

Table of Contents

Introduction

1 Scaling Overview

1.1	The Role of Scaling and its Importance.....	1-2
1.1.1	Cruise Based Tenures	1-2
1.2	The Evolution of BCs Scaling Practices	1-3
1.2.1	British Columbia’s Official Scales	1-3
1.2.2	History of Log Grading in BC	1-6
1.2.3	The Roles and Responsibility for Scaling.....	1-8
1.2.4	Scaling Methods.....	1-9
1.2.4.1	Piece Scaling	1-9
1.2.4.2	Weight Scaling.....	1-9
1.2.4.3	Special Forest Products.....	1-10
1.3	The Legal and Administrative Framework for Scaling	1-11
1.3.1	General.....	1-11
1.3.2	The <i>Forest Act</i> – Part 6 – Timber Scaling	1-11
1.3.3	The <i>Forest Act</i> – Part 5 – Timber Marking.....	1-11
1.4	Who Can Scale?.....	1-13
1.5	Scaling Requirements in British Columbia.....	1-14

2 Timber Marking and Branding

2.1	Registered Timber Marks	2-3
2.1.1	Purpose of Timber Marks	2-4
2.1.2	Timber Marking Requirements.....	2-5
2.1.3	Requirements of the Scaler	2-5
2.1.4	Timber Mark Formats	2-6
2.1.4.1	Recording Characters.....	2-6
2.1.5	Types of Marks	2-7
2.1.5.1	Major Types of Timber Marks.....	2-7
2.1.5.2	Marks for Privately Owned Land.....	2-11
2.2	Log Brands.....	2-12
2.2.1	Scaled Timber Brands.....	2-12
2.2.1.1	Authority	2-12
2.2.1.2	Purpose.....	2-12
2.2.1.3	Marking Requirements.....	2-13
2.2.2	Requirements of Scalers and Timber Weighers.....	2-13
2.2.2.1	Format of Scaled Timber Brands	2-13
2.2.2.2	Applying for a Scaled Timber Brand (FS 1308).....	2-13
2.3	Marine Log Brands	2-14
2.3.1	Authority.....	2-14

2.3.2 Purpose.....	2-14
2.3.3 Marking Requirements.....	2-14
2.3.4 Requirements of Scalers	2-14
2.3.5 Format of Marine Log Brands	2-15
2.3.6 Applying for a Marine Log Brand	2-15
2.4 Log Salvage Identification Marks.....	2-16
2.4.1 Authority	2-16
2.4.2 Purpose.....	2-16
2.4.3 Marking Requirements.....	2-16
2.4.4 Format of Log Salvage Identification Marks	2-16

3 Species Identification and Defects

3.1 Purpose of Classification by Species	3-2
3.2 Common Tree Defects	3-6
3.2.1 Disease	3-6
3.2.2 Other Natural Defects	3-6
3.2.3 Mechanical Defects.....	3-7

4 Smalian's Formula

4.1 Smalian's Formula.....	4-2
4.1.1 Smalian's Formula in Detail.....	4-2
4.2 Log Forms and the Formula.....	4-4
4.2.1 Smalian's Formula - Example Calculation.....	4-8
4.2.2 Smalian's Formula - Simplified	4-9
4.2.3 Smalian's Simple Formula - Example Calculation	4-10
4.2.4 The Application of Smalian's Formula	4-10
4.3 Other Formulae	4-11

5 Scaling Tools

5.1 Scaling Tools	5-2
5.1.1 BC Metric Scaling Stick	5-2
5.1.2 Tally sheets	5-2
5.1.3 Hand-held Computers	5-2
5.1.4 Volume Tables	5-2
5.1.5 Measuring Tapes.....	5-2
5.1.6 Limits of Error	5-2
5.2 The BC Metric Scale Stick	5-3
5.2.1 Application of the Scale Stick to Measure Diameters	5-3
5.2.2 Application of the Scale Stick to Measure Widths and Thicknesses	5-3
5.2.3 The Application of the Scale Stick to Measure Lengths.....	5-3
5.2.4 The Application of the Scale Stick for Unit Volumes	5-4

5.2.5 The Application of the Scale Stick for Half Volumes	5-4
5.3 Log Scale Stick Specifications as Approved for Official Scaling in British Columbia	5-14
5.3.1 Parts of a Scale Stick.....	5-16

6 Gross Measurement Procedures

6.1 Measurements	6-3
6.1.1 Units of Measure.....	6-3
6.1.2 The British Columbia Metric Scale	6-3
6.1.3 Errors in Measurement.....	6-3
6.2 Measuring Log Dimensions	6-5
6.2.1 Measuring Log Diameters.....	6-5
6.2.1.1 Measuring Round and Out of Round Log Ends.....	6-6
6.2.1.2 Measuring Shattered and Split-Back End Diameters.....	6-7
6.2.1.3 Measuring Irregular End Diameters.....	6-8
6.2.1.4 Measuring Forked End Diameters	6-9
6.2.2 Measuring Flared Butt Diameters	6-9
6.2.2.1 Callipering.....	6-10
6.2.2.2 Projecting the Normal Line of Taper	6-11
6.2.3 Measuring Lengths.....	6-13
6.2.3.1 Length Rounding Conventions and Measuring Tools	6-14
6.2.3.2 Finding the Geometric Centre of a Log for Length Measurement	6-15
6.2.3.3 Measuring Lengths of Butt Logs with Undercut	6-16
6.2.3.4 Measuring Lengths of Logs With Portions Under Ten Centimetres (10 cm)	6-17
6.2.3.5 Measuring Lengths of Logs With Shattered Ends	6-18
6.2.3.6 Measuring Lengths of Logs with Sniped Ends	6-19
6.2.3.7 Measuring Lengths of Logs with Missing Chunks	6-20
6.2.3.8 Measuring Lengths of Logs with Forks	6-20
6.2.3.9 Measuring Lengths of Logs with Sweep	6-22
6.2.3.10 Measuring Lengths of Logs with Crook	6-22
6.3 Measuring Slab Ends	6-23
6.3.1 Measuring Semicircular Slab Ends.....	6-24
6.3.2 Measuring Slab Ends and Sectors with a Hole	6-26
6.3.2.1 Measuring a Semicircular Slab End with Hole.....	6-26
6.3.2.2 Measuring a Slab Sector with Hole.....	6-28
6.3.3 Measuring Sectors (pie wedge slab ends) Smaller than a Semicircle.....	6-28
6.3.3.1 Measuring Small Sectors by Averaging the Dimensions.....	6-30
6.3.3.2 Measuring a True Quadrant and Other Sectors by Applying a Factor.....	6-31
6.3.4 Measuring Slab Sectors and Segments Greater Than a Semicircle	6-32
6.3.5 Measuring Four Sided (plank-like, timber-like) Slab Ends	6-32
6.3.6 Measuring Triangular (three sided) Slab Ends	6-35

