

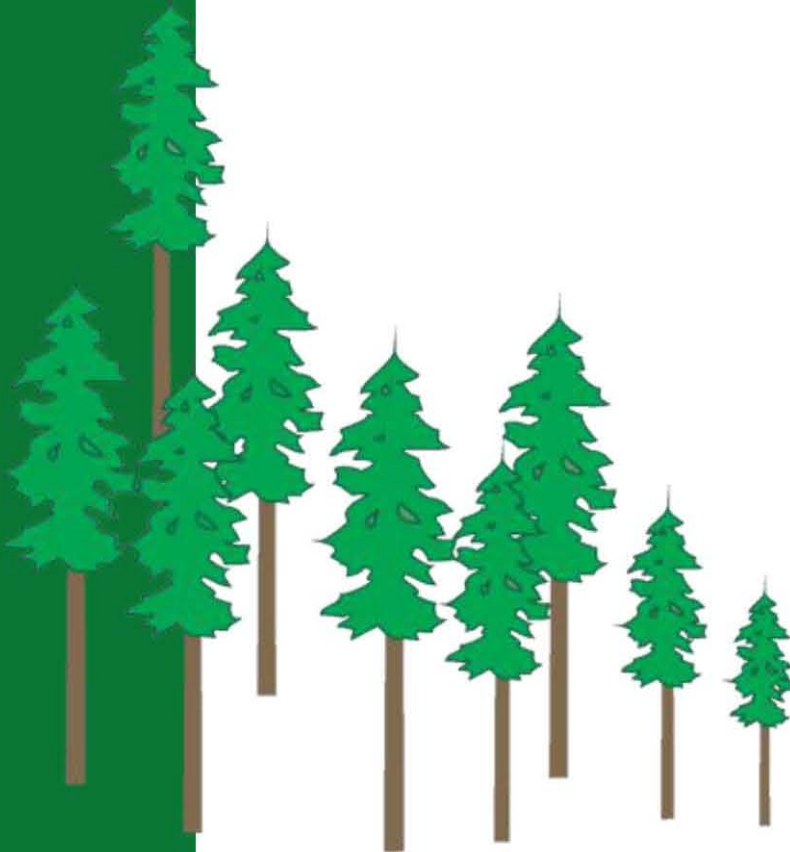


Interior MARKET PRICING SYSTEM

Update – 2013

July 1, 2013

Timber Pricing
Branch



Interior Market Pricing System: Update – 2013

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1. INTRODUCTION

The purpose of this paper is to provide an overview of the July 1, 2013 update to the Interior Market Pricing System (MPS).¹

2. AUCTION DATASET

The new auction dataset used in the update contains winning bids and data from 1191 sales over the five year period January 1, 2008, through December 31, 2012.

3. EQUATIONS

The 2012 MPS equations were re-estimated with the new auction dataset to establish the 2013 benchmark equations. No other changes were made.

¹ This paper is not intended to provide the basis for calculating stumpage rates nor should it be used as guidance for interpreting the legal policies and procedures for calculating stumpage rates, which are contained in the *Interior Appraisal Manual*. The *Interior Appraisal Manual* contains the policies and procedures referred to in Section 105 of the *Forest Act*.

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Estimated Winning Bid Equation

