

**ALBERTA SCALING MANUAL**

**Scaling Methods – SMALIAN SCALE**

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### 3.0 Methods for Scaling Crown Timber

When scaling sample scale loads at mass scale sites, there are two primary approved scaling methods: the Smalian Scale and the Cube Scale. An operator approved for one method of scaling Crown timber is bound to scale by that method unless otherwise approved in writing by PLFD. Both methods are designed to calculate the volume of sound wood in a log or logs expressed in cubic metres (equivalent to 35.315 cubic feet).

<b>Differences / Similarities Between Methods Approved for Scaling Sample Loads for Mass Scaling</b>	
<b>Smalian</b>	<ul style="list-style-type: none"> <li>- Logs are spread out and each log is measured</li> <li>- Each log length plus butt and top diameters are measured</li> <li>- Smalian formula used to calculate volume</li> <li>- All defects may apply depending on product scaled for</li> </ul>
<b>Cube Scale</b>	<ul style="list-style-type: none"> <li>- Logs are stacked and cut to the same length</li> <li>- Diameters are usually measured on one pile face</li> <li>- Volumes are determined using a cylindrical volume formula</li> <li>- Deductible defects include soft rot and missing wood only</li> </ul>

**Table 3.1 – Approved Mass Scale Methods**

## 3.1 Smalian Scale

### 3.1.1 Background

The Smalian Scale is the standard scaling method endorsed by the Canadian Standards Association. Both log ends are directly measured along with the log length making this method reasonably accurate. Volumes are calculated using Smalian's formula:

$$V = \frac{a_t + a_b}{2} \times L$$

Where:

V = volume (cubic metres)

$a_t$  = area of log top  $(3.14159 \times \text{top diameter(cm)}/200)^2$

$a_b$  = area of log butt  $(3.14159 \times \text{butt diameter(cm)}/200)^2$

L = log length (metres)

### 3.1.2 Volume Determination

There are two ways to calculate the volume of a log using the Smalian method once the required measurements (top diameter, butt diameter, and length) are obtained: using the formulas, or using the table of Smalian Half Volume of Cylinders – Appendix 7.

The total volume of a log or logs is the gross volume, but there are log conditions/defects that may be deducted from the gross volume resulting in a net volume. It is the net volume that is of primary concern when scaling. Section 3.1.4 details the applicability and procedures for deducting defects from gross volumes.

### 3.1.3 Smalian Log Scale Tally - Form TM32S

Log measurement data can be manually recorded on form TM32S, also named the Log Scale Tally Sheet. This form is in the same format as Mscale to facilitate data entry. There are four main sections to the TM32S. The following is an example of a Smalian TM32 showing the basic sections:

## Header Information

TM 325  
Rev. 10/11

### SMALIAN LOG SCALE TALLY SHEET

DISPOSITION HOLDER				MILL NAME OR LOCATION				MILL NO.		DISPOSITION			SUB-DISP		SOURCE (Non Disp)														
LOAD NO.	DATE WEIGHED			POP	TOP	NET WEIGHT (KG)			TM9 NUMBER	PRIMARY CODES			BLOCK	TREES	MILL CODE	PAGE													
g	Year	M	D	i	j	k			l	SP	CD	PR	LGTH	m	n	o	p	q											
LOG NO.	SP	CD	PR	BUTT	TOP	LGTH	VOL	T	M	C1	C2	C3	VOL	I	LOG NO.	SP	CD	PR	BUTT	TOP	LGTH	VOL	T	M	C1	C2	C3	VOL	F
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
20																													
LOG GROUP 1								SUMMARIZE								LOG GROUP 1													
LOG GROUP 2								TOTALS ON								LOG GROUP 2													
LOG GROUP 3								REVERSE								LOG GROUP 3													
LOG GROUP 4								SIDE OF								LOG GROUP 4													
LOG GROUP 5																LOG GROUP 5													
LOG GROUP 6																LOG GROUP 6													
TOTAL																TOTAL													

Gross volume data

Deduction data

Gross volume data

Deduction data

Front-page summary data

SPECIES CODES			
Aspen	AS	Other Deciduous	OD
Balsam Poplar	ZL	Fir	FR
Birch	B	Balsam Poplar	BP
Diagnose Fir	DF	Diagnose Pine	DP
Balsam Fir	BF	Spinebreak Pine	SP
Diagnose P	DP	Spruce	S
Emmenanthe Cedar	EC	Black Spruce	SB
Incidental Deciduous	ID	Engelmann Spruce	SE
Incidental Fir	IF	White Spruce	SW
Larch	L	Spruce and Pine	SP
Other Coniferous	OC		

