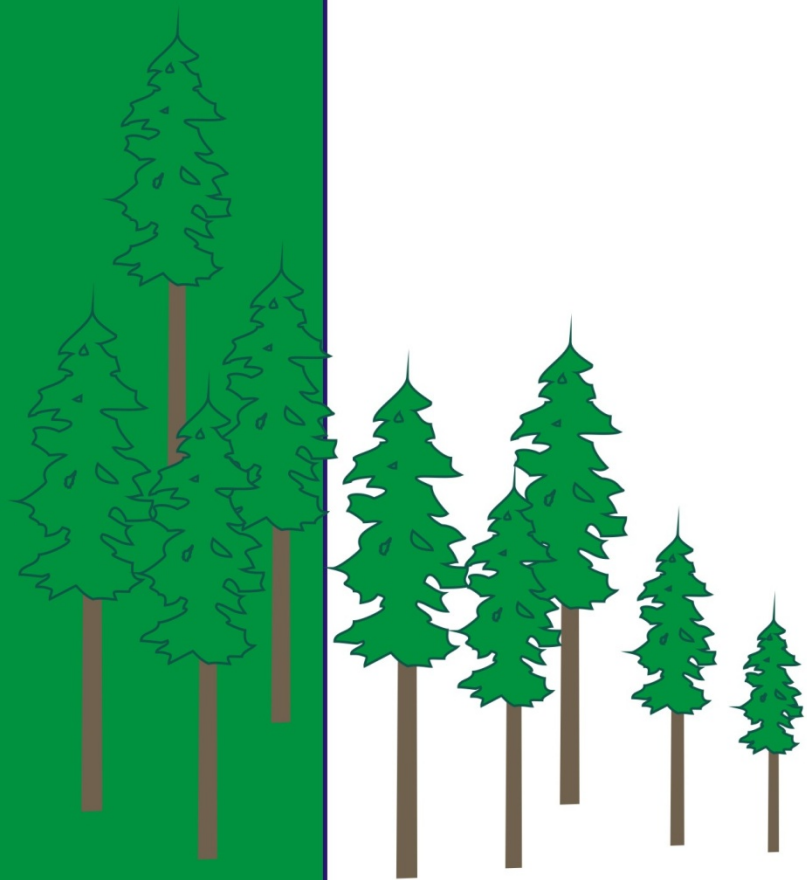
# Interior

# MARKET PRICING SYSTEM

**Update – 2020**



**July 1, 2020**

Timber Pricing Branch

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# Interior Market Pricing System: Update – 2020

## 1. INTRODUCTION

The purpose of this paper is to provide an overview of the July 1, 2020 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 3404 sales over the 13.25 year period January 1, 2007 through March 31, 2020.

[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*.

## 3. EQUATIONS

### Estimated Winning Bid Equation

| Variable | 2020 Final Equation | |
|---|---|---|
| | Co-efficient | t – Statistic |
| LN (Number of Bidders) | 6.753747 | 22.68782 |
| Constant | 15.30443 | 4.696060 |
| Real Stand Selling Price | 0.456728 | 30.72193 |
| Cedar Fraction | -5.427549 | -0.812956 |
| Cedar Fraction*Cedar Decay | -115.9992 | -4.011498 |
| Hemlock Fraction | -9.352000 | -4.567858 |
| Balsam Fraction | -5.660949 | -4.677531 |
| Larch Fraction + Yellow Pine Fraction | -21.46276 | -5.811277 |
| [(Fir Fraction + Yellow Pine Fraction) * Dry Belt] or [District DRM or DMH] | -2.610198 | -1.320807 |
| Cable Yarding | -27.56946 | -13.68064 |
| LN(Volume/1000) | 2.319143 | 9.058281 |
| Decay Fraction | -16.11313 | -2.545265 |
| Fire Damaged Fraction | -14.02999 | -5.587056 |
| LN (Volume per Tree) | 7.156109 | 12.34499 |
| Cycle + 0.5 *(Cycle – 6.0 hours) | -1.451285 | -10.72950 |
| Zone 9 | -5.137867 | -5.215866 |
| Cruise Based * (1 – RG35) | -8.337147 | -8.020980 |
| Cruise Based * (RG35) | -10.60107 | -16.10043 |
| Decked Fraction | 12.79138 | 0.724985 |
| Ground Skid Slope Squared (15-50) | -0.012703 | -6.527629 |
| Auction Year | 5.885803 | 6.036606 |
| Grey Fraction | -0.963440 | -9.351745 |
| Exchange Rate | -38.93264 | -15.04275 |
| Total Interior Harvest | 0.368942 | 9.929916 |
| Blowdown | -18.68037 | -3.726056 |
| Deciduous (Cruise Based) | -19.93449 | -7.128364 |
| Camp | -1.452823 | -3.321290 |
| Distance to Support Centre | -0.033712 | -5.312823 |
| Partial Cut 2030 | -6.764438 | -3.037316 |
| Other Attack | -31.94406 | -3.073828 |
| Count of Sales: | 3,404 | |
| Adjusted $R^2$ | 0.745073 | |