Variable	2012 Equation		Benchmark Equation ¹	
	Co-efficient	t – Statistic	Co-efficient	t – Statistic
LN (Number of Bidders)	3.079783	16.63302	3.204420	16.29339
Constant	21.59218	4.742837	-8.494034	-1.552036
Exchange Rate (\$US/\$C)	-8.995256	-2.202930	7.347426	1.558249
Real Stand Selling Price	0.128184	6.298410	0.184238	9.389700
HemBal Fraction	-9.739417	-9.993599	-7.404419	-7.581239
Cedar Fraction * (1 - Cedar Decay Fraction) * (1 – Zone 6)	30.55413	9.354203	18.17304	6.507839
Fir Fraction * Dry Belt	-7.513999	-3.655860	-5.983015	-2.880915
Cable Yard Fraction	-6.799818	-7.040011	-7.726276	-8.095976
LN(Volume/1000)	0.914559	5.295644	0.841832	4.705436
Decay Fraction	-13.64371	-4.010296	-8.445115	-2.399548
Fire Damaged Fraction	-10.25956	-3.966091	-10.21475	-3.960248
LN (Volume per Tree)	4.929575	11.63092	3.801012	8.710163
LN (Volume per Hectare)	1.435285	3.265887	2.078213	4.075855
Cycle Time	-1.132551	-11.51343	-0.990834	-9.737530
Zone 9	-4.577367	-7.219039	-3.457293	-5.614577
Deciduous Indicator * Deciduous Fraction	-7.016940	-3.354349	-0.736903	-0.232360
(Red + Grey Attack Fraction) * (2007 Auctions + 2008 Auctions)*(1 - Cruise Based)	-4.108566	-5.386112	n/a	n/a
(Red + Grey Attack Fraction) * (2008 Auctions) * (1 – Cruise Based)	n/a	n/a	-2.215926	-2.367336
(Other Pest Attack Fraction) * (1 – Cruise Based)	-4.760061	-2.055066	-2.525324	-1.113875
Cruise Based	-5.367084	-15.00010	-5.529434	-16.35070
2008 Auctions	-4.656851	-8.377871	n/a	n/a
2009 Auctions	-7.465433	-14.25957	0.084604	0.114753
2010 Auctions	-6.502375	-11.32133	-0.703696	-1.353156
2011 Auctions	-4.434605	-6.355386	0.528098	0.968755
2012 Auctions	n/a	n/a	2.069919	3.967033
Adjusted R²	0.733492		0.680625	

¹2012 equation using updated auction set

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Number of Bidders Equation

Variable	2012 Equation		Benchmark Equation ¹	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Forecast Real Winning Bid	0.059377	20.08446	0.069426	22.53307
Constant	-1.154166	-12.20970	-0.885993	-11.36678
2008 Auctions	0.376475	7.046623	n/a	n/a
2009 Auctions	0.279668	5.117194	-0.109630	-2.450295
2010 Auctions	0.335633	5.759428	-0.098938	-2.031630
2011 Auctions	0.360599	6.322648	-0.097973	-1.892075
2012 Auctions	n/a	n/a	-0.293060	-5.654181
Cruise Based	0.304728	6.348797	0.443658	10.12039
District Average Number of Bidders	0.277652	14.93401	0.271049	15.72667
Partial Cut Fraction	-0.889357	-2.627811	-0.841314	-2.371408
Slope	-0.009987	-6.474260	-0.010260	-7.144930
First and Second Quarter Auctions	0.082497	2.640339	0.108969	3.729164
Highway Haul	0.131030	3.107282	0.107899	2.683964
Adjusted R ²	0.400788		0.458187	

¹2012 equation using updated auction set

New variables were tested to see if they would improve the statistics, compared to the benchmark equations. Likewise, variables that were no longer significant were removed. The final data set contains 1191 auction sales.

The final equations, compared to the Benchmark Equations, are shown below.

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Estimated Winning Bid

Variable	Benchmark Equation ¹		2013 Final Equation	
	Co-efficient	t – Statistic	Co-efficient	t – Statistic
LN (Number of Bidders)	3.204420	16.29339	3.189247	16.28758
Constant	-8.494034	-1.552036	6.017931	1.616668
Exchange Rate (\$US/\$C)	7.347426	1.558249	n/a	n/a
Real Stand Selling Price	0.184238	9.389700	0.168880	8.491173
HemBal Fraction	-7.404419	-7.581239	-8.417271	-8.003148
Cedar Fraction * (1 - Cedar Decay Fraction) * (1 - Zone 6))	18.17304	6.507839	20.40898	7.215382
Fir Fraction * Dry Belt	-5.983015	-2.880915	n/a	n/a
Cable Yard Fraction	-7.726276	-8.095976	-7.795386	-8.239212
LN(Volume/1000)	0.841832	4.705436	0.894897	5.038229
Decay Fraction	-8.445115	-2.399548	-11.20834	-2.933332
Fire Damaged Fraction	-10.21475	-3.960248	-11.12619	-4.355080
LN (Volume per Tree)	3.801012	8.710163	4.182745	9.254218
LN (Volume per Hectare)	2.078213	4.075855	1.139364	1.979178
Cycle Time	-0.990834	-9.737530	-1.020745	-10.05443
Zone 9	-3.457293	-5.614577	-2.958362	-4.151176
Deciduous Fraction	n/a	n/a	-6.177155	-2.454664
Deciduous Indicator * Deciduous Fraction	-0.736903	-0.232360	n/a	n/a
(Red + Grey Attack Fraction) * (2008 Auctions) * (1 – Cruise Based)	-2.215926	-2.367336	-1.821319	-1.666593
(Other Pest Attack Fraction) * (1 – Cruise Based)	-2.525324	-1.113875	n/a	n/a
Attack * (1 – Cruise Base)	n/a	n/a	-1.206970	-1.446242
Cruise Based	-5.529434	-16.35070	n/a	n/a
Cruise Based * (1 – RG35)	n/a	n/a	-4.453539	-7.850520
Cruise Based * (RG35)	n/a	n/a	-6.571226	-13.44562
2009 Auctions	0.084604	0.114753	-0.768470	-1.490970
2010 Auctions	-0.703696	-1.353156	-0.682086	-1.327132
2011 Auctions	0.528098	0.968755	0.874078	1.673291
2012 Auctions	2.069919	3.967033	2.324275	4.502148
(Fir Fraction + Yellow Pine Fraction) * Dry Belt	n/a	n/a	-5.019723	-2.813009
Larch Fraction + Yellow Pine Fraction	n/a	n/a	-8.154536	-3.251986
Adjusted R ²	0.680625		0.686335	

