersection (See Section [2.4.1](#) (b)).
- c. If using a GIS grid, over-lay the new grid by positioning the first plot of the new grid over the most westerly plot on the most southerly line of the original grid (in the net merchantable area). Disregard the overlapping plot.

2. Existing Cruise Design

Additional plots must be systematically located on the existing cruise strips.

## 2.5 Other Timber Cruising Conditions

This section describes the timber cruising procedures that are required for situations where timber must be re-cruised, where it is unsafe to cruise, where patch cuts are used and where there is a combination of Timber Licence and Crown lands.

### 2.5.1 Standards for Re-cruising

**Re-cruising is required:**

1. If the cruise is of mature timber (> 120 years) and 10 years has elapsed since the fieldwork was performed.
2. If the cruise is of immature timber (< 121 years) and 5 years has elapsed since the fieldwork was performed.
3. If required in a reappraisal as outlined in the [Coast or Interior Appraisal Manuals](#).
4. As required by a check cruise (Chapter [3 Quality Assurance](#)).
5. As determined by the Regional Executive Director.

### 2.5.2 Unsafe to Cruise

Where it is unsafe for cruisers to sample the stand, the preferred methodology is to establish cruise plots in the same timber type (where it is safe to cruise) adjacent to the unsafe area.

The sampling intensity must be sufficient to reliably estimate the attributes of the unsafe area.

As appropriate, the damage codes will be determined by a procedure subject to mutual agreement by the licensee and the Regional Executive Director, or Timber Sales Manager and Regional Executive Director.

If an individual plot cannot be completed safely, it will be dropped and the reason documented.

### 2.5.3 Cruising Patch Cut Silviculture Systems

The following sampling procedure must be used for cruising patch cuts:

1. Outline the proposed block including the outside boundaries of the patches.
2. Overlay an appropriate grid over the gross block area that will ensure the sampling design requirements are achieved on the entire block area (See Section [2.3](#)).

3. Patches that are 1.0 ha in size or greater will be unique timber types and will have the required minimum number of plots (See Section [2.2](#)).
4. Patches smaller than 1.0 ha may be aggregated and considered as one timber type in the compilation. These aggregated areas may be considered “partial cut” in the Interior for appraisal **cost estimate** purposes. Cruise data for this timber type should be representative of the patch cut areas.
5. Areas between the patches may be compiled as a unique timber type (Example 1) or aggregated with patches smaller than 1.0 ha as one unique timber type (Example 2). Appropriate percent reductions are to be applied in the compilation.

Example 1 (Refer to [Figure 2.2 Example of Patch Cut block](#)):

Gross Block – 30.0 hectares. Cruise grid covers the whole block.

Type 1: 12 patches less than 1.0 hectare each. Total = 6.0 ha (Patches identified as letters A to L)

Type 2: area between all the patches where some incidental volume will be removed, 15.0 hectares (e.g. skid trails and selection harvest = 20% volume removal or 80 % volume reduction)

Type 3-8: 6 patches, each one is greater than 1.0 ha, totalling 9.0 ha. Each patch must be cruised. (Patches identified as numbers 1-6)

Total of 15.0 ha clearcut and 15.0 ha at 80% volume reduction

Example 2 (Refer to [Figure 2.2 Example of Patch Cut block](#)):

Gross block area – 30.0 hectares

Types 1-6: 6 patches, each one is greater than 1.0 ha, totalling 9.0 ha. Each patch must be cruised. (Patches identified as numbers 1-6)

Type 7: Area between patches and patches less than 1.0 ha (total 21.0 ha)  
 Amount of harvest on skid trails and incidental harvest between patches = 3.0 ha  
 12 patches equalling 6.0 ha (Patches identified as letters A to L)  
 $(6.0 + 3.0) / (30.0 - 9.0) = 9.0 / 21.0 = 42.9\%$  to be removed (57.1% volume reserved)

Total of 9.0 ha clearcut (Types 1-6) and 21.0 ha at 42.9% volume reduction (Type 7)

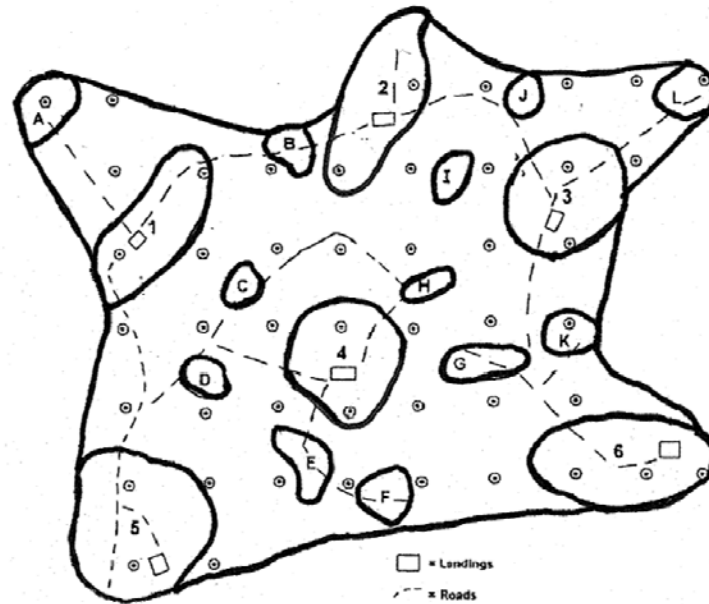


Figure 2.2 Example of Patch Cut block.

#### 2.5.4 Schedule "A" (Timber Licence) and "B" (Crown) Lands

Schedule "A" and "B" lands in a Tree Farm Licence (TFL) can be cruised, compiled and appraised together, but a separate summary page in the compilation is required for both timbermarks.

Schedule "A" and "B" lands not in a TFL can be cruised together, but must have separate compilations because they must be appraised separately. If a cutblock contains both Schedule "A" and "B" lands, all plots in the cutblock must be used in both of the compilations.

