



**BRITISH
COLUMBIA**

Ministry of Forests
and Range

INTERIOR MARKET PRICING SYSTEM

Update - 2007

July 3, 2007



Revenue
Branch

Table of Contents

Introduction.....	1
Auction Dataset.....	1
Equations.....	1
Specified Operations.....	5
Tenure Obligation Adjustments.....	6
Summary.....	6
Appendix 1.....	7
Final Estimated Winning Bid.....	8
Final Number of Bidders.....	9
Variables and Definitions.....	10
Appendix 2.....	12
Definitions of Specified Operations.....	13

1. INTRODUCTION

The purpose of this paper is to provide a overview of the July 1, 2007 update to the Interior Market Pricing System (MPS).¹

2. AUCTION DATASET

The initial auction dataset used in the update contains winning bids and data from 1193 sales over the 5 year period January 1, 2002 through December 31, 2006. The final auction dataset contains 1133 sales.

3. EQUATIONS

With the initial auction dataset, the 2006 equations were re-estimated. No other changes were made.

The results are the benchmark equations, shown below.

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*.

Estimated Winning Bid Equation

Variable	2006 Equation		Benchmark Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	24.40171	9.030120	24.98464	8.848955
Real Stand Selling Price	0.159428	7.546786	0.186059	8.229854
FIR Fraction	6.796802	4.904354	6.995829	4.361388
HemBal Fraction	-9.908752	-5.267265	-13.47627	-7.435418
Cedar Fraction	29.15937	6.175813	25.52088	5.488858
Volume per Hectare/1000	8.706226	3.055413	5.904127	2.058643
LN (Volume/1000)	2.691565	10.36842	2.136256	8.090345
1/Volume per tree *(1-HemBal Fraction)	-2.069715	-8.062047	-2.653967	-10.26622
Grade 3 Fraction	11.31771	6.707950	12.91010	7.167245
Deciduous Fraction	-11.32074	-4.491924	-14.06616	-6.472201
Decay Fraction	-27.08290	-4.134271	-26.28002	-4.100054
Cableyard Fraction	-8.789590	-6.164032	-7.742212	-4.859866
Helicopter Logging Fraction	-28.08467	-9.433969	-31.48068	-7.991283
Horse Logging Fraction	-9.391041	-8.628725	-7.384510	-7.237939
Fire Damaged Fraction	-17.39914	-14.92976	-14.85646	-8.487116
Cycle Time	-1.971888	-13.69849	-1.676839	-11.39787
Tow(Distance)	-0.026901	-1.246343	-0.009060	-0.414814
LN (Number of Bidders)	5.341422	18.83123	4.748712	16.59771
Salvage Logging indicator	-2.160891	-3.954949	-2.781177	-5.234099
Fort Nelson – Peace Zone	-3.008954	-3.940827	-2.467765	-2.941779
2002 auctions	-0.465792	-0.714781	n/a	n/a
2003 auctions	-2.056223	-2.570809	-1.068366	-1.320563
2004 auctions	-3.606570	-5.229112	-3.192207	-4.814435
2005 auctions	1.022189	1.226200	2.215240	2.664568
2006 auctions	n/a	n/a	-8.245232	-9.427509
Number of Observations	1182		1193	
Adjusted R ²	0.683282		0.697884	
*LN means the natural logarithm				

Number of Bidders Equation

Variable	2006 Equation		Benchmark Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	0.658527	1.397406	1.217805	2.545441
Forecast Real Winning Bid	0.037255	22.16828	0.038328	21.48945
District Average Number of Bidders	0.090192	6.257363	0.131577	7.971045
Exchange rate(\$US/\$C)	-1.485989	-2.017900	-2.818872	-3.722825
Partial cut fraction	-0.325923	-2.826510	-0.521478	-3.851337
Slope %	-0.004579	-3.657875	-0.004752	-3.450914
Horse logging fraction	-0.318166	-3.057847	-0.302980	-2.211238
Salvage logging indicator	-0.105875	-3.141695	-0.045285	-1.307376
Spring auction indicator	0.221511	4.916477	0.156706	3.667205
Winter auction indicator	-0.073479	-1.826619	-0.032735	-0.749345
2002 auctions	-0.093070	-1.782964	n/a	n/a
2003 auctions	0.231395	2.848263	0.411774	5.049212
2004 auctions	0.026096	0.228550	0.293882	2.539898
2005 auctions	-0.132164	-0.878641	0.202951	1.320226
2006 auctions	n/a	n/a	1.116838	5.684642
Number of Observations	1182		1193	
Adjusted R ²	0.410573		0.408001	

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. In particular, the variable Tow (Distance) is no longer statistically significant, so it was removed. At the same time, auction sales that had Towing were removed from the initial dataset, along with some other sales (for example, certain deciduous and 'skidder/swing' auction sales). The final data set contains 1133 auction sales. See Appendix 1 for detailed statistics and definitions.