¹2012 equation using updated auction set

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Number of Bidders Equation

Variable	Benchmark Equation ¹		2013 Final Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Forecast Real Winning Bid	0.069426	22.53307	0.068500	22.09335
Constant	-0.885993	-11.36678	-0.853916	-10.94391
2009 Auctions	-0.109630	-2.450295	-0.108060	-2.400450
2010 Auctions	-0.098938	-2.031630	-0.099833	-2.036028
2011 Auctions	-0.097973	-1.892075	-0.101144	-1.935510
2012 Auctions	-0.293060	-5.654181	-0.294235	-5.625442
Cruise Based	0.443658	10.12039	n/a	n/a
Cruise Based * (1 – RG35)	n/a	n/a	0.318020	4.908335
Cruise Based * (RG35)	n/a	n/a	0.470764	9.974600
District Average Number of Bidders	0.271049	15.72667	0.262359	14.95623
Partial Cut Fraction	-0.841314	-2.371408	-0.898853	-2.516599
Slope	-0.010260	-7.144930	-0.009457	-6.413497
First and Second Quarter Auctions	0.108969	3.729164	0.101332	3.443459
Highway Haul	0.107899	2.683964	0.103257	2.551908
Adjusted R ²	0.458187		0.451514	

¹2012 equation using updated auction set

To implement the new equation in the *Interior Appraisal Manual*, the two equations are reduced to one MPS equation. This is done by substituting the Number of Bidders equation into the Estimated Winning Bid Equation (and thereby eliminating the variable: LN (Number of Bidders)). The two equations together result in greater statistical accuracy and reliability compared to the benchmark equations. See Appendix 1 for detailed statistics on the estimated winning bid and number of bidders equations and variable definitions.

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4. SPECIFIED OPERATIONS

The auction dataset used to develop the MPS equation is comprised of 1191 auctions. There are some harvesting situations that are not accounted for in the data and equation, and therefore a specified operation cost estimate may be used for these situations in the calculation of stumpage rates.

The specified operations are shown below and described in Appendix 2.

Specified Operations	Current Adjustment	Update July 1, 2013
1. Rail Haul	Appraisal Manual	Appraisal Manual
2. Barge/Ferry	Appraisal Manual	Appraisal Manual
3. Dump, Boom, Tow, Dewater and Reload	Appraisal Manual	Appraisal Manual
4. Camp Costs	\$1.33/m ³ \$2.50/m ³ if rail	\$1.25/m ³ \$2.36/m ³ if rail
5. Skyline Yarding	\$1.39/m ³	\$3.40/m ³
6. Horse Logging	\$8.67/m ³	\$8.67/m ³
7. Market Logger Specified Operations Cost	\$0.08/m ³	\$0.06/m ³
8. Helicopter	Appraisal Manual	\$76.99/m ³

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5. TENURE OBLIGATION ADJUSTMENTS

As outlined in the Interior Tenure Obligations Adjustment paper (dated June 5, 2006), the adjustments are based on licensee data submitted in the Interior Log Cost Report.