Timber Licence and other Crown land in a Tree Farm Licence (TFL) can be cruised, compiled and appraised together, but a separate summary page in the compilation is required for both cutting authorities.

Timber Licence and other Crown land not in a TFL (i.e., in a Forest Licence) can be cruised together, but must have separate compilations because they must be appraised separately. If a cutblock contains both Timber Licence and other Crown lands, all plots in the cutblock must be used in both of the compilations.





## 2.8 Forest Typing

Forest types are areas of land identified on a cruise plan map with similar timber characteristics. They are generally identified from aerial photos and may increase sampling efficiency and provide a more accurate estimate of timber volume and value.

For more information on the general principles and procedures that may be used to describe forest types, see the document titled ‘VRI Photo Interpretation Procedures’ at the following web link:

[www.for.gov.bc.ca/hts/vri/standards/photo.html](http://www.for.gov.bc.ca/hts/vri/standards/photo.html)

Appraisal cruising recognizes four categories of stratification:

- 1. Forest Types (Timber Types):** Generally describe areas of similar inventory forest cover composition (e.g., first and second leading species by volume, age, height and site class). These areas contain merchantable timber and are sampled for appraisal. Timber type polygons must be contiguous and unique to each cutblock.
- 2. Non-Forest Types:** These areas are not sampled for appraisal (i.e., rock bluff, swamp, constructed linear tenure, creek, riparian reserve area, slide track and gravel pit). A non-productive area can be less than one hectare in size, but typing out of non-productive areas must be consistent (e.g., if a 0.5 ha non-productive area is typed out then all non-productive areas 0.5 ha and larger must be typed out).
- 3. Forest Reserves:** Describe areas reserved from harvest due to forest management purposes (e.g., Goshawk nest, visual quality reserve, wildlife tree patch). These areas may contain merchantable timber but are not sampled for appraisal.
- 4. Silviculture Treatment Units:** Describe areas that will receive different forms of silvicultural or harvest treatments. (e.g., stumping for root rot and partial cutting areas). These areas contain merchantable timber and are sampled. Treatment units may consist of an entire timber type, a portion of a timber type or a portion of multiple timber types.



## 3.2 Cruise Plan Standards

The cruise plan is a key document that supports the integrity of the sample design.

A cruise plan must include the requirements identified in sections [2.2](#) and [3.2.1](#), as well as the cruise plan form ([FS 693](#)). If all the required information is included on the cruise plan map, a cruise plan form (FS693) is not required.

The cruise fieldwork and compilation may not be accepted for use in the appraisal if the above conditions are not met.

### 3.2.1 Cruise Plan Map Standards

1. The cruise plan map will be legible and of good quality 1:5 000 or 1:10 000 scale.
2. The cruise plan map will provide neat and clear lines, lettering and numbers.
3. The cruise plan and cruise plan map shall include the items indicated in Table [3-1](#).

A sample cruise plan map can be seen at the following link:

[www.for.gov.bc.ca/ftp/hva/external/!publish/web/Cruising/Sample\\_Cruise\\_Plan\\_Map.pdf](http://www.for.gov.bc.ca/ftp/hva/external/!publish/web/Cruising/Sample_Cruise_Plan_Map.pdf)

**Table 3-1 Requirements for Cruise Plan and Final Cruise Submissions**

	<b>Requirements</b>	<b>Cruise Plan Submission</b>	<b>Final Cruise Submission</b>
a	Tenure and Cutting authority	Yes (if known)	Yes
b	Forest Region and District	Yes	Yes
c	Scale	Yes	Yes
d	Timber Supply Area	Not required	Yes
e	North Arrow, Declination, Map base	Yes	Yes
f	Maturity of forest inventory polygons/blocks identified	Yes	Yes
g	Timber type lines and identifier (including a forest cover map of the cruise and adjacent areas for cruises containing Lodgepole Pine)	Yes (Forest Cover map not required for Coast)	Yes
h	Plots identified as measure or count plots and numbered	Yes	Yes
i	Block numbers (including any old numbers if changed)	Yes	Yes
j	Block and type net areas	Yes	Yes
k	Harvest methods and areas	Only required for heli logging areas	Yes
l	Existing and proposed roads	Yes	Yes
m	Forest Inventory Zone	Not Required	Yes
n	PSYU	Not Required	Yes
o	Biogeoclimatic zone(s) and sub zone(s)	Not Required	Interior only
p	Portions of each cut block boundary where boundary trees will be stubbed	Yes – Interior only (if known)	Yes – Interior only
q	Plots used in the compilation are clearly indicated	Not required	Yes
r	Locations of baselines (when used), boundary tie lines, points of commencement and actual strip line location with direction of travel	Not Required	Yes
s	Contour lines - clearly legible	Not Required	Yes
t	Physiographic features	Only if they affect sampling	Only if they affect sampling
u	Legal survey features	Only if they affect sampling	Yes
v	Forest and non-forest type boundaries	Yes	Yes

The height in metres must be recorded in the plot record (Card Type 9) in the Bowron, Longworth, Monkman, Purden and Robson PSYUs and TFL 30. Tree heights are used to determine mature red cedar loss factors in these PSYUs and TFL (Loss Factor Table 0296). The height in metres in Card Type 9 is not a check cruise item in any other PSYU or TFL. (See [4.3.1.9](#))

#### 4 – Pathological Indicators (Section [4.3.2.7](#))

No more than 10.0 % of all trees checked can have a risk group change resulting from incorrect pathological indicator records.

#### 5 – Damage Codes (Section [4.3.2.18](#))

The following standards apply to the measurement of damage codes:

- a. No more than 5.0 percent of all trees checked can have an incorrect code.
- b. Incorrect codes that result in a risk group change will contribute to the number of pathological indicators and risk group changes (not applicable to CGNF cruises).
- c. In the case of a reappraisal due to damage as specified in the [Interior Appraisal Manual](#), the following standards will apply:
  - i. All reclassification of insect damage **and down tree** codes must be based on field data collection.
  - ii. In order to provide the MFLNRO with adequate time to perform check cruises, re-sweep data must be provided to the MFLNRO at least 10 working days prior to the commencement of any harvest activity, or some other mutually agreed upon time frame. In turn, the MFLNRO must respond to the licensee within that time frame if there are any concerns with the cruise, otherwise the cruise will be considered acceptable.
  - iii. In order to check and verify the re-sweep insect **and down tree** code data and confirm who performed the cruise, the following information must be made available to the MFLNRO:

The date(s) the re-sweep was completed.