7 Firmwood Defects and Conventions

7.1 Firmwood Deductions.....	7-2
7.2 Firmwood Deduction Principles	7-3
7.3 Geometric Shapes	7-4
7.4 Deduction Methods.....	7-5
7.4.1 Gross/Net Method.....	7-6
7.4.2 Net Dimensions Method	7-6
7.4.2.1 Length Deduction.....	7-6
7.4.2.2 Average Unit Volumes	7-7
7.4.2.3 Diameter Deduction or Radius Reduction Method.....	7-8
7.5 Conventions for Estimating Rot.....	7-9
7.5.1 Scaling Conventions versus Local Knowledge.....	7-9
7.6 Formulas and Their Terms.....	7-10
7.7 Defect Conventions and Examples	7-11
7.7.1 Conical Defects.....	7-11
7.7.2 Butt Rot Conventions.....	7-11
7.7.3 Butt Defect - Butt Rot (Conical) Partial Length of Log.....	7-12
7.7.3.1 Example and Illustration - Butt Rot Visible at Butt End of Log.....	7-12
7.7.3.1 The Gross/Net Calculation- Butt Rot.....	7-13
7.7.3.2 The Net Dimensions Calculation – Butt Rot	7-14
7.7.3.3 Example and Illustration - Butt Rot Visible at Both Ends of Log.....	7-14
7.7.4 The Catface (Conical).....	7-19
7.7.4.1 Example and Illustration - Single Catface	7-19
7.7.4.2 The Gross/Net Calculation – Single Catface	7-19
7.7.4.3 Net Dimensions Calculation - Single Catface.....	7-20
7.7.5 The Catface (Double Conical)	7-21
7.7.5.1 Example and Illustration - Double Catface.....	7-22
7.7.5.2 The Gross/Net Calculation – Double Catface.....	7-22
7.7.5.3 Net Dimensions Calculation - Double Catface	7-23
7.7.6 Standard Heart Rot Conventions	7-24
7.7.6.1 Cylindrical Defects	7-24
7.7.6.2 Heart Defect – Conventions - Partial Length.....	7-27
7.7.7 Assessing Conk, Indian Paint Fungus and Pin Rot.....	7-29
7.7.7.1 Basic Conk Assessments.....	7-30
7.7.7.2 Assessing Conk Rot; Visible Conk Knot(s), No Rot Visible	7-31
7.7.7.3 Assessing Conk Rot; Visible Conk Knot(s), Rot Visible at One End.....	7-31
7.7.7.4 Assessing Conk Rot; No Visible Conk Knot(s), Rot Visible at One End.....	7-32
7.7.8 Ring Defect	7-33
7.7.8.1 Ring Rot Conventions.....	7-33
7.7.8.2 Ring Defect - Through Running	7-33
7.7.8.3 Ring Defect - Partial Length of Log	7-36
7.7.9 Pocket Defects	7-38

7.7.9.1	Pocket Rot Conventions.....	7-38
7.7.9.2	Pocket Defect - Partial Length.....	7-43
7.7.10	Triangular defects	7-45
7.7.10.1	Example and Illustration - Triangular Defect	7-45
7.7.10.2	The Gross/Net Calculation – Triangular Defect	7-46
7.7.10.3	Net Calculation - Triangular Defects.....	7-47
7.7.11	Sap Rot Conventions.....	7-48
7.7.11.1	Sap Rot Examples and Calculations	7-48
7.7.11.2	Gross/Net Calculation – Sap Rot, Full Length	7-48
7.7.11.3	Net Dimensions Calculation-Sap Rot-Full Length	7-49
7.7.11.4	Net Dimensions Calculations – Diameter Deduction	7-50
7.7.12	Other Defects	7-50
7.7.12.1	Missing Segments	7-51
7.7.13	Missing Sectors	7-53
7.7.13.1	Example and Illustration – Missing Segment/Surface Defect	7-54
7.7.13.2	The Gross/Net Calculation – Sector Defect.....	7-54
7.7.13.3	Net Dimensions Calculation - Sector Defect	7-55
7.7.14	Assessing Goitre	7-56

8 Timber Grading

8.1	Timber Grading.....	8-2
8.2	Timber Grading Requirements.....	8-3
8.3	Principles of Timber Grading	8-4
8.3.1	Characteristics Which Reduce Product Recovery (Quantity).....	8-6
8.3.1.1	Fractures and Fibre Separation	8-6
8.3.1.2	Bark Seams	8-9
8.3.1.3	Sweep, Crook and Pistol Grip.....	8-9
8.3.1.4	Rot, Hole, Char, and Missing Wood.....	8-9
8.3.2	Characteristics Which Reduce Product Recovery (Quality).....	8-10
8.3.2.1	Twist (Spiral Grain)	8-11
8.3.2.2	Knots	8-13
8.3.2.3	Insect or Worm Holes	8-18
8.3.2.4	Non-Permissible Defects	8-19
8.3.2.5	Grain Density (Ring Count) - Coastal Grading Only.....	8-19
8.3.2.6	Compression Wood (Interior only).....	8-20
8.4	Applying the Principles of Grading	8-22
8.4.1	Determining Grade Reduction	8-23
8.4.2	Log Size	8-23
8.4.2.1	Length	8-24
8.5	Assessing Product Recovery.....	8-25
8.5.1	Lengths of Defects	8-26
8.5.2	Determining Grade Reduction for Collars (Shells).....	8-26
8.5.3	Determining Grade Reduction for Sound Hearts (Residual Cores).....	8-28