The tenure obligation adjustments are shown below.

Tenure Obligation	Current Adjustment	Update July 1, 2013
Total Administration Cost	2009/10 Cost Base	2010/11 Cost Base
Development Cost	2009/10 Cost Base	2010/11 Cost Base
Total Road Management Cost	2009/10 Cost Base	2010/11 Cost Base
Market Logger Road Cost	\$1.29m ³	\$1.20/m ³
Total Silviculture Cost	2006/10 Cost Base	2007/11 Cost Base
Return to Forest Management	1.031	1.027
Low Grade Percent Adjustment	Mark Specific 1/(1-%low grade/100)	Mark Specific 1/(1-%low grade/100)

6. SUMMARY

The new final equation, specified operations and tenure obligation adjustments will be used in the MPS for the Interior, starting July 1, 2013.

APPENDIX 1

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FINAL ESTIMATED WINNING BID

Dependent Variable: RBID (Winning Bid in 1997 Dollars)

Method: Least Squares

Date: 04/19/13 Time: 08:36

Sample: 1 1675 IF IN_1191=1

Included observations: 1191

	Coefficient	Std. Error	t-Statistic	Prob.
LN (Number of Bidders)	3.189247	0.195808	16.28758	0.0000
Constant	6.017931	3.722427	1.616668	0.1062
Real Stand Selling Price	0.168880	0.019889	8.491173	0.0000
Cedar Fraction * (1 - Cedar Decay Fraction)*(1 - Zone 6)	20.40898	2.828538	7.215382	0.0000
HemBal Fraction	-8.417271	1.051745	-8.003148	0.0000
Larch Fraction + Yellow Pine Fraction	-8.154536	2.507556	-3.251986	0.0012
(Fir Fraction + Yellow Pine Fraction) * Dry Belt	-5.019723	1.784467	-2.813009	0.0050
Cable Yard Fraction	-7.795386	0.946132	-8.239212	0.0000
LN (Volume/1000)	0.894897	0.177621	5.038229	0.0000
Decay Fraction	-11.20834	3.821026	-2.933332	0.0034
Fire Damaged Fraction	-11.12619	2.554761	-4.355080	0.0000
LN (Volume per Tree)	4.182745	0.451983	9.254218	0.0000
LN (Volume per Hectare)	1.139364	0.575675	1.979178	0.0480
Cycle Time	-1.020745	0.101522	-10.05443	0.0000
Zone 9	-2.958362	0.712656	-4.151176	0.0000
Deciduous Fraction	-6.177155	2.516497	-2.454664	0.0142
(Red and Grey Attack Fraction) * 2008 Auctions * (1 - Cruise Based)	-1.821319	1.092840	-1.666593	0.0959
Attack * (1-Cruise Based)	-1.206970	0.834556	-1.446242	0.1484
Cruise Based * (1 - RG35)	-4.453539	0.567292	-7.850520	0.0000
Cruise Based * RG35	-6.571226	0.488726	-13.44562	0.0000
2009 Auctions	-0.768470	0.515416	-1.490970	0.1362
2010 Auctions	-0.682086	0.513955	-1.327132	0.1847
2011 Auctions	0.874078	0.522370	1.673291	0.0945
2012 Auctions	2.324275	0.516259	4.502148	0.0000
R-squared	0.692398	Mean dependent var		13.63118
Adjusted R-squared	0.686335	S.D. dependent var		7.498978
S.E. of regression	4.199860	Akaike info criterion		5.727925
Sum squared resid	20584.50	Schwarz criterion		5.830344
Log likelihood	-3386.979	Hannan-Quinn criter.		5.766519
F-statistic	114.2114	Durbin-Watson stat		1.733168
Prob(F-statistic)	0.000000			

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FINAL NUMBER OF BIDDERS

Dependent Variable: LN (Number of Bidders)