**LN means the natural logarithm**

**Number of Bidders Equation - dependent variable is LN(NB)**

| Variable | 2019 Final Equation | |
|---|---|---|
| | Co-efficient | t - Statistic |
| Forecast Real Winning Bid | 0.013967 | 27.18844 |
| Constant | -0.332815 | -6.612136 |
| Auction Year | -0.272755 | -8.248635 |
| Cruise Based * (1 – (RG35)) | 0.040128 | 1.010483 |
| Cruise Based * (RG35) | 0.092588 | 4.008555 |
| District Average Number of Bidders | 0.263876 | 16.19403 |
| Partial Cut Fraction | -0.214540 | -1.422384 |
| Slope | -0.005719 | -6.877327 |
| First and Second Quarter Auctions | 0.088454 | 4.846924 |
| Highway Haul | 0.076730 | 3.067499 |
| Count of sales: | 3,404 | |
| Adjusted $R^2$ | 0.266118 | |

**LN means the natural logarithm**

The new dataset is made up of 13.25 years of sales. The oldest year (2007) was preserved in order to make sure an entire market cycle is represented in the dataset, including the last major downturn.

The MPS regressions are much like previous years with one minor change. The other attack variable has now been split into an early and late period, much like had been done previously with the cable yarding variable. This was done to reflect the recent severe attack levels of spruce bark beetle and other pests.

In addition to the minor change to regression specifics, two changes were made which reduce the overall lag to market conditions as reflected in BCTS bids:

a) The lag from the end of the BCTS auction data period has been reduced from six months to three months. In other words, the data period now ends March 31, 2020 when under the previous schedule it would have ended December 31, 2019 for July 1, 2020 implementation, and;
b) An Estimated Winning Bid Adjustment Factor will be applied on a quarterly basis to account for the average difference between the estimated winning bids and the actual bids.

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). See Appendix 1 for detailed statistics on the estimated winning bid and number of bidder's equations and variable definitions.

## 4. SPECIFIED OPERATIONS

The auction dataset used to develop the MPS equation is comprised of 3,404 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 (July 1, 2019) | Update July 1, 2020 |
|---|---|---|
| 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 | N/A | N/A |
| 5. Skyline Yarding | $2.07/$m^3$ | $2.84/$m^3$ |
| 6. Horse Logging | $8.67/$m^3$ | $8.67/$m^3$ |
| 7. Market Logger Specified Operations Cost | $0.07/$m^3$ Combined in Final Tenure Obligation Adjustment | $0.07/$m^3$ Combined in Final Tenure Obligation Adjustment |
| 8. Helicopter | $108.58/$m^3$ | $113.79/$m^3$ |

## 5. TENURE OBLIGATION ADJUSTMENTS

As outlined in the Interior Tenure Obligations Adjustment paper (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, 2020 |
|---|---|---|
| Total Administration Cost | 2016/17 Cost Base | 2017/18 Cost Base |
| Development Cost | 2016/17 Cost Base | 2017/18 Cost Base |
| Total Road Management Cost | 2016/17 Cost Base | 2017/18 Cost Base |
| Market Logger Development Cost | $\$1.45/m^3$ | $\$1.53/m^3$ |
| Total Silviculture Cost | 2016/17 Cost Base | 2017/18 Cost Base |
| Return to Forest Management | | |
| Low Grade Percent Adjustment | Mark Specific<br>1/(1-%low grade/100) | Mark Specific<br>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, 2020.