8.5.4	Determining Grade Reduction for Multiple Defects 8-31	Slab Thickness and Grading	8-32
8.5.4.1	For Coastal Grades.....		8-33
8.5.4.2	For Interior Grades.....		8-34
8.6	Determining Trim Allowance		8-35
8.6.1	The Application of Trim Allowance for Butt Rots.....		8-39
8.6.2	Trim Allowance and Ring Shake		8-42
8.6.3	Trim Allowance and Ring Rot.....		8-45
8.6.4	Trim Allowance and Multiple Ring Rot		8-48
8.6.5	Application of Trim Allowance to Checks and Shake.....		8-52
8.6.6	Application of Trim Allowance to Off Centre and Overlapping Defect		8-54
8.6.7	Determining Grade Reduction for Spiral Checks		8-57
8.6.8	Determining Lengths for Grading Purposes – Logs and Log Segments		8-59
8.6.9	Assessing Grade in Logs with Crook, Pistol Grip and Sweep.....		8-65
8.6.9.1	Crook.....		8-65
8.6.9.2	Pistol Grip		8-65
8.6.9.3	Sweep.....		8-66

9 Interior Grading

9.1	Interpreting the Schedule of Interior Timber Grades.....		9-2
9.1.1	Grade Applicability.....		9-2
9.1.2	Grade Precedence.....		9-2
9.1.3	Identifying Undersized Logs in the Interior		9-3
9.2	Physical Characteristics Affecting Log Grades		9-4
9.2.1	Compression Wood.....		9-4
9.2.2	Checks.....		9-4
9.2.3	Procedures for Assessing Checks under the Grade Code 2 Log Requirements to Make the Grade:.....		9-4
9.2.4	Delay in Scaling		9-5
9.3	Potential for Manufacture of Product - Quantity		9-6
9.3.1	Log Size		9-6
9.3.2	Insect or Worm Holes		9-6
9.4	Potential for Manufacture of Products - Quality.....		9-7
9.4.1	Occasional Oversized Knots		9-7
9.4.2	Knot Spacing.....		9-7
9.4.3	Twist (Spiral Grain)		9-8
9.4.4	Non-Permissible Defects		9-8
9.5	Interior Grade Rules and Application.....		9-9
9.5.1	Firmwood Reject - Grade Code Z (weight scale, species code or species code R).....		9-9
9.5.1.1	Grade Rule		9-9
9.5.1.2	Application of the Grade Rule		9-9
9.5.2	Undersized Log Grade- Grade Code 6.....		9-9
9.5.2.1	Grade Rule		9-9

9.5.2.2	Log Requirements to Make the Grade	9-9
9.5.3	Premium Sawlog- Grade Code 1	9-10
9.5.3.1	Grade Rule	9-10
9.5.3.2	Log Requirements to Make the Grade	9-10
9.5.4	Sawlog - Grade Code 2	9-12
9.5.4.1	Grade Rule	9-12
9.5.4.2	Log Requirements to Make the Grade	9-12
9.5.5	Lumber Reject Grade Code 4	9-14
9.5.5.1	Grade Rule	9-14
9.5.5.2	Log Requirements to Make the Grade	9-14

10 Coast Grading

10.1	Interpreting the Schedule of Coast Timber Grades.....	10-2
10.1.1	Grade Applicability.....	10-2
10.1.2	Grade Precedence.....	10-2
10.2	Physical Characteristics Affecting Log Grades	10-3
10.2.1	Potential for Manufacture of Products - Quantity.....	10-3
10.2.2	Log Size	10-3
10.2.2.1	Length	10-4
10.2.2.2	Grade Reduction for Conk, Pin Rot and Indian Paint Rot.....	10-4
10.3	Potential for Manufacture of Products - Quality.....	10-5
10.3.1	Size of Knots.....	10-5
10.3.2	Occasional Oversized Knots	10-5
10.3.3	Pitch	10-5
10.3.4	Growth Rate (Ring Count).....	10-5
10.3.5	Stain	10-6
10.4	Coast Grade Rules and Requirements.....	10-7
10.4.1	Firmwood Reject - All Species - Grade Code Z (species code or code R)	10-7
10.4.1.1	Grade Rule	10-7
10.4.2	Coniferous Grades	10-7
10.4.3	Balsam and Hemlock Grades.....	10-7
10.4.3.1	No 1 Lumber Balsam and Hemlock, Grade Code D	10-8
10.4.3.2	No. 2 Lumber Balsam and Hemlock, Grade Code F	10-8
10.4.3.3	No. 2 Sawlog Balsam and Hemlock, Grade Code H	10-9
10.4.3.4	No. 3 Sawlog Balsam and Hemlock, Grade Code I.....	10-10
10.4.3.5	No. 4 Sawlog Balsam and Hemlock, Grade Code J	10-10
10.4.3.6	No. 5 Chipper Balsam and Hemlock, Grade Code U	10-11
10.4.4	Cedar Grades.....	10-12
10.4.4.1	Lumber Grades.....	10-12
10.4.4.2	No. 1 Lumber Cedar, Grade Code D	10-12
10.4.4.3	No. 2 Lumber Cedar, Grade Code F.....	10-13