Method: Least Squares

Date: 04/19/13 Time: 08:41

Sample: 1 1675 IF IN_1191=1

Included observations: 1191

	Coefficient	Std. Error	t-Statistic	Prob.
Forecast Real Winning Bid	0.068500	0.003101	22.09335	0.0000
Constant	-0.853916	0.078027	-10.94391	0.0000
2009 Auctions	-0.108060	0.045017	-2.400450	0.0165
2010 Auctions	-0.099833	0.049033	-2.036028	0.0420
2011 Auctions	-0.101144	0.052257	-1.935510	0.0532
2012 Auctions	-0.294235	0.052304	-5.625442	0.0000
Cruise Based * (1 - RG35)	0.318020	0.064792	4.908335	0.0000
Cruise Based * RG35	0.470764	0.047196	9.974600	0.0000
District Average Number of Bidders	0.262359	0.017542	14.95623	0.0000
Partial Cut Fraction	-0.898853	0.357170	-2.516599	0.0120
Slope	-0.009457	0.001474	-6.413497	0.0000
First and Second Quarter Auctions	0.101332	0.029428	3.443459	0.0006
Highway Transportation	0.103257	0.040463	2.551908	0.0108
R-squared	0.457045	Mean dependent var		0.869532
Adjusted R-squared	0.451514	S.D. dependent var		0.670376
S.E. of regression	0.496479	Akaike info criterion		1.448305
Sum squared resid	290.3672	Schwarz criterion		1.503782
Log likelihood	-849.4658	Hannan-Quinn criter.		1.469211
F-statistic	82.63410	Durbin-Watson stat		1.875734
Prob(F-statistic)	0.000000			

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VARIABLE DEFINITIONS FOR EQUATIONS

Variable	Definition
2007 Auctions	If the auction sold in 2007, then AUC 2007 = 1.
2008 Auctions	If the auction sold in 2008, then AUC 2008 = 1.
2009 Auctions	If the auction sold in 2009, then AUC 2009 = 1.
2010 Auctions	If the auction sold in 2010, then AUC 2010 = 1.
2011 Auctions	If the auction sold in 2011, then AUC 2011 = 1.
2012 Auctions	If the auction sold in 2012, then AUC 2012 = 1.
Attack	Fraction of Total Net Coniferous Volume that is Lodgepole pine green, red and grey attack plus the fraction of Total Net Coniferous volume that is other insect attack.
Cable Yard Fraction	Fraction of harvest method volume that is appraised as overhead cable yarding (includes Skyline <600m horizontal).
Cedar Decay Fraction	Cedar decay (%) from the appraisal summary report/100.
Cedar Fraction	Fraction of total net coniferous volume that is cedar.
Consumer Price Index (CPI)	Monthly B.C. Consumer Price Index (CANSIM 326-0020, 2002 = 100) X 1.1787.
Consumer Price Index Factor (CPIF)	CPIF = CPI/109.3.
Cruise Based	1 if cruise-based, 0 if scale based.
Cycle Time	Hauling round trip cycle time (Primary CT (hrs) + Secondary CT (hrs)). See sections 3.5.1.1 and 3.5.1.3 of the Appraisal Manual.
Decay Fraction	Prorated coniferous species decay % (from appraisal summary report) / 100.
Deciduous Fraction	Fraction of the total net cruise volume that is the total net deciduous volume.
Deciduous Indicator	If upset stumpage rate is determined under section 5.1.1(5) of the Appraisal Manual, Competitive Deciduous = 1, otherwise CD = 0.
District Average Number of Bidders	Average number of bidders for the district, in which the cutting authority area is located (see Table 3-2, section 3.3 Appraisal Manual).
Dry Belt	Fraction of the Net Merchantable Area of the cutting authority that is located in Dry Belt Douglas Fir Zones as per the table in the <i>Cruising Manual</i> . If the BEC zone/subzone combination does not appear in