## APPENDIX 1

## FINAL ESTIMATED WINNING BID

Dependent Variable: BID*155.6/CPI
Method: Least Squares
Date: 06/30/20 Time: 10:28
Sample: 1 4025 IF IN_3404=1
Included observations: 3404
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 15.30443 | 3.258993 | 4.696060 | 0.0000 |
| LOG(NB) | 6.753747 | 0.297682 | 22.68782 | 0.0000 |
| SPI*155.6/CPI | 0.456728 | 0.014867 | 30.72193 | 0.0000 |
| CE | -5.427549 | 6.676316 | -0.812956 | 0.4163 |
| CE*CEDAR_DECAY | -115.9992 | 28.91668 | -4.011498 | 0.0001 |
| HE | -9.352000 | 2.047349 | -4.567858 | 0.0000 |
| BA+2*(BA-0.5)*(BA>.5) | -5.660949 | 1.210243 | -5.660949 | 0.0000 |
| LA+YE | -21.46276 | 3.693294 | -5.811277 | 0.0000 |
| (FI+YE)*DRY_OR_DRM_DMH | -2.610198 | 1.976215 | -1.320807 | 0.1867 |
| CABLE*(AWARD_YEAR<=2012) | -3.377102 | 1.949977 | -1.731868 | 0.0834 |
| CABLE*(AWARD_YEAR>=2013) | -27.56946 | 2.015216 | -13.68064 | 0.0000 |
| LOG(CVOL/1000) | 2.319143 | 0.256025 | 9.058281 | 0.0000 |
| FIRE | -14.02999 | 2.511160 | -5.587056 | 0.0000 |
| NET_DECAY*SB | -16.11313 | 6.330629 | -2.545265 | 0.0110 |
| OTHER*(1-YEM_2020) | -4.758599 | 3.126806 | -1.521872 | 0.1281 |
| OTHER*(YEM_2020) | -31.94406 | 10.39227 | -3.073828 | 0.0021 |
| LOG(VPT) | 7.156109 | 0.579677 | 12.34499 | 0.0000 |
| Z9 | -5.137867 | 0.985046 | -5.215866 | 0.0000 |
| CYCLE+0.5*CYCLE_6PLUS | -1.451285 | 0.135261 | -10.72950 | 0.0000 |
| GREY*((AWARD_YEAR-2008)*(AWARD_YEAR>=2008)+3*(AWARD_YEAR-2015)*(AWARD_YEAR>=2015))*CB*D_RG35 | -0.963440 | 0.103022 | -9.351745 | 0.0000 |
| CB*(1-D_RG35) | -8.337147 | 1.039418 | -8.020980 | 0.0000 |
| CB*D_RG35 | -10.60107 | 0.658434 | -16.10043 | 0.0000 |
| DECKED | 12.79138 | 17.64364 | 0.724985 | 0.4685 |
| GS*GS_SLOPE_SQ_15_50 | -0.012703 | 0.001946 | -6.527629 | 0.0000 |
| NET_BLOWDOWN | -18.68037 | 5.013442 | -3.726056 | 0.0002 |
| NET_DECID*(CB+DECID_BONUS*SB) | -19.93449 | 2.796502 | -7.128364 | 0.0000 |
| (DSC_2020_NOSMSQ>100)*(DSC_2020_NOSMSQ-100) | -0.033712 | 0.006345 | -5.312823 | 0.0000 |
| CAMP_DIST_2020<=16 | -1.452823 | 0.437427 | -3.321290 | 0.0009 |
| PC_20_30 | -6.764438 | 2.227111 | -3.037316 | 0.0024 |
| HARVOL_S | 0.368942 | 0.037155 | 9.929916 | 0.0000 |
| FX_3_1 | -38.93264 | 2.588133 | -15.04275 | 0.0000 |
| AUCTION_YEAR | 5.885803 | 0.975019 | 6.036606 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.747396 | Mean dependent var | 30.46781 |
| Adjusted R-squared | 0.745073 | S.D. dependent var | 21.58025 |

## FINAL NUMBER OF BIDDERS

Dependent Variable: LOG(NB)
Method: Least Squares
Date: 07/08/20 Time: 09:38
Sample: 1 4025 IF IN_3404=1
Included observations: 3404
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -0.332815 | 0.050334 | -6.612136 | 0.0000 |
| BIDF*155.6/CPI | 0.013967 | 0.000514 | 27.18844 | 0.0000 |
| CB*(1-D_RG35) | 0.040128 | 0.039712 | 1.010483 | 0.3123 |
| CB*D_RG35 | 0.092588 | 0.023098 | 4.008555 | 0.0001 |
| PARCUT | -0.214540 | 0.150832 | -1.422384 | 0.1550 |
| SLOPE | -0.005719 | 0.000832 | -6.877327 | 0.0000 |
| DANB_3404 | 0.263876 | 0.016295 | 16.19403 | 0.0000 |
| HWY_TRAN | 0.076730 | 0.025014 | 3.067499 | 0.0022 |
| D_Q1+D_Q2 | 0.088454 | 0.018250 | 4.846924 | 0.0000 |
| AUCTION_YEAR | -0.272755 | 0.033067 | -8.248635 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.268059 | Mean dependent var | 0.842465 |
| Adjusted R-squared | 0.266118 | S.D. dependent var | 0.614877 |