10.4.4.4	Sawlog Grades	10-13
10.4.4.5	No. 2 Sawlog Cedar, Grade Code H	10-14
10.4.4.6	No. 3 Sawlog Cedar, Grade Code I	10-14
10.4.4.7	No. 4 Sawlog Cedar, Grade Code J	10-15
10.4.4.8	Shingle Grades	10-16
10.4.4.9	No. 1 Shingle Cedar, Grade Code K	10-16
10.4.4.10	No. 2 Shingle Cedar, Grade Code L	10-17
10.4.4.11	No. 3 Shingle Cedar, Grade Code M	10-18
10.4.5	Cypress Grades	10-18
10.4.5.1	No. 1 Lumber Cypress, Grade Code D	10-18
10.4.5.2	No. 2 Lumber Cypress, Grade Code F	10-20
10.4.5.3	No. 2 Sawlog Cypress, Grade Code H	10-20
10.4.5.4	No. 3 Sawlog Cypress, Grade Code I	10-21
10.4.6	Fir and Pine Grades	10-21
10.4.6.1	No. 1 Lumber Fir and Pine, Grade Code D	10-22
10.4.6.2	No. 2 Lumber Fir and Pine, Grade Code F	10-22
10.4.6.3	No. 2 Peeler Fir, Grade Code B	10-23
10.4.6.4	No. 3 Peeler Fir, Grade Code C	10-25
10.4.6.5	No. 2 Sawlog Fir and Pine, Grade Code H	10-27
10.4.6.6	No. 3 Sawlog Fir and Pine, Grade Code I	10-28
10.4.7	Spruce Grades	10-29
10.4.7.1	No. 1 Premium Spruce, Grade Code D	10-29
10.4.7.2	No. 2 Premium Spruce, Grade Code E	10-29
10.4.7.3	No. 1 Lumber Spruce, Grade Code F	10-30
10.4.7.4	No. 2 Lumber Spruce, Grade Code G	10-31
10.4.7.5	No. 2 Sawlog Spruce, Grade Code H	10-32
10.4.7.6	No. 3 Sawlog Spruce, Grade Code I	10-33
10.4.8	No. 4 Sawlog All Coniferous, Grade Code J	10-34
10.4.8.1	Grade Rule	10-34
10.4.8.2	Log Requirements to Make the Grade	10-34
10.4.9	No. 5 Utility All Coniferous, Grade Code U (except Balsam and Hemlock) 10-35	
10.4.9.1	Grade Rule	10-35
10.4.9.2	Log Requirements to Make the Grade	10-35
10.4.10	No. 6 Chipper All Coniferous, Grade Code X	10-36
10.4.10.1	Grade Rule	10-36
10.4.10.2	Log Requirements to Make the Grade	10-36
10.4.11	No. 7 Chipper All Coniferous, Grade Code Y	10-36
10.4.11.1	Grade Rule	10-36
10.5	Broadleaf Species and Yew	10-37
10.5.1	Applicability	10-37
10.5.2	Sawlog, Grade Code W	10-37
10.5.2.1	Grade Rule	10-37
10.5.2.2	Log Requirements to Make the Grade	10-37
10.5.2.3	Chipper, Grade Code Y	10-37
10.6	Applying the Principles of Grading Using Field Methods	10-38

10.6.1 Formula #1	10-38
10.6.2 Formula #2	10-39
10.6.3 Formula #3	10-39
10.6.3.1 For Converting Grade Reduction in Metres to a Percentage	10-39
10.6.3.2 For Estimating Grade Reduction Percentage from Length Losses	10-39

11 Documenting and Reporting Scale

11.1 Scale Documentation	11-3
11.1.1 Introduction.....	11-3
11.1.2 Documentation Conventions.....	11-3
11.1.3 Electronic Reporting	11-4
11.2 Scale Returns	11-5
11.2.1 Type of Scale	11-5
11.2.1.1 FS 1211 - Piece Scale Detailed Log Listing (NET)	11-6
11.2.1.2 FS 1212 - Beachcomb Piece Scale Detailed Log Listing (NET)	11-7
11.2.1.3 FS 1217 - Weight Slip.....	11-8
11.2.1.4 FS 1210 - Sample Scale Detailed Log Listing (NET).....	11-9
11.2.2 Electronic Weight Scale Documentation/Reports.....	11-10
11.2.2.1 Computer Generated Weight Slip	11-14
11.2.2.2 FS 222 - Special Forest Products Scale Return and Transportation Document.....	11-16
11.2.2.3 FS 200 - Christmas Tree Return	11-17
11.2.2.4 FS 701 - Volume Estimate - Other.....	11-18
11.3 Administrative Documents	11-19
11.4 Timing Requirements for Submitting Scale Data	11-25
11.4.1 Weight Scale Site	11-25
11.4.2 Piece Scale Site	11-25
11.4.3 Penalties for Late Submission of Scale Returns	11-26
11.4.4 Electronic Submission of Scale Results	11-27
11.5 Scale Data Computation and Documentation Standards and Controls.....	11-28
11.5.1 Compliance Checking.....	11-29
11.6 Correction of Errors	11-30
11.6.1 Key Punch/coding Errors	11-30
11.6.2 Measurement/Grade Errors and Missing Dimensions	11-30
11.7 Data Loss	11-31
11.7.1 Conventions to Minimize Data Loss.....	11-31
11.7.2 Reconstructing Data Which is Lost	11-32
11.8 Access to Scale Data.....	11-34