The cruiser must take responsibility for the cruise data in accordance with Section [3.8\(4\)](#) of this manual.

The original and the updated damage code for each re-classified tree.

- iv. Due to the rapid nature of change associated with the needle colour attribute versus other timber attributes, insect code classification will only be counted as an incorrect damage code if the cruiser's code is greater than the code determined by the MFLNRO (e.g., the cruiser called a red

attack (code 2) and the check cruise assessed the tree as green attack (code 1).

- v. The intent of allowing licensees to re-sweep for insect **and down tree** codes is to provide the most recent description of the damage. As such, the MFLNRO check cruise efforts will focus primarily on the correct determination of the insect **and down tree** code attribute; however if in the general practice of completing the insect **and down tree** code assessment, the MFLNRO becomes aware of other significant inconsistencies with respect to the cruise standards, these issues will be addressed on a case by case basis.

## **6 – Tree Ages** (Section [4.3.2.6](#))

The standards applied to the measurement of tree ages are:

1. Tree ages determined by increment boring:
  - a. The age in 10's and tree classes must result in the correct application of the loss factors consistent with the Tree Class Modification of Loss Factor Tables (Table 17 – see Appendices), where applicable.
  - b. At least ninety-five (95.0) percent of all trees must be placed in the correct age in 10's and tree class, where applicable.
  - c. Coast - age in 10's of 13 and 14 - all of the tree classes must be verified since tree classes 1, 2, 3, 8 and 9 contribute to the percent second growth reporting.
2. Tree ages determined by forest cover age classes:
  1. All interior PI trees must have the correct age class as determined from the most current forest inventory types.

## **7 – Diameter at Breast Height** (Section [4.3.2.5](#))

The height of the diameter line marked at breast height must not exceed plus or minus 5 percent (plus or minus 6.5 cm) from the true breast-height of 1.3 m above high side. When this limit is exceeded, the true position is used for a. and b. below.

The DBH measurement standards are shown in Table [3-5](#). Both a. and b. must be exceeded before the standard is determined to be incorrect.

**Table 3-6 Plot Distance Standards**

Attribute	Maximum Variation
Plot centre reference tree to plot centre	Plus or minus 1.0 percent of horizontal distance
Radius - fixed and variable radius plots	Plus or minus 1.0 percent of horizontal distance
Length and width: fixed rectangular plots	Plus or minus 1.0 percent of horizontal distance

### Establishing Cruise Plots Using GPS Technology

As of November 1, 2014, cruises may be rejected for not meeting these standards when GPS is used to establish cruise plots.

In order to use GPS technology to establish cruise plots, the GPS receiver must meet the following standards:

- Able to achieve submetre accuracy under ideal conditions (i.e. open area, no interference, good satellite coverage)
- Real time correction system with external antenna
- Minimum satellite elevation angle/mask is 15 degrees above the horizon
- RMS (Root Mean Square) minimum rating of 100 cm

If GPS is used to establish cruise plots, the following data must be submitted to the Ministry in a PRP table:

- Cutblock
- Timber type
- Cruise plot number
- Horizontal Distance (m) from PRP to Cruise plot
- Calculated bearing (degrees) from PRP to Cruise plot
- Average PDOP – *maximum of 6.0*
- Average HDOP – *maximum of 4.0*
- Number of satellites when establishing PRP – *minimum of 4*
- Number of hits received when establishing PRP – *minimum of 50 hits*
- **Mean difference of hits in metres (MDH)** – *maximum of 1.0*
- Time of PRP establishment – specify UTC or GMT
- PRP coordinates – specify UTM or BC Albers\*
- Cruise plot coordinates - specify UTM or BC Albers\*

The required format of the PRP table is shown in Table [3-7](#).

\* *The map projection system used (i.e. BC Albers, UTM, etc) must be consistent with the cruise plan.*

**Table 3-7 Sample of Required Format for PRP Table**

C B	T Y P E	P L O T	H D (m)	B R G (°)	P D O P	H D O P	# S A T	# H I T	MDH (m)	Time (UTC)	PRP Easting	PRP Northing	PT Easting	PT Northing
											UTM	UTM	UTM	UTM
7	2	1	16.6	110	3.4	1.9	6	50	0.3	144144.00	683417.473	5657508.768	683433.292	5657503.723
7	2	2	9.7	329	3.9	2.3	8	50	0.1	163211.00	682934.854	5657577.685	682929.529	5657585.834
7	2	3	8.9	157	2.3	2.9	8	50	0.5	181932.00	683125.834	5657600.981	683129.624	5657592.922
7	2	4	11.6	063	2.0	1.7	9	50	0.4	214811.00	683219.529	5657590.781	683229.672	5657596.466
7	2	5	11.7	349	2.0	2.2	9	50	0.2	220113.00	683332.437	5657588.624	683329.720	5657600.010

Cruise plots that are located with GPS must meet the following standards. In order for a cruise to be rejected for cruise plot location data, either both of the first 2 standards (1 and 2) must be exceeded or the last standard (3) must be exceeded:

1. The average absolute variation of all cruise plot locations checked must be within 3.0 m of the check cruise plot locations.
2. The Circular Error Probability standards:
  - a) 50.0% of all cruise plots checked must be within 2.5 m of their respective check cruise plot locations, and
  - b) 90.0% of all cruise plots checked must be within 5.0 m of their respective check cruise plot locations.
3. The distance and bearing between the cruiser's PRP and cruise plot must meet the same standards as those for conventional methods:
  - a) Horizontal distance: plus or minus 2.0 percent
  - b) Bearing: plus or minus 2.0 degrees

In order to require a re-cruise based on these standards, a minimum of 5 cruise plot locations or 10% of the cruise plot locations, whichever is greater, must be checked with a GPS unit that meets the aforementioned standards.