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

Estimated Winning Bid

Variable	Benchmark Equation		Final Equation	
	Co-efficient	t – Statistic	Co-efficient	t – Statistic
Constant	24.98464	8.848955	27.50628	9.970842
Real Stand Selling Price	0.186059	8.229854	0.174490	7.737896
FIR Fraction	6.995829	4.361388	6.500597	4.095498
HemBal Fraction	-13.47627	-7.435418	-12.89714	-7.040192
Cedar Fraction	25.52088	5.488858	23.09428	5.408024
Volume per Hectare/1000	5.904127	2.058643	4.825013	1.683968
LN (Volume/1000)	2.136256	8.090345	n/a	n/a
LN ((Vol – Deck_Vol)/1000))	n/a	n/a	2.178258	8.310748
1/Volume per tree *(1-HemBal Fraction)	-2.653967	-10.26622	-1.151656	-2.262554
Grade 3 Fraction	12.91010	7.167245	12.18485	6.864476
Deciduous Fraction	-14.06616	-6.472201	-10.45422	-3.438955
Decay Fraction	-26.28002	-4.100054	-29.49454	-4.620984
Cableyard Fraction	-7.742212	-4.859866	-7.743592	-4.294034
Helicopter Logging Fraction	-31.48068	-7.991283	-33.31608	-8.526350
Horse Logging Fraction	-7.384510	-7.237939	-7.232724	-6.873909
Fire Damaged Fraction	-14.85646	-8.487116	-14.48430	-8.136430
Cycle Time	-1.676839	-11.39787	-1.721603	-11.53573
Tow(Distance)	-0.009060	-0.414814	n/a	n/a
LN (Number of Bidders)	4.748712	16.59771	4.704155	16.28722
Salvage Logging indicator	-2.781177	-5.234099	-2.780152	-5.154571
Fort Nelson – Peace Zone	-2.467765	-2.941779	-2.699050	-3.224216
2003 auctions	-1.068366	-1.320563	-1.565476	-1.948649
2004 auctions	-3.192207	-4.814435	-3.277362	-5.049053
2005 auctions	2.215240	2.664568	2.174661	2.566641
2006 auctions	-8.245232	-9.427509	-8.879848	-9.982754
Decked Volume Fraction	n/a	n/a	130.0489	1.988883
LN (Volume per Tree)	n/a	n/a	4.931008	3.628468
Adjusted R ²	0.697884		0.710233	
*LN means the natural logarithm				

Number of Bidders Equation

Variable	Benchmark Equation		Final Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	1.217805	2.545441	1.262116	3.011341
Forecast Real Winning Bid	0.038328	21.48945	0.039401	21.81794
District Average Number of Bidders	0.131577	7.971045	0.133055	7.894047
Exchange rate(\$US/\$CDN)	-2.818872	-3.722825	-3.026744	-4.713646
Partial cut fraction	-0.521478	-3.851337	-0.503874	-3.761580
Slope %	-0.004752	-3.450914	-0.004182	-2.913257
Horse logging fraction	-0.302980	-2.211238	-0.213833	-1.487041
Salvage logging indicator	-0.045285	-1.307376	n/a	n/a
Spring auction indicator	0.156706	3.667205	0.164435	3.838852
Winter auction indicator	-0.032735	-0.749345	n/a	n/a
2003 auctions	0.411774	5.049212	0.428716	5.659053
2004 auctions	0.293882	2.539898	0.308310	2.984956
2005 auctions	0.202951	1.320226	0.216573	1.621361
2006 auctions	1.116838	5.684642	1.182766	7.083305
Adjusted R ²	0.408001		0.412133	

For both equations, the statistical accuracy and reliability was improved.

To implement the new equations in the *Interior Appraisal Manual*, the two equations are reduced to one 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).

4. SPECIFIED OPERATIONS

The auction dataset used to develop MPS is comprised of 1133 auctions. There are some harvesting situations that are not represented in the auction dataset (for example, skyline yarding) and therefore, a specified operation cost estimate is used in the calculation of stumpage rates. See Appendix 2 for definitions of each specified operation.

The specified operations are shown below. Cost estimates from the current Interior Appraisal Manual are used for 1, 2, and 3 below.