## VARIABLES AND DEFINITIONS FOR EQUATIONS

| Variable | Definition |
|---|---|
| Auction year | If the auction sold in the 12 months ending March 2020, then Auction Year = 1. |
| Balsam Fraction | Fraction of the Total Net Coniferous Volume that is balsam. |
| Blowdown | Blowdown fraction – grey fraction (can't be < 0) |
| Camp | 1 if eligible for CAMP under IAM Section 3.2.30 |
| Cable Yard Fraction | Fraction of harvest method volume that is appraised as overhead cable yarding (includes Skyline <600m horizontal). |
| Cable Yarding | Cable Yard Fraction – from 2014, 2015, 2016, 2017 and 2018 auctions. |
| Cedar Decay Fraction | Cedar decay (%) from the appraisal summary report/100. |
| Cedar Fraction | Fraction of total net coniferous volume that is cedar. |
| Cedar Fraction * Cedar Decay Fraction | Fraction of total net coniferous volume that is cedar * Cedar decay (%) from the appraisal summary report/100. |
| Constant | Fixed value. |
| Cruise Based | 1 if cruise based, 0 if scale based. |
| CYCLE | Hauling round trip cycle time (Primary CT (hrs) + Secondary CT (hrs). See sections 3.5.1 and 3.5.2 of the Interior Appraisal Manual. |
| CYCLE_INC6 | CYCLE – 6.0 hours. If <0, then 0. |
| Decay Fraction | Decay fraction minus other attack fraction (can't be < 0). |
| Deciduous Fraction | Fraction of the total net cruise volume that is the total net deciduous volume |
| Deciduous (Cruise Based) | Same as Deciduous Fraction but applies to cruise based only. |
| Decked Fraction | Fraction of cutting authority volume that has been decked and/or partially harvested in the timber sale licence. Cutting authority volume = total net cruise volume + volume of decked/partially harvested timber + right-of-way volume. |
| DSC (Distance to Support Centre) | Distance to Support Centre: see IAM section 3.2.29 |
| 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). |
| District DRM or DMH | See 'Dry Belt' |

| | |
|---|---|
| Dry Belt | Dry Belt = 1 if the cutting authority volume is located in the Rocky Mountain (DRM) or 100 Mile House (DMH) Forest Districts.<br><br>Otherwise, Dry Belt is the 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 *Cruising Manual*. If the BEC zone/subzone combination does not appear in that table, then the following logic must apply:<br><br>- If the subzone is very dry (begins with x) then the zone/subzone combination is Dry Belt.<br>- 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.<br>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. |
| Exchange Rate | US$/C$ (a stronger C$ leads to a higher value) in decimal form. |
| 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_Q1 + Q2 =1. |
| Forecast Real Winning Bid | Estimated winning bid from the estimated winning bid equation. |
| GREY | Fraction of total net coniferous volume that is grey Mountain Pine Beetle attacked lodgepole pine. |
| Grey Fraction | GREY*3*(2018.5-2015)*Cruise_Based*RG35 |
| Ground Skid Slope Squared (15-50) | See 'GS_Slope' definition in Section 3.3 'Estimated Winning Bid Variables' of the *Interior Appraisal Manual* for more information. |
| HemBal Fraction | Fraction of total net coniferous volume that is hemlock and balsam. |
| Hemlock Fraction | Fraction of the Total Net Coniferous Volume that is hemlock. |
| Highway Haul | 1 if primary haul method is highway, otherwise HWY = 0. |
| LAG | Lag in years. LAG = 0 if Zone 5 or Zone 6 as defined in Section 3.5 of the Interior Appraisal Manual or Cariboo Chilcotin District or Quesnel District, otherwise LAG = 2. |

| | |
|---|---|
| Larch Fraction + Yellow Pine Fraction | Fraction of total net coniferous volume that is larch and yellow pine. |
| Other Attack | Other Attack is the fraction of the Total Net Coniferous Volume that is insect attack other than Mountain Pine Beetle attacked Lodgepole Pine. |
| 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. |
| Partial Cut 2030 | Partial Cut 2030 is for cutting authorities with greater than 20% partial cut retention levels. See section 3.2.23 of the Appraisal Manual. |
| RBID | Real Winning bid ($/m3). |
| Real Stand Selling Price | Real estimated stand lumber value ($/m3). 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. |
| Total Interior Harvest | Total Interior harvest (million m3) in a recent 12 month period. Includes all species and tenure types. Excludes waste. |
| Volume | The zonal volume from Table 3-3 (See Appraisal Manual section 3.3) for the cutting authority unless:<br>1. The cutting authority is a BCTS cutting authority; if so then use the Total Net Coniferous Volume for the cutting authority.<br>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:<br>- The Total Net Coniferous Volume, or |

| | |
|---|---|
| | - The sum of the AAC volumes described above |
| Volume per Tree | Cutting authority average net volume per tree, from appraisal summary report (m3). |
| Volume per hectare | Natural logarithm of volume per hectare. |
| YEM | Year Ending March of 2020. |
| 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

## DESCRIPTION OF SPECIFIED OPERATIONS

If sufficient auction data is not available for an activity employed by either BCTS or other licences, 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 meter 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