11.9 Invoices and Volume Statements	11-35
---	-------

12 Special Forest Products

12.1 Special Forest Products	12-2
12.2 Definition of Special Forest Products	12-3
12.2.1 Classification as Special Forest Products.....	12-3
12.2.2 Exporting Special Forest Products	12-5
12.3 General Requirements.....	12-6
12.3.1 Scaling.....	12-6
12.3.2 Recording the Scale	12-6
12.4 Special Forest Product Descriptions	12-7
12.4.1 Christmas Trees	12-7
12.4.2 Firewood	12-7
12.4.3 Mining Timbers	12-8
12.4.4 Stakes and Sticks.....	12-8
12.4.5 Cants	12-12
12.4.6 Posts and Rails (Split and Round)	12-12
12.4.7 Shake and Shingle Bolts, Blocks and Blanks	12-15
12.4.8 Shakes	12-16
12.4.9 Woodchips	12-17
12.4.10 Hogged Tree Material	12-17
12.5 General Requirements.....	12-18
12.5.1 Timber Marking	12-18
12.5.2 Transport Documentation	12-18
12.5.3 Document Handling for Special Forest Products.....	12-19
12.6 Special Forest Product Scaling Methods	12-20
12.6.1 Round Piece Sampling Method.....	12-21
12.6.1.1 Calculation of the Piece Sampling Method.....	12-22
12.6.2 Stacked Special Forest Products Method.....	12-24
12.6.3 Christmas Tree Piece Count Method	12-28
12.6.4 Estimating Volumes of Tree Length Piles	12-30
12.6.4.1 Sampling the Pile and Counting Pieces	12-30
12.6.4.2 Measuring the Pile and Applying a Factor.....	12-31
12.6.5 Finding Piece Sample Requirements	12-34
12.7 Botanical Forest Products	12-36
12.7.1 Medicinal and Pharmaceutical Products	12-37
12.7.2 Wild Edible Mushrooms	12-37
12.7.3 Floral and Greenery Products	12-38
12.7.4 Wild Berries and Fruit	12-38
12.7.5 Herb and Vegetable Products.....	12-39
12.7.6 Landscaping Products	12-39
12.7.7 Craft Products	12-40
12.7.8 Miscellaneous Botanical Forest Products	12-40
12.8 Woodchips and Hogged Tree Material	12-41

12.9 Condensed Table of Half Volumes	12-43
12.9.1 Application of the Table	12-43
12.9.2 Table of Full Volumes for Round Fence Posts	12-46

13 The Weight Scale System

13.1 Weight Scaling - Overview of the System	13-3
13.1.1 Background	13-3
13.1.2 Estimating Volumes Under Weight Scaling	13-3
13.1.3 Objectives of the Weight Scale System	13-4
13.1.4 Elements of Weight Scaling	13-5
13.1.4.1 Scale Site Authorization	13-5
13.1.4.2 The Weight Scale Sample Plan	13-5
13.1.4.3 Sampling Frequency	13-5
13.1.4.4 Weighing Loads and Processing Samples	13-6
13.1.4.5 Compilation and Reporting Requirements	13-6
13.1.4.6 Automated Scale Sites (not operated by a Timber Weigher)	13-6
13.2 Statistics Underlying the Weight Scale System	13-7
13.2.1 Statistical Concepts	13-7
13.2.1.1 An Overview of Estimating Using Statistics	13-7
13.2.1.2 Accuracy and Precision	13-9
13.2.1.3 Determining the Sample Size	13-10
13.2.1.4 Stratified Random Sampling	13-11
13.2.1.5 The Weight Scale Sampling Plan	13-13
13.2.1.6 Chapter Summary	13-14
13.3 Summary of Statistical Formulae in Weight Scaling	13-15
13.3.1 Ratio of a Stratum	13-15
13.3.2 Estimate of Total Volume in a Stratum (From a Sample)	13-16
13.3.2.1 Estimate of Variance of Total Volume in a Stratum (From a Sample.....)	13-16
13.3.3 Estimate of Variance for Load Volumes in a Stratum (From a Sample).....	13-17
13.3.4 Precision of the Estimated Volume of a Stratum (From a Sample)	13-17
13.3.5 Estimate of Total Volume in a Population (Combining Strata)	13-18
13.3.6 Estimate of Variance of Total Volume in a Population (Combining Strata)	13-18
13.3.7 Precision of the Estimated Total Volume in a Population (From a Sample)	13-18
13.3.8 Sample Size (for Planning)	13-19
13.3.8.1 Required for the Population	13-19
13.3.8.2 A Stratum Containing a Pre-specified Target Precision (for Planning)	13-20
13.3.8.3 Sample Size for a Population Containing Some Pre-specified Strata (for Planning)	13-21
13.3.9 Relative Variance of a Stratum (from a Sample)	13-22

13.3.10	Relative Variance of a Population (From a Sample)	13-22
13.3.11	Combining Strata	13-23
13.3.12	Dividing Strata (Splitting of Strata)	13-23
13.4	Automated Scale Sites (not operated by a Timber Weigher)	13-24
13.5	Scanner Scaling	13-24

14 Weight Scale Sampling

14.1	Setting Up the Sampling Plan	14-3
14.1.1	Defining the Weight Scale Population	14-3
14.1.1.1	The Sampling Plan	14-4
14.1.2	PSY	14-5
14.1.3	Setting the Sampling Objectives	14-5
14.1.3.1	Sampling Objectives	14-5
14.1.3.2	Precision Requirements	14-5
14.1.4	Stratification to Meet the Sampling Objectives	14-6
14.1.4.1	Why We Stratify	14-6
14.1.4.2	How are the Objectives of Stratification Met	14-6
14.1.4.3	Common Stratification Methods	14-10
14.1.5	Determining and Allocating the Sample Size	14-12
14.1.5.1	Subsampling	14-14
14.1.6	Selecting and Processing Samples	14-14
14.2	Monitoring Sampling Plan Progress and Weight Scale Results	14-16
14.2.1	During the Sampling Year	14-16
14.2.2	At Year-end	14-16
14.3	Managing the Sampling Plan	14-19
14.3.1	Management Responsibility	14-19
14.3.2	Revising the Sampling Plan	14-19
14.3.3	Sample Plan Revisions	14-20
14.3.4	Options	14-21
14.3.4.1	Stratum 01	14-22
14.3.4.2	Stratum 02	14-22
14.3.4.3	Stratum 03	14-23
14.3.5	Sampling Plan Amendments	14-23
14.3.6	Standard Deviations	14-23
14.4	Operational Procedures to Ensure Sampling Plan Integrity	14-25
14.4.1	Inspecting Loads Before Weighing	14-25
14.4.2	Processing the Load	14-25
14.4.2.1	Previously Scaled Timber	14-25
14.4.2.2	Unscaled Timber	14-26
14.4.3	Managing Sample Loads	14-26
14.4.4	Loads Not Suitable for the Sample Plan	14-27
14.4.5	Importance of Accurate Stratification	14-28
14.4.6	Testing of Weight Scales for Accuracy (Eccentricity Test)	14-28
14.4.7	Records Management at a Weight Scale	14-30