For additional information on precision standards for GPS plot locations, please see [Circular Error Probability Method](#) in the appendices.

At each cruise plot that is checked for plot location (GPS or conventional), a count plot will be completed at the check cruise plot location using the same BAF as the original cruise plot. The count plot data will be tracked to enable the Ministry to compare trends and variations between original and check cruise data over time.

### 4.3 Front Side of Cruise Tally Sheet (FS [205](#))

The following section identifies the card position and information required following the format of the Cruise Tally Sheet. Where digital data capture software is used, the information collected must follow the format and standards of the Cruise Tally Sheet.

#### 4.3.1 Card Type 9

This card is to be completed for every new plot. The data on this card provides the plot attributes. Optional fields are identified. These fields should be entered if known. Where fields are not identified as optional, they are considered mandatory.

##### 4.3.1.1 Positions 2 to 7 Licence Number (Optional)

Enter the license as provided by the Licensee. This may be Alpha/numeric, and cannot exceed 6 spaces.

##### 4.3.1.2 Positions 8 to 10 Cutting Permit (Optional)

Enter Alpha/Numeric, cannot exceed 3 spaces.

##### 4.3.1.3 Positions 11 to 13 Block (within the Cutting Permit)

Enter: Alpha/Numeric, cannot exceed 3 spaces. Enter only 3 spaces for blocks with more than 3 digits/letters in the block name. (i.e. block ABC123 may be entered as 123, and identified in its entirety in the compilation program for reporting purposes)

##### 4.3.1.4 Positions 14 to 15 Strip Number (Number of Strip on which Plot is Located, if strips are used).

If no strip lines are used, these two spaces may be utilized in cruises with 3 or 4 digit plot numbers.

When using strip lines, they will be run using compass, clinometer and metric surveyor tape or electronic measuring devices. Allowances for slope must be made since all distances must be horizontal. (See [Horizontal Distance Correction](#) in Appendices) Strip lines will be marked with survey tape so they can be used to locate plots in the future.

Where used, all of the cruise strip lines must be linked to the boundary. The tie point or reference point of each strip line must be well established on the ground so that it may be found at a future date.

##### 4.3.1.5 Positions 16 to 17 Plot Number or Letter

Will accept alpha/numeric designations.

Plots are to be numbered without duplication on the same strip line (if used).

Three digit plot numbers may be truncated to 2 digits in some compilation software.

Moving plot centres from the measured/ traversed location presents significant bias and is only permitted in accordance with Section [2.4.2.2](#). If the plot cannot be completed safely, it will be dropped and the reason documented.

### **Establishing Cruise Plots using Conventional Methods**

For cruises using conventional methods, the cruise must originate from valid tie points such as map locations like road locations, falling corners and GPS positions. The cruise must be tied to at least one (1) and preferably two (2) tie points. Tie points must be linked to the cruise grid with an accurate traverse.

A map feature (falling corner, junction, etc) or GPS station must be selected to establish the Point of Commencement (POC).

To establish cruise plots, travel the distance and bearing identified on the cruise plan or map. When the required distance has been measured, a stake, pin or equally effective marker must be established at the plot centre. If this location is within a tree, mark the plot centre with an “X” at the point on the tree. The plot centre is the point at which the marker enters the ground and not the top of the marker.

A reference point (RP) must be recorded in the traverse notes or on the cruise tally card. It is acceptable to use a reference tree that is an “in” tree and record the bearing and distance from plot centre to the nearest point on the tree at breast height. The reference point will be used to determine the position of the plot centre for check cruising. It is recommended that the reference information is recorded below stump height to facilitate correct tree measurements and to ensure the information is available post-harvest.

### **Establishing Cruise Plots using GPS Technology**

As of November 1, 2014, cruises may be rejected for not following these procedures when GPS is used to establish cruise plots.

1. Use the GPS to navigate to the cruise plot.
2. When you are within 10 to 20 metres of the cruise plot location, locate a suitable PRP (Plot Reference Point). The most suitable location for the PRP is generally the least obstructed or most open location. Optimally, the PRP should be 10 to 20 m from the plot location. Where few natural openings exist, the PRP must be an absolute minimum of 5.0 m from the plot location.

**NOTE:** The PRP must be a fixed feature that cannot be moved by hand, such as: a small standing tree (< 3m tall), cut stump, broken stump, root wad, fence post, etc. Large trees are not acceptable due to deflection and interference of GPS signals. If using a small tree, hold the antenna directly above the point where the tree enters the ground. If using another fixed object, paint a spot on the object and position the GPS antenna directly above this spot.

3. Review the data displayed on the GPS receiver screen. When the number of satellites, PDOP/HDOP and **Mean Difference of Hits** are within tolerances (see