Specified Operations	Current Adjustment	Update 2007
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 (formerly Isolated Cutting Authorities)	\$5.28/m ³	\$2.43/m ³
5. Skyline Yarding	\$10.20/m ³	\$8.07/m ³

5. TENURE OBLIGATION ADJUSTMENTS

As outlined in the Interior Tenure Obligations Adjustment paper (dated June 5, 2006), the adjustments are based on cost surveys.

The tenure obligation adjustments are shown below.

Tenure Obligation	Current Adjustment	Update 2007
Forest Planning and Administration Cost	\$5.40/m ³ - \$11.24/m ³ (based on District)	Formula
Road Development Cost	Appraisal Manual	Appraisal Manual
Road Management Cost	Appraisal Manual	Appraisal Manual
Market Logger Road Cost	\$1.60/m ³	1.21/m ³
Basic Silviculture Cost (Average)	\$1263/ha	\$1165/ha
Return to Forest Management	1.049	1.037
Low Grade Percent Adjustment	Mark Specific 1/(1-%low grade/100)	Mark Specific 1/(1-%low grade/100)

6. SUMMARY

The new equations, specified operations and tenure obligation adjustments will be used to calculate the average market price for the Interior, starting July 1, 2007.

APPENDIX 1

FINAL ESTIMATED WINNING BID

Dependent Variable: Real Winning Bid

Method: Least Squares

Date: 06/25/07 Time: 10:06

Sample (adjusted): 228 1580

Included observations: 1133 after adjustments

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	27.50628	2.758671	9.970842	0.0000
Real Stand Selling Price	0.174490	0.022550	7.737896	0.0000
Fir Fraction	6.500597	1.587254	4.095498	0.0000
Hembal Fraction	-12.89714	1.831931	-7.040192	0.0000
Cedar Fraction	23.09428	4.270373	5.408024	0.0000
Volume Per Hectare/1000	4.825013	2.865265	1.683968	0.0925
*LN (Volume – Decked Volume/1000)	2.178258	0.262101	8.310748	0.0000
1/Volume Per Tree *(1-Hembal Fraction)	-1.151656	0.509007	-2.262554	0.0239
Grade 3 Fraction	12.18485	1.775059	6.864476	0.0000
Deciduous Fraction	-10.45422	3.039939	-3.438955	0.0006
Decay	-29.49454	6.382739	-4.620984	0.0000
Cableyard Fraction	-7.743592	1.803337	-4.294034	0.0000
Helicopter Logging Fraction	-33.31608	3.907426	-8.526350	0.0000
Horse Logging Fraction	-7.232724	1.052200	-6.873909	0.0000
Fire Damage Fraction	-14.48430	1.780179	-8.136430	0.0000
Cycle Time	-1.721603	0.149241	-11.53573	0.0000
LN (Number of Bidders)	4.704155	0.288825	16.28722	0.0000
Salvage	-2.780152	0.539357	-5.154571	0.0000
Fort Nelson/Peace Zone	-2.699050	0.837118	-3.224216	0.0013
2003 Auctions	-1.565476	0.803365	-1.948649	0.0516
2004 Auctions	-3.277362	0.649104	-5.049053	0.0000
2005 Auctions	2.174661	0.847279	2.566641	0.0104
2006 Auctions	-8.879848	0.889519	-9.982754	0.0000
Decked Volume Fraction	130.0489	65.38790	1.988883	0.0470
*LN (volume per tree)	4.931008	1.358978	3.628468	0.0003
R-squared	0.716377	Mean dependent var		34.77003
Adjusted R-squared	0.710233	S.D. dependent var		12.55977
S.E. of regression	6.760919	Akaike info criterion		6.682013
Sum squared resid	50646.71	Schwarz criterion		6.793059
Log likelihood	-3760.360	F-statistic		116.6081
Durbin-Watson stat	1.595257	Prob(F-statistic)		0.000000

*LN means the natural logarithm

FINAL NUMBER OF BIDDERS

Dependent Variable: *LN (Number of Bidders)
 Method: Least Squares
 Date: 06/25/07 Time: 11:25
 Sample (adjusted): 228 1580
 Included observations: 1133 after adjustments
 White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.262116	0.419121	3.011341	0.0027
Forecast Real Winning Bid	0.039401	0.001806	21.81794	0.0000
District Average Number of Bidders	0.133055	0.016855	7.894047	0.0000
Exchange Rate	-3.026744	0.642124	-4.713646	0.0000
Partial Cut Fraction	-0.503874	0.133953	-3.761580	0.0002
Slope %	-0.004182	0.001435	-2.913257	0.0036
Horse Logging Fraction	-0.213833	0.143798	-1.487041	0.1373
Second Quarter Auctions	0.164435	0.042834	3.838852	0.0001
2003 Auctions	0.428716	0.075758	5.659053	0.0000
2004 Auctions	0.308310	0.103288	2.984956	0.0029
2005 Auctions	0.216573	0.133575	1.621361	0.1052
2006 Auctions	1.182766	0.166979	7.083305	0.0000
R-squared	0.417846	Mean dependent var		1.226191
Adjusted R-squared	0.412133	S.D. dependent var		0.696995
S.E. of regression	0.534403	Akaike info criterion		1.595202
Sum squared resid	320.1427	Schwarz criterion		1.648505
Log likelihood	-891.6821	F-statistic		73.14600
Durbin-Watson stat	1.795383	Prob(F-statistic)		0.000000