14.4.8	Changes to Scale Data	14-31
14.4.9	Emergency Procedures.....	14-31
14.5	Emergency Procedures in the Event of a Weight Scale Breakdown	14-33
14.5.1	Breakdown of the Weighing Device (Weight Indicator is Unavailable or Inaccurate)	14-33
14.5.2	Alternatives to Weight Scaling	14-33
14.5.2.1	Responsibilities	14-34
14.5.3	Breakdown of the Weight Scale Computer or Sample Selector	14-34
14.5.4	Procedures.....	14-34

15 Scaling Administration

15.1	The Roles and Responsibilities for Scaling	15-3
15.2	Scale Site Application and Authorization	15-4
15.2.1	Site Registration.....	15-4
15.2.2	Applicants Responsibilities.....	15-4
15.2.3	Ministry Responsibilities	15-4
15.2.4	Scale Site Authorizations	15-6
15.2.4.1	Content of a Scale Site Authorization.....	15-6
15.2.4.2	Ministry Responsibilities	15-7
15.3	Designating the Place of Scale.....	15-10
15.3.1	Applicant's Responsibilities	15-10
15.3.2	Ministry Responsibilities	15-12
15.3.3	Scaler and Scale Site Operator's Responsibilities	15-13
15.4	The Training, Examination and Licensing of Scalers	15-15
15.4.1	Scaler Training.....	15-15
15.4.2	Scaling Examination	15-15
15.4.3	Examination Procedures	15-15
15.4.4	Requirements to Take the Examination	15-16
15.4.4.1	Applications	15-16
15.4.4.2	Payment of Examination Fees.....	15-18
15.4.5	The Administration of Scaling Licences.....	15-18
15.4.5.1	Marking Requirements.....	15-18
15.4.5.2	Review by Unsuccessful Candidates	15-18
15.4.6	Other Examination and Endorsements.....	15-18
15.4.6.1	Scaling Endorsements	15-18
15.4.6.2	Re-examinations	15-18
15.4.6.3	Other Examinations	15-19
15.4.7	Scalers Oath	15-19
15.5	Authorization and Appointments of Scalers	15-20
15.5.1	Legal Requirement for Authorization and Appointments.....	15-20
15.5.1.1	Administrative Reasons for Authorization and Appointments... ..	15-20
15.5.2	Terms of Requirements of Authorization and Appointments	15-20
15.5.2.1	Official Scalers.....	15-20
15.5.2.2	Licensed Scalers.....	15-21

15.5.2.3 Acting Scalers-Ministry Scalers.....	15-21
15.5.3 How to Obtain an Authorization and/or Appointment.....	15-22
15.5.4 Authorization Conditions.....	15-23
15.6 Assessing Compliance with Scaling Requirements	15-25
15.6.1 Check Scaling	15-25
15.6.1.1 Purpose of Check Scaling	15-25
15.6.1.2 Conducting a Check Scale	15-25
15.6.1.3 Check Scale Frequency.....	15-26
15.6.1.4 Division of Responsibilities – The Scaler.....	15-26
15.6.1.5 Division of Responsibilities – The Site Operator	15-26
15.6.2 Checks to be Made.....	15-27
15.6.2.1 Piece Scale	15-27
15.6.2.2 Weight/Sample Scale.....	15-27
15.6.2.3 Special Forest Products - Stacked.....	15-28
15.6.2.4 Special Forest Products - Piece Sampling	15-28
15.6.3 Actions on Completion of the Check Scale	15-28
15.6.3.1 Check Scale Advisory.....	15-28
15.6.3.2 Replacement of the Original Scale by a Check Scale.....	15-28
15.6.3.3 Update Scaler File and Records	15-29
15.6.3.4 Second Check Scale.....	15-29
15.6.3.5 Second Scales.....	15-30
15.6.3.6 Suspension of a Scaling Licence.....	15-30
15.6.3.7 Cancellation of a Scaling Licence.....	15-31
15.6.4 Scale Site Inspections	15-31
15.6.4.1 Purpose of Scale Site Inspections	15-31
15.6.4.2 What to Expect From a Scale Site Inspection.....	15-31
15.6.4.3 Actions on Completion of a Scale Site Inspection.....	15-34