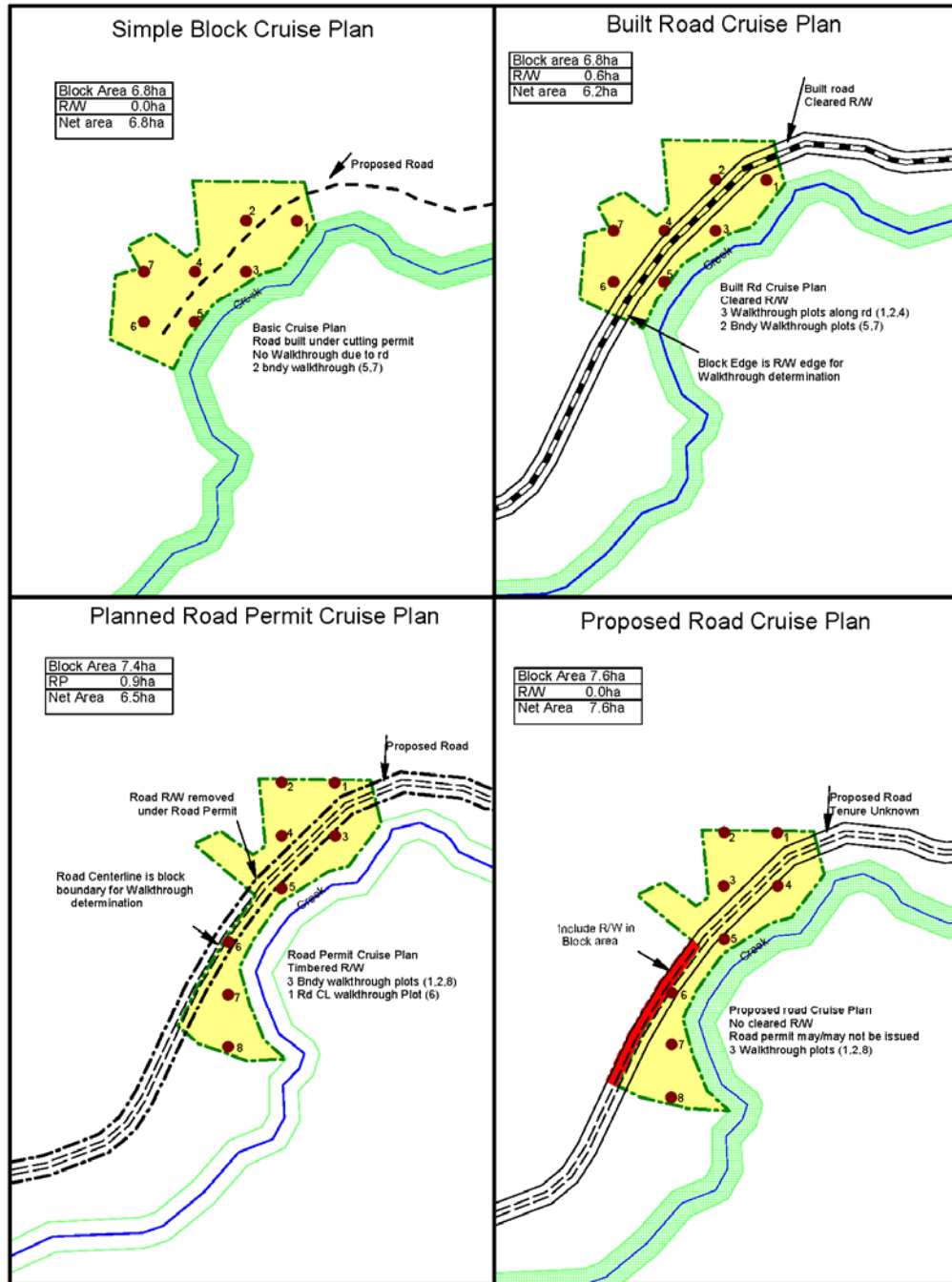


Figure 4.8 Walkthrough Method - Unflagged and Harvested Rights of Way.

#### 4.3.1.16 Positions 37 to 39 DBH Limit

The minimum DBH to which the trees on the main plot are measured to meet the timber merchantability specifications for appraisal purposes.

The timber merchantability specifications for coast cruises are dependant upon the maturity level of the block. See Section [5.4.3](#).

##### Coast Cruises

1. Immature - code 12.0 cm (less than 121 years old for coniferous, less than 41 years old for deciduous ).
2. Mature - code 17.5 cm (greater than 120 years old for coniferous, greater than 40 years old for deciduous).

##### Interior Cruises

1. PL - code 12.5 cm.
2. All other species - code 17.5 cm.

The Map Area Statement (MAS) determines the compilation level of the cruise (see Section [5.4.3](#)). Measured trees below this minimum can be tallied but, based on diameter, will be ignored in the compilation. For count plots the minimum DBH tallied must be the same as the DBH entered on the MAS (See Section [5.2.7](#)). DBH must be recorded for count plot trees where timber merchantability specifications may indicate a different DBH limit level from the field tally level.

### **Marking Trees**

A paint line or tag must be displayed on the tree at the point of DBH measurement, with the numbers facing the plot centre, to facilitate checking. Borderline "in" trees must be numbered; "out" trees will be labelled with an "X". Trees are to be marked the same in both count and measure plots. Live useless and dead useless stems are not tallied in count plots.

#### 4.3.1.17 Positions 40 to 52 Sub-Plot Sizes

In stands with a high density of stems in the smaller diameter classes, a sub-plot may be established for the smaller diameter classes. The same sub-plot size should be maintained throughout the timber type. The sub-plot should always be smaller than the main plot. Sub-plots are not generally used for appraisal cruising.

<b>WET AND DRY BELT DOUGLAS FIR ZONES</b>		
	<b>Biogeoclimatic Zone</b>	<b>Biogeoclimatic Subzone and Variant</b>
<b>Wet Belt Code = 1</b>	ESSF (Englemann Spruce - Subalpine Fir)	dc, dk, dm, dv, mc, mk, mm, mv, mw, vc, vv, wc, wk, wm, wv
	ICH (Interior Cedar Hemlock)	dk, dm, dw, mc, mk, mm, mw, vc, vk, w, wk
	IDF (Interior Douglas Fir)	mw, ww
	MS (Montane Spruce)	undifferentiated, mw
	SBPS (Sub-Boreal Pine - Spruce)	dc, mc, mk
	SBS (Sub-Boreal Spruce)	undifferentiated, dh, dk, dw, mc, mh, mk, mm, mw, vk, wk
<b>Dry Belt Code = 2</b>	BG (Bunchgrass)	xh, xw
	ESSF (Englemann Spruce - Subalpine Fir)	xc, xv
	ICH (Interior Cedar Hemlock)	xw
	IDF (Interior Douglas Fir)	undifferentiated, dc, dk1, dk2, dm1, dm2, dw, xh, xk, xm, xw
	MS (Montane Spruce)	dc, dk, dm, dv, xk, xv
	PP (Ponderosa Pine)	xh, dh
	SBPS (Sub-Boreal Pine - Spruce)	xc

If subzones are missing from the above listing, the general rule to apply is: very dry and dry subzones are Dry Belt; and moist, wet and very wet are Wet Belt.