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	<p>that table, then the following logic shall apply:</p> <ul style="list-style-type: none"> - If the subzone is very dry (begins with x) then the zone/subzone combination is Dry Belt. - If the subzone is dry (begins with d) then the zone/subzone combination is Dry Belt only if the BEC zone is IDF, MS or PP. <p>If the subzone is not very dry or dry (does not begin with x or d) then the zone/subzone combination is not Dry Belt.</p>
Exchange Rate	Exchange rate (\$US per \$C). Bank of Canada three month average rate beginning five months prior to the stumpage rate effective date, as published by Timber Pricing Branch. Note: if the Canadian dollar is “below par”, this number is less than one.
Fir Fraction	Fraction of total net coniferous volume that is Douglas Fir.
Fir Fraction + Yellow Pine Fraction	Fraction of total net coniferous volume that is Douglas fir and yellow pine.
Fire Damaged Fraction	Fraction of total net coniferous volume that is fire damaged.
First and Second Quarter Auctions	If the auction sold in January to June, $D_{-1} + Q2 = 1$.
Forecast Real Winning Bid	Estimated winning bid from the estimated winning bid equation.
HemBal Fraction	Fraction of total net coniferous volume that is hemlock and balsam.
Highway Haul	1 if primary haul method is highway, otherwise HWY = 0.
Larch Fraction + Yellow Pine Fraction	Fraction of total net coniferous volume that is larch and yellow pine.
LN	Natural logarithm.
Other Pest Attack Fraction	Fraction of total net coniferous volume that is other insect attack.
Partial Cut Fraction	Fraction of the harvest method volume that is appraised as partial cut. $PC = (100 - CAPCUT\%)/100$. See section 4.5 of Appraisal Manual for definition of CAPCUT%. The 80% limit in the definition of CAPCUT in section 4.5 does not apply.
RBID	Winning bid in 1997 dollars.

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Real Stand Selling Price	Estimated stand lumber value (\$/m ³) in 1997 dollars. Weighted average of (LRF * Lumber price by coniferous species). See Appraisal Manual section 3.2.
Red + Grey Attack Fraction	Fraction of total net coniferous volume that is red and grey mountain pine beetle attack.
RG35	1 if Total Net Coniferous Volume of timber on the cutting authority area is comprised of 35% or greater red and grey Mountain Pine Beetle attacked Lodgepole pine, otherwise RG35 = 0.
Slope	Cutting authority average slope from the appraisal summary report.
Volume	The zonal volume from Table 3-3 (See Appraisal Manual section 3.3) for the cutting authority unless: <ol style="list-style-type: none"> 1. The cutting authority is a BCTS cutting authority; if so then use the Total Net Coniferous Volume for the cutting authority. 2. The cutting authority is not a BCTS cutting authority and, the sum of all the AAC's for all the licences that the licensee has in the same TSA as the cutting authority being appraised is less than the zonal volume indicated in Table 3-3 for the selling price zone in which the cutting authority is located, if so, then use the greater of: <ul style="list-style-type: none"> - The Total Net Coniferous Volume, or - The sum of the AAC volumes described above.
Volume per Hectare	Net coniferous volume per hectare (m ³ /ha).
Volume per Tree	Cutting authority average net volume per tree, from appraisal summary report (m ³).
Zone 6	Skeena selling price zone variable. Zone 6 = 1 if cutting authority is appraised with selling price zone 6, otherwise Zone 6 = 0.
Zone 9	Fort Nelson – Peace selling price zone variable. Zone 9 = 1 if cutting authority is appraised with selling price zone 9, otherwise Zone 9 = 0.

APPENDIX 2

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DESCRIPTION OF SPECIFIED OPERATIONS

If sufficient auction data is not available for an activity employed by either BCTS or other licenses, the ministry may, for those identified situations, implement a specified operations cost estimate in the calculation of the stumpage rate.

The specified operations will be used to adjust the MPS stumpage rate for the estimated incremental cost of the identified situation. The explicit assumption is that if a bidder was faced with a similar situation he or she would lower the bid by the extra cost incurred because of the identified situation.

The situations that may be eligible for specified operations adjustment will be determined according to the following principles:

- the expectation that a bid would be influenced by this situation;
- representation (number of samples, if any, in the auction data set);
- materiality of estimated cost differential (supported by verifiable financial data); and,
- statistical analysis (including the premise that other represented situations and variables in the MPS database and equations may serve as a proxy for the situation in question).

The ministry, after considering the above and any other relevant technical information, may or may not designate the situation as an identified situation eligible for specified operations and, if eligible, will specify the dollars per cubic metre adjustment.

The ultimate objective is to have a representative auction database and hence, few, if any, specified operations adjustments.

The following are identified as specified operations for the Interior MPS. Cost estimates from the updated *Interior Appraisal Manual* are used for the following:

- Rail Haul
- Rail haul including truck to rail transfer and rail transport.
- Barge/Ferry
- Barge/ferry used to truck haul (private).
- Barge/ferry not used for truck haul (private).
- Dump and boom
- Tow
- Dewater and reload
- Camp costs
- Skyline Yarding
- Horse Logging
- Market Logger Specified Operations Cost
- High Development Cost (BCTS only)
- Helicopter