Figures

Figure 1.1 The B.C. Log Rule.....	1-3
Figure 1.2 The Smalian Formula	1-4
Figure 1.3 Scaling in B.C. – Principal Events	1-6
Figure 4.1 The Smalian Formula	4-2
Figure 4.2 Depictions of Three Typical Log Forms	4-4
Figure 4.3 Graph of the Effects of Taper on Log Volume.....	4-5
Figure 4.4 Two Ways to Visualize Smalian’s Formula.....	4-6
Figure 4.5 Measurements for Finding the Values.....	4-7
Figure 5.1 Basic Parts of the Official BC Metric Scale Stick.....	5-5
Figure 5.2 Sides and Edge of a BC Metric Scale Stick.....	5-6
Figure 5.3 Locating Centimetres from the Edge of a BC Metric Scale Stick.....	5-7
Figure 5.4 Scale Stick Edges Showing the Red Markings for Length Measurements	5-8
Figure 5.5 Using the BC Metric Scale Stick to Calculate Half Volumes	5-9
Figure 5.6 Use of the Side and Edge of the Stick in Calculating 2 m Half Volumes	5-10
Figure 5.7 Obtaining Unit Volumes (or.....	5-11
Figure 5.8 Using the Side and Edge of the Stick for Lengths in Tenths of Metres	5-12
Figure 5.9 BC Metric Log Scale Stick – Specifications Sketch	5-16
Figure 6.1 The Method for Measuring and Averaging Diameters.....	6-6
Figure 6.2 The Method for Measuring Shattered and Split Back Ends	6-7
Figure 6.3 The Method for Measuring Irregular Diameters – Except Flared Butts	6-8
Figure 6.4 The Method of Measuring Butt Diameter by Callipering	6-11
Figure 6.5 Method of Measuring Butt Diameter by Projecting the Normal Log Taper.....	6-13
Figure 6.6 Length Measurement of Logs Through the Geometric Centre.....	6-15
Figure 6.7 Length Measurement of Logs with Undercut.....	6-16
Figure 6.8 Length Measurement of Logs and Slabs with Segment Under 10 cm.....	6-17
Figure 6.9 Length Measurement of Logs with Shattered End.	6-18
Figure 6.10 Length Measurement of a Partially Bucked Split Back (sniped) End.	6-19
Figure 6.11 Length Measurement of a Log with Missing Chunk.....	6-20
Figure 6.12 Length Measurement of Forked Logs	6-21
Figure 6.13 Length Measurements of Logs with Sweep.	6-22
Figure 6.14 Length Measurement of Logs with Crook.....	6-22
Figure 6.15 Typical Slab Shapes	6-23
Figure 6.16 Measurement of a Semicircular Slab End.	6-24
Figure 6.17 Measurement of a Semicircular Slab End with Hole	6-26
Figure 6.18 Measurement of a Sector Slab End with Hole.....	6-28
Figure 6.19 Measurement of Sectors (pie wedge slab ends).....	6-29
Figure 6.20 Measurement of Four-sided (quadrilateral) Slab Ends.....	6-33

Figure 6.21 Measurement of Triangular or Wedge-shaped Slab Ends	6-35
Figure 7.1 The Geometric Shapes Used in Scaling and Firmwood Deductions	7-4
Figure 7.2 A Log with Butt Rot – One End Visible	7-13
Figure 7.3 A Log with Butt Rot – Through Running	7-15
Figure 7.4 A Log with Conical Catface	7-19
Figure 7.5 A Log with a Double Conical Catface	7-22
Figure 7.6 A Log with Through-running Heart Rot.....	7-25
Figure 7.7 A Log with Partial Length Heart Rot.	7-28
Figure 7.8 A Log with Through-running Ring Rot.....	7-34
Figure 7.9 A Log with Partial Length Ring Rot.	7-37
Figure 7.10 A Log with Through-running Pocket Rot.....	7-41
Figure 7.11 A Log with Partial-length Pocket Rot	7-44
Figure 7.12 A Log with Partial-length Triangular Defect	7-46
Figure 7.13 A Log with Sap Rot.....	7-49
Figure 7.14 A Log with Missing Segment.....	7-52
Figure 7.15 A Log with Sector Defect Extending to the Heart.....	7-55
Figure 8.1 Minimum Dimensions for Recovery	8-6
Figure 8.2 Weather Checking	8-8
Figure 8.3 An Example of Irregular Surface Checks.....	8-8
Figure 8.4 An Example of a ‘Skipping’ Irregular Surface Checks	8-9
Figure 8.5 Measuring Twist – Placing the Stick	8-12
Figure 8.6 Measuring Twist – Reading the Deflection	8-12
Figure 8.7 Measuring Knot Diameters.....	8-13
Figure 8.8 Measuring Bunch (cluster) Knots.....	8-15
Figure 8.9 Assessing Knots – Coast and Interior.....	8-16
Figure 8.10 Knots and Midpoint.....	8-17
Figure 8.11 Oversized Knots Distributed Over Entire Surface	8-17
Figure 8.12 Oversized Knots Near the Top of the Log.....	8-18
Figure 8.13 Oversized Knots on One Side.....	8-18
Figure 8.14 Measuring Compression Wood (the shaded area is the area of grade consideration).....	8-20
Figure 8.15 Examples of Logs with a Portion of the Collar Too Thin to Produce Lumber.....	8-28
Figure 8.16 Examples of Logs with Entire Collar Too Thin to Produce Lumber ...	8-28
Figure 8.17 Examples of Logs with Sufficient Collar to Produce Lumber	8-28
Figure 8.18 Sap Rot	8-29
Figure 8.19 Advanced Sap Rot	8-29
Figure 8.20 Residual Core is a Grade Reduction.....	8-30
Figure 8.21 Shaded Areas are Unsuitable for the Recovery of Lumber	8-31
Figure 8.22 Slabs with Portions Meeting the Grade Rule.....	8-32
Figure 8.23 Measure Minimum Thicknesses at Right Angles to the Grain.....	8-33
Figure 8.24 The Application of Trim Allowance Around Heart Rot and Hole.	8-36
Figure 8.25 Collar Too Thin to Cut Lumber.....	8-38
Figure 8.26 Trim and the Twenty Percent Rule.....	8-39
Figure 8.27 Simple Butt Rot	8-40