**5.2.5 Positions 15 to 16 Tree Class and Species Compilations (optional)**

The default values for appraisal purpose compilations are zero. This will ensure that useless tree class volumes are excluded and all species are compiled in the same manner.

### 5.2.6 Positions 17 to 18 Type of Compilation (required)

Enter 3 for Interior Cruises and 32 for Coastal cruises. This represents the appropriate end product or combination of products.

### 5.2.7 Positions 19 to 27 Timber Merchantability Specifications (required for Interior compilations)

This section indicates the minimum timber merchantability specifications that will be assigned by the cruise compilation programs when the compilation program is used for appraisal purposes.

Coast		DBH	Stump	Top
	Mature	17.5	30	15.0
	Immature	12.0	30	10.0
Interior	All	17.5	30	10.0
	Lodgepole Pine	12.5	30	10.0
	Cedar > 140 years	17.5	30	15.0

Red cedar (Interior only):

- if greater than 50.0 percent of the red cedar net volume is in trees less than 141 years old, the top diameter inside bark is 10.0 cm, and
- if greater than or equal to 50.0 percent of the red cedar net volume is in trees greater than 140 years old, the top diameter inside bark is 15.0 cm.

The stump height, top dib, DBH limit or log length can be altered in Positions 30 to 74 for one or more species on the sale in compilations that are not used for appraisal purposes.

### 5.2.8 Positions 28 to 29 Log Lengths (to the nearest metre) (required)

Log Lengths for product analysis. If not equal to 5 m for Interior or 10 m for Coast, reports are titled "Not for Appraisal Purposes".

One exception is the portion of the Coast Mountains Resource District west of the Cascade Mountains administrative line in coastal FIZ A utilizes Interior appraisals. This area is permitted to use 5 m logs for interior appraisal purposes.

Log Lengths for other purposes can be 1 to 99 m.

(Zero) 0 = total tree length between stump height and top dib.

**5.2.9 Positons 30 to 74 Exceptions (optional)**

See Sections [5.2.6](#) to [5.2.8](#). See Section [4.3.2.4](#) for species codes.

**5.2.10 Position 75 Block or Average Line Method of Compilation (required)**

Enter A for all cruises used for appraisal purposes as the average line method must be used.

**5.2.11 Position 76 (required for CGNF cruises)**

Enter C for CGNF cruises.

**5.2.12 Position 77 100% (required for 100% cruises)**

Enter A if this cruise or stump cruise is 100% measure.

**5.2.13 Positions 78 to 80 Stump Cruise Information (required for stump cruises)**

See Section [6.8](#).

### **5.3 Type Description (Card Type C)**

This section contains the area information for the types, harvest methods and treatment units within the compilation.

#### **5.3.1 Positions 14 to 15 Type Number (required)**

The type number corresponds to the type number on the cruise map for the area to be compiled within that type polygon.

#### **5.3.2 Positions 16 to 28 Map Label and Type Identity (optional)**

Timber types were traditionally given labels that followed inventory naming conventions, but this is not mandatory. For further information, see the [Timber Type Label Information](#) in the appendices.

#### **5.3.3 Positions 29 to 88 Timber Type Area (required)**

Record the merchantable timbered hectares for each timber type (stratum) and treatment unit in the cutting authority to the nearest 0.1 ha.

### A.6.1.5 Defoliators (Path/Tree Class = Risk Group, All Species)

This damage category includes hemlock looper, budworms, moths and other defoliators. If the classification is doubtful, assess the cambium on the north side at DBH.

- Code X - trees with living cambium. Tree classes 1, 2, 5, 6, 8, and
- Code Y - trees with dry cambium. All tree classes are allowed.
- All other insect attack codes take precedence over defoliator, codes x and y except code 4, Blister Rust.

## A.6.2 Fire Damage

The following fire damage codes apply to all appraisal cruises and will be entered in column 62 of the cruise tally sheet ([Figure 4.1 Cruise Tally Sheet – FS 205C \(front side\)](#)):

### A.6.2.1 Light Damage - Code A

Damage consisting of scorched bark and foliage but no charring in the merchantable portion of the stem. Bark scorching greater than or equal to 5 years after the date that the fire **was recorded by the** Ministry of Forests, Lands and Natural Resource Operations does not qualify for the fire damage coding.

Classification: The risk group will be determined by the tree class and pathology.

### A.6.2.2 Moderate Damage - Code B

Damage of any age consisting of some shallow charring of wood fibre in the merchantable portion of the stem.

Classification: Assign the tree class and record the pathological indicators as normal. The compilation program will down grade risk group 1 trees to risk group 2.

### A.6.2.3 Heavy Damage - Code C

Damage of any age consisting of extensive shallow charring or deep charring in the merchantable portion of the stem. Multiple deep checks in trees less than 30 cm DBH with fire damage also qualify for heavy damage.

Classification: Assign the tree class and record the pathological indicator as normal. The compilation program will down grade these trees to the highest risk group.

Trees are coded as they appear at the time of the cruise only and not at the anticipated time of harvesting.

Definitions:

“**Merchantable section**” means the section of the stem between 30 cm stump and the 10 cm or 15cm top diameter inside bark as per the appropriate timber merchantability standards. Damage outside of these limits was not included in the loss factor data.

“**Charring**” means the actual destruction of wood by fire. There must be identifiable damage to a surface area greater than 100 cm<sup>2</sup>.

“**Shallow charring**” means charring which is greater than 100 cm<sup>2</sup> in surface area and less than one-third of the radius of the tree.

“**Deep charring**” means where charring is deeper than one-third of the radius of the tree.

“**Multiple deep checks**” means where more than 1 check is deeper than one-third of the radius of the tree.