***LN means the natural logarithm**

VARIABLES AND DEFINITIONS

Variable	Definition
Estimated Winning Bid	The market stumpage price for the cutting authority expressed in \$/m ³
Real Stand Selling Price	Estimated stand lumber value (\$/m ³) in 1997 dollars. Weighed average of (LRF * Lumber price by species)
Volume Per Hectare/1000	Total net coniferous cruise volume (cubic metres per hectare) / 1000.
Partial Cut Fraction	Fraction of the harvest method volume that is appraised as partial cut. $PC = (100 - CAPCUT\%)/100$. See section 4.9 of Appraisal Manual for definition of CAPCUT%. The 80% limit in section 4.9 does not apply.
Fir Fraction	Fraction of the net coniferous volume that is Douglas Fir.
Volume	Net coniferous cruise volume (m ³)
Cableyard Fraction	Fraction of total harvest method volume that is appraised as overhead cable yarding.
Helicopter Logging Fraction	Fraction of total harvest method volume that is appraised as helicopter yarding.
Horse Logging Fraction	Fraction of the total harvest method volume that is appraised as horse yarding.
Fire Damage Fraction	Fraction of net coniferous cruise volume that is fire damaged.
Cycle Time	Hauling round trip cycle time from the landing to the point of appraisal or water dump site and return (hrs).
HemBal Fraction	Fraction of net coniferous volume that is Hemlock and Balsam.
Cedar Fraction	Fraction of net coniferous volume that is Cedar.
Salvage	Where greater than one third of the net coniferous cruise volume is attacked by mountain pine beetle or other pests, salvage = 1, otherwise salvage = 0.
Volume per Tree	Cutting permit average volume per tree from the cruise (m ³).
Deciduous Fraction	$\text{Net deciduous cruise volume (m}^3\text{)} / (\text{net deciduous cruise volume (m}^3\text{)} + \text{net coniferous cruise volume (m}^3\text{)})$.
Slope %	Cutting permit average slope from cruise.
District average number of bidders	Average number of bidders by district from the auction dataset.

Decay	Prorated species decay % from the cruise / 100.
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.
2003 Auctions	If auction sold in 2003 then AUC 2003 = 1.
2004 Auctions	If auction sold in 2004 then AUC 2004 = 1.
2005 Auctions	If auction sold in 2005 then AUC 2005 = 1.
2006 Auctions	If auction sold in 2006 then AUC 2006 = 1.
Deck Fraction	Fraction of timber sale total net coniferous cruise volume that has been felled and decked.
Decked Volume	Volume of decked timber in the timber sale that has been felled and decked.
Exchange Rate	Exchange rate (\$US/\$C). Bank of Canada three month average rate beginning five months prior to the stumpage rate effective date, as published by Revenue Branch.
Grade 3 Fraction	Fraction of coniferous billed volume that was Grade 3. In the modeling dataset this was set to zero for sales December 5, 2005 and later, because after that date Bids applied to Grade 3 as well as green sawlogs. This variable is set to zero for calculation of the average market price because grade 3 is no longer a valid grade.
Second Quarter Auctions	If auction sold in April to June Q2 = 1.
Consumer Price Index	Monthly B.C. Consumer Price Index (STATS CAN – P110000).
Consumer Price Index Factor	CPIF = CPI/109.3

APPENDIX 2

DEFINITIONS OF SPECIFIED OPERATIONS

If sufficient auction data is not available, the ministry will, for those identified situations, implement specified operations.

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 a specified operations and, if eligible, 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 current Interior Appraisal Manual are used for 1, 2, and 3, below:

1. Rail Haul
 - Rail haul including truck to rail transfer and rail transport.
2. Barge/Ferry
 - Barge/ferry used to truck haul (private).
 - Barge/ferry not used for truck haul (private).
3. Dump, Boom, Tow, Dewater, Reload
 - Dump, boom
 - Tow
 - Dewater and reload
4. Camp costs
 - Cost estimate is \$2.43/m³
5. Skyline Yarding
 - Cost estimate is \$8.07/m³