Figure 8.28 Through Running Butt Rot.....	8-41
Figure 8.29 Irregular Butt Defects in a Fluted Butt Log.....	8-42
Figure 8.30 Ring Shake and Both Collar and Core are Thick Enough to Produce Lumber.....	8-43
Figure 8.31 Ring Shake and Only the Core is Thick Enough to Produce Lumber.....	8-44
Figure 8.32 Ring Shake and Only the Collar is Thick Enough to Produce Lumber.....	8-45
Figure 8.33 Both Core and Collar Meet the Grade Rule	8-46
Figure 8.34 Only the Collar Meets the Grade Rules.....	8-47
Figure 8.35 Only the Core Meets the Grade Rule.....	8-48
Figure 8.36 Multiple Ring Rot and the Firmwood Between Rings is Less Than 5 Rads	8-49
Figure 8.37 Multiple Ring Rot and the Firmwood Between Rings is 5 Rads or More.....	8-50
Figure 8.38 Partial Ring Rot 2 Rads Thick.....	8-51
Figure 8.39 Irregular Heart Check.....	8-53
Figure 8.40 Extensive Surface Checking.....	8-54
Figure 8.41 Trim Allowance for Check and Split in Relation to Collars	8-54
Figure 8.42 Trim Allowance for Multiple Heart Check.....	8-55
Figure 8.43 The Application of Trim Allowance to Off Centre Defects.....	8-56
Figure 8.44 The Application of Trim Allowance to Overlapping Defects	8-57
Figure 8.45 Logs Shorter Than 5 Metres are Assessed on Their Length.....	8-58
Figure 8.46 Logs 5 Metres and Longer are Assessed in 2.5 Metre Segments	8-59
Figure 8.47 Log with Spiral Heart Check.....	8-59
Figure 8.48 Short Breakage Pieces Contained in a Conventional Load.....	8-61
Figure 8.49 Rat Tail Tops Delivered with a Short Segment Over 10 cm	8-62
Figure 8.50 Assessing Grade in Log with Severe Heart Rot and Residual Length is Too Short to Cut Lumber.....	8-63
Figure 8.51 Examples of Short Logs Left After Bucking at the Scale Site and Deemed to be 2.5 m Long (Interior) and 5.2 m Long (Coast)	8-64
Figure 8.52 Example of Logs Cut to Special Forest Product Lengths but Not Classified as Such and Deemed to be 2.5 m Long (Interior) and 5.2 m Long (Coast)	8-65
Figure 8.53 Visually Bucking a Log with Crook to Assess Lumber Recovery.....	8-66
Figure 8.54 Visually Bucking a Log with Pistol Grip to Assess Lumber Recovery	8-66
Figure 8.55 Visually Bucking a Log with Sweep to Assess Lumber Recovery	8-67
Figure 8.56 An Ellipse Shape is Created When Sweep Misaligns the Two Ends of a Log.....	8-67
Figure 8.57 Measuring the Offset for 2.5 m Log.....	8-69
Figure 8.58 Measuring the Offset of Logs 2.5 m to 4.9 m.....	8-70
Figure 9.1 Measuring Diameter for Interior Undersize Grade.....	9-3
Figure 9.2 Knot Spacing Measurement	9-7
Figure 11.1 FS 1211 – Piece Scale Detailed Log Listing (NET).....	11-6
Figure 11.2 FS 1212 – Beachcomb Piece Scale Detailed Log Listing	11-7

Figure 11.3 FS 1217 – Weigh Slip.....	11-8
Figure 11.4 FS 1210 – Sample Scale Detailed Log Listing (NET)	11-9
Figure 11.5 Weight Scale Safety Sheet Example.	11-10
Figure 11.6 Weight Scale Daily Audit Log Example.	11-11
Figure 11.7 Weight Slip Example.....	11-13
Figure 11.8 Example and Instructions for Completing the Special Forest Products Scale Return and Transportation Document	11-15
Figure 11.9 FS 200 – Load Description Slip/Christmas Tree Scale Return	11-16
Figure 11.10 FS 701 – Volume Estimate - Other	11-17
Figure 11.11 Site Arrival and Departure Ledgers.....	11-20
Figure 11.12 FS 649 – Load Description Slip.	11-21
Figure 12.1 Flow Diagram Outlining Selection of Scaling Methods and Forms	12-19
Figure 12.2 A Pile of Posts Sorted to Size Classes and Ready for Sampling.	12-22
Figure 12.3 Completed FS 222 for 100 Round Fence Posts.....	12-23
Figure 12.4 Completed FS 701 – Volume Estimate – Other Summarizing the FS 222 in Figure 12.3.....	12-24
Figure 12.5 Completed FS 222 with Split Product	12-26
Figure 12.6 A Completed FS 701 – Volume Estimate – Other – Summarizes the Information from the FS 222 in Figure 12.7.	12-27
Figure 12.7 A Completed FS 701 – Volume Estimate – Other Which Summarizes the Information on the FS 200.	12-29
Figure 12.8 Selecting a Sample Section from a Log Deck	12-30
Figure 12.9 Two Methods of Measuring the Length and Height of a Pile	12-32
Figure 12.10 Finding the Average Width of a Pile by Averaging Five Representative Tree Lengths.....	12-33
Figure 12.11 Squaring Up a Pile by taking Length Measurement at Exactly One-half the Height of the Pile	12-33
Figure 13.1 A Loaded Logging Truck on the Platform of a Weight Scale.....	13-2
Figure 13.2 Conceptual Formula for Estimating Volumes	13-4
Figure 13.3 Conceptual Overview of Weight Scale Sampling	13-9
Figure 13.4 In this Dartboard Example, the 3 Darts (x) are Precise but Inaccurate and Biased	13-10
Figure 13.5 Graphs to Show the Impact of Stratification.	13-13
Figure 14.1 An Approved and Active Sampling Plan as Shown in HBS Stratum Advisor	14-15
Figure 15.1 An Example of an Application for a Scale Site (FS 1309).....	15-5
Figure 15.2 An Example of a Scale Site Authorization Letter	15-9
Figure 15.3 enter fig name here	15-11
Figure 15.4 Example of a Mark Site Designation (page 1)	15-13
Figure 15.5 Example of an Application to Take a Scaling Exam/Appointment as an Acting Scaler/Authorization to Scale at a Site.....	15-17
Figure 15.6 Completed Application for Authorization to Scale	15-22
Figure 15.7 An Example of an Authorization to Scale (Page 1).....	15-24
Figure 15.8 Scaling Site Inspection Report (Page1).....	15-32