1. Surface checking may occur as the result of fire damage but this does not affect the tree classification.
2. Trees are coded as they appear at the time of the cruise and not at the anticipated time of harvesting.

### A.6.3 Down Trees

The following Down Tree Codes apply to all appraisal cruises and will be entered in column 63 of the Tally Sheet ([Figure 4.1 Cruise Tally Sheet – FS 205C \(front side\)](#).) if they are located in the merchantable portion<sup>1</sup> of living or dead potential trees and the tree is:

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<sup>1</sup> *The merchantable portion of the tree is from 30cm stump height to a 10cm or 15cm top diameter inside bark as per the appropriate timber merchantability standards. Damage outside of these limits was not included in the loss factor data.*



**Distribution of "t"**

<b>Degrees of Freedom</b>	<b>0.05 (95 % Confidence Interval)</b>
1	12.706
2	4.303
3	3.182
4	2.776
5	2.571
6	2.447
7	2.365
8	2.306
9	2.262
10	2.228
11	2.201
12	2.179
13	2.160
14	2.145
15	2.131
16	2.120
17	2.110
18	2.101
19	2.093
20	2.086
21	2.080
22	2.074
23	2.069
24	2.064
25	2.060
26	2.056
27	2.052
28	2.048
29	2.045
30	2.042
31 – 67	2.000
68 – 112	1.980
113 +	1.960

**FS 693 Provincial Cruise Plan**



Ministry of Forests, Lands and Natural Resource Operations

**PROVINCIAL CRUISE PLAN**

Tenure:  
C.P. (if known):

<b>ATTENTION</b>								
<b>District Manager:</b>				<b>Cruise Area (ha):</b> 0				
<b>Licensee:</b>				<b>Base Map #:</b>				
<b>Location (name):</b>				<b>Wet or Dry Belt Fir (interior only):</b>				
<b>Contact:</b>				<b>BEC Subzone/Variant:</b>				
<b>TSA:</b>			<b>PSYU:</b>			<b>FIZ:</b>		
<b>COMPILING AGENCY</b>								
Name:				Address:				
<b>CRUISING AGENCY</b>								
Agency Name:			Proposed Cruiser Name(s):			Prof. Designation(s):		
Address:								
<b>TENTATIVE CRUISE DATES</b>								
Start:				Finish:				
Access:								
<b>TYPE OF SAMPLE GRID</b>								
GIS Grid – UTM or BC Albers:				GPS Used <input type="radio"/> Yes <input type="radio"/> No				
Local Grid <input type="radio"/> Yes <input type="radio"/> No								
BLOCK #	Block Area (ha)	Plot Size (proposed BAF)	Timber Type number	# Measure Plots	# Count Plots	Grid Spacing (m)	Mature or Immature	Comments
Total	0			0	0			
<b>SAMPLING ERROR OBJECTIVE</b>								
Scale Based		MPB Cruise Based		Green Cruise Based		S.E. Waived <input type="radio"/> Yes <input type="radio"/> No		
<b>MINIMUM DBH LIMITS (cm):</b>				<b>COAST</b>		<b>INTERIOR</b>		
				Mature Blocks	Immature Blocks	Standard (cm)	Lodgepole Pine (cm)	
<b>Field Tally</b>		Non-Appraisal						
		Appraisal		17.5	12.0	17.5	12.5	
<b>Signed:</b>								
_____ (Authorized Licensee Representative)			_____ Prof. Designation			_____ Date		

FS 693 HVA 2014/07 Please be advised that this information may be released under the Freedom of Information and Protection of Privacy Act

**Figure A.5 FS 693 - Provincial Cruise Plan (Page 1 of 2)**

MARKING	Ribbon Colour	Paint Colour	Axe Blaze	Other (tags)
Baseline				
Boundaries				
Harvest Methods				
Strips				
Plot Centre				
Tie Points				
Non Forest Types				
Riparian Areas				
Wildlife Tree Patches				
Other				
Comments				

Figure A.6 FS 693 - Provincial Cruise Plan (Page 2 of 2)

Link: [www.for.gov.bc.ca/pscripts/isb/forms/forms.asp](http://www.for.gov.bc.ca/pscripts/isb/forms/forms.asp)

# FS 694 Provincial Cruise Plan and Map Check List



Ministry of  
Forests, Lands and  
Natural Resource Operations

TENURE:	___	___
C.P.:	___	___
CRUISE AREA (ha):	___	___
BASE MAP #:	___	___

## PROVINCIAL CRUISE PLAN AND MAP CHECK LIST

A. TENURE and CRUISING AGENCY INFORMATION	YES	NO	N/A
1. Licensee's name:			
2. Tenure and Cutting Permit & Block numbers:			
3. Forest Region & District:			
4. Timber Supply Area (TSA):			
5. Name(s) of persons who completed the cruise fieldwork:			
6. Name(s) of persons who completed the cruise plan and map:			
<b>B. AREA INFORMATION</b>			
7. Cutting Boundaries and Block Net Areas:			
8. Timber Type Net Areas:			
9. Harvesting Method & Net Areas for Heli-Logging:			
10. Non-Forest Type & Forest Reserve Areas:			
<b>C. CRUISE PLAN MAP</b>			
11. Tenure information adequate:			
12. Acceptable map scale (1:5 000; 1:10 000):			
13. Timber type lines and descriptions. A forest cover map included for the cruise and surrounding area if PI is present:			
14. Minimum number of plots per timber type polygon:			
15. Sufficient number of plots per type or 1.0 plots per hectare and SE waived:			
16. Maximum grid - 200m if cruise < 250 ha or 250m if cruise ≥ 250 ha:			
17. Prism and/or fixed area plot size consistent in each type?			
18. Cut block boundaries and forest types clearly delineated on map?			
19. Point of Commencement established:			
20. Strips tied to cutblock boundaries (unless GPS is used):			
21. Measure & Count Plots identified and numbered:			
22. Legal Survey Features (if they affect sampling):			
23. Portions of Cutting Boundaries that will be Stubbed (if applicable):			
24. Existing & Proposed Roads identified:			

Note: The cruise plan map may contain all of the information in lieu of using the form too.

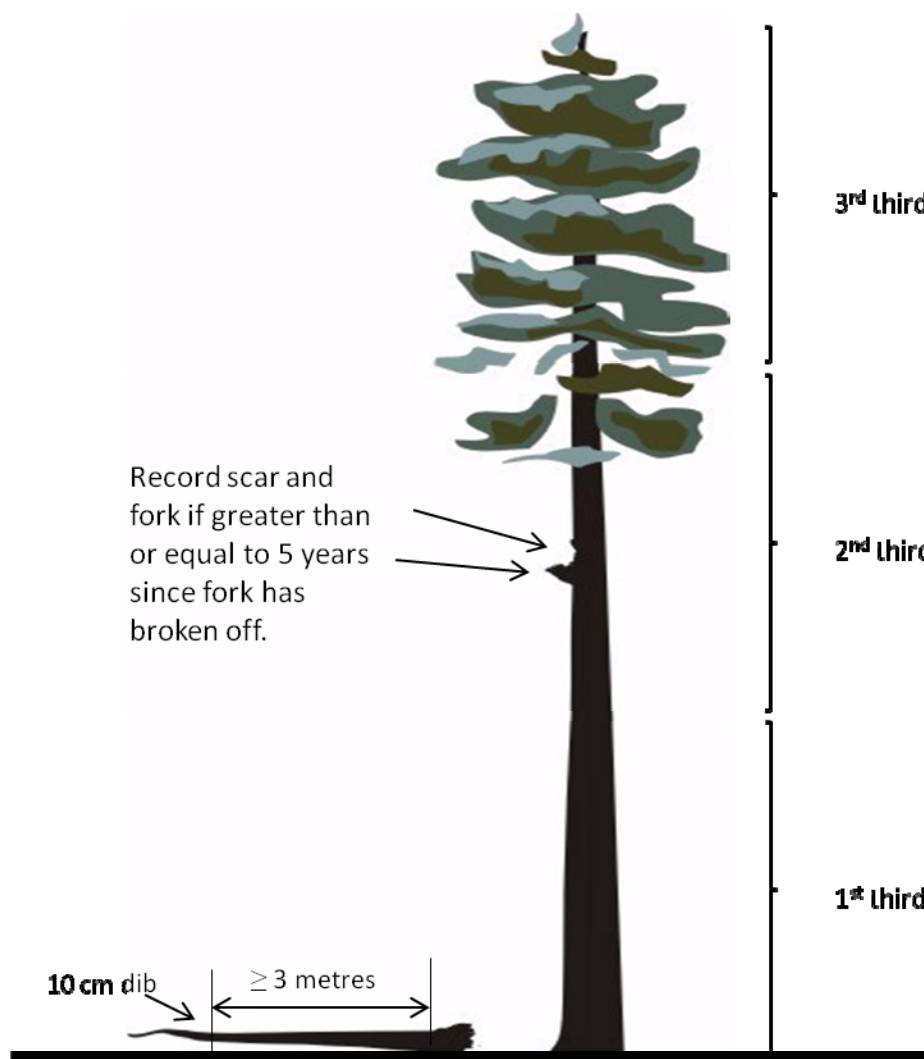
Remarks:

Action:	
Signature:	Professional Designation:

FS 694 HVA 2014/02 Please be advised that this information may be released under the Freedom of Information and Protection of Privacy Act

Figure A.7 FS 694 - Provincial Cruise Plan and Map Check List

Link <https://gww.for.gov.bc.ca/gscripts/his/forms/forms.asp>



Record down tree code if fork broke from first or second third of tree.

**Segment of Cruise Tally Card (FST 205)**

Tree Number	Height	Species	DBH	Tree Class	Conk	Blind Conk	Scar	Fork/Crook	Frost Crack	Mistletoe	Rotten Branch	Dead/Broken Top	Down Tree
01	40.0	F	80.0	2			2	2					m

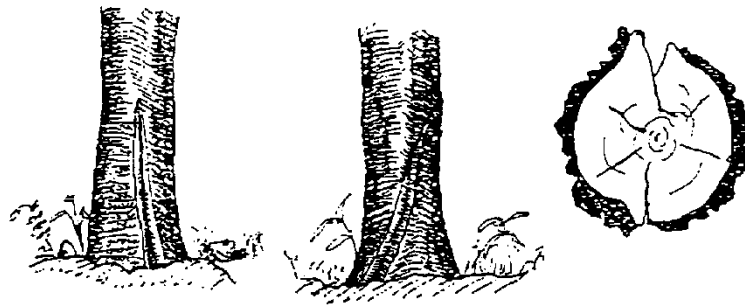
**Figure A.26 Fork/crook.**

Record a down tree code (clean break) since the fork is long enough to produce a merchantable log. Record fork and scar if the injury is at least 5 years old. See Section [A.6.3](#) in [Damaged Stands](#) (Appendix 6) for the down tree codes. See Section [A.4.2.3](#) for details regarding the coding of scars and see Section [A.4.2](#) for details regarding the coding of pathology on secondary leaders.

#### A.4.2.5 Frost Cracks

- frost cracks result from deep radial splitting of the trunk caused by uneven expansion of the wood after sudden and pronounced drops in temperature,
- the cracks usually originate at the base of the trunk and extend up the tree following the longitudinal grain of the tree (see [Figure A.27 Appearance of Frost Crack on Standing Trees](#)),
- frost cracks are often repeatedly opened by wind stresses or by low temperatures which freeze the moisture within the cracks and expands and splits the tree further,
- repeated healing of the wood produces considerable callous tissue giving the wood a pronounced ribbed appearance, and
- frost cracks must have occurred at least 5 years previously before they can be recorded<sup>6</sup>.

Frost cracks are often associated with severe basal decay.



**Figure A.27 Appearance of Frost Crack on Standing Trees**

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<sup>6</sup> Recent pathological damage and pathological factors above 10 cm top diameter were not included in the loss factor data.