DIRECTION CODES	
Black Spruce	BP
White Spruce	WP
Diagnose	DP
Engelmann	EP
Emmenanthe	EM
Black Spruce	SB
Balsam Fir	BF
Diagnose Spruce	DS
Other Deciduous	OD
Tanbark Spruce	TS

DISPOSITION CODES	
Aspen	AS
Balsam Poplar	ZL
Birch	B
Diagnose Fir	DF
Balsam Fir	BF
Diagnose P	DP
Emmenanthe Cedar	EC
Incidental Deciduous	ID
Incidental Fir	IF
Larch	L
Other Coniferous	OC

DILLECT TYPES	
Heart Rot	1
Diagnose Rot	2
Diagnose Rot	3
Diagnose Rot	4
Diagnose Rot	5

DEDUCTION METHODS	
Branches	1
Heart Rot	2
Diagnose Rot	3
Diagnose Rot	4
Diagnose Rot	5
Diagnose Rot	6

Figure 3.1 a – Smalian Log Scale Tally Sheet (Front Page)

### 3.1.3.1 Header Information

Header information must always be completed on each page of a sample load. This information identifies a load and allows for the tracking of scale data throughout the weigh scale/reporting process. There are 17 fields to complete in the Header section:

- a. DISPOSITION HOLDER – the name of the company or individual under whose name the disposition was issued.
- b. MILL NAME OR LOCATION – the name of the mill if different from the disposition holder, and/or the location of the mill.
- c. MILL NO. – the number assigned to a mill by the LFD.
- d. DISPOSITION – disposition numbers have ten characters. The first three define the type of disposition:

FMA	– Forest Management Agreement
CTL	– Coniferous Timber License
CTP	– Community Timber Permit
DTL	– Deciduous Timber License
DTP	– Deciduous Timber Permit
LTP	– Local Timber Permit*

**Table 3.2 Crown Disposition Types**

\* When using the micro log scale program an LTP is entered in the “Source” field rather than as a Disposition.

The remaining characters depend upon the disposition type, and are listed below:

1. FMA – the next two characters indicate the year in which the current agreement commenced. The remaining characters are sequential for all FMAs in the province.
2. CTL, CTP, DTL, and DTP – the first character indicates the forest; the following three characters indicate the management unit in which the disposition is located; and the last three characters indicate the sequence of issuance.
3. LTP – the seven characters are sequential for all LTPs in the province.

- e. SUB-DISP – the subdisposition field allows for four characters to indicate a further stratification of a disposition. An example would be working circles within an FMA.
- f. SOURCE – this field is where non-disposition sources are indicated. Non-disposition wood comes from sources other than the regular dispositions issued by PLFD. Such sources include private land, industrial salvage, etc. The legal land description or special land use coding is entered into this field.
- g. LOAD NUMBER – the sequential load number from a given population
- h. DATE WEIGHED – the date the load was weighed.
- i. POP – the population number under which the load (and the disposition) is included.
- j. TOP – The minimum top size for the population as dictated by the utilization standard of the disposition(s) included in the population.
- k. NET WEIGHT – the weight of the trees / log / bolts in the load (kg).
- l. TM9 NUMBER – the number from the haul form accompanying the load.
- m. PRIMARY CODES – The primary codes indicate the primary type of log in a load in regards to species, condition, product, and length.
- n. Once these primary codes are recorded it is not necessary to repeat them when recording individual log data; if the SP CD PR codes are left blank it is assumed that the primary codes apply.
- o. BLOCK – The number of the cutblock from which the load originated.
- p. TREES – the number of trees or logs in a load.
- q. MILL CODE – the two-letter mill code assigned to the mill by the LFD.
- r. PAGE/OF – the page reference

### **3.1.3.2 Gross Volume Recording**

Under the header information is the section where individual log measurements are recorded. Forty logs per page can be recorded. Unless indicated as PRIMARY CODES in the header information, a log's species, condition, and product code is recorded, as well as a gross volume.

When completing a TM32, as opposed to using Mscale, gross volumes are obtained by using the HALF VOLUMES OF CYLINDERS (M<sup>3</sup> 1000X) volume table.

To determine a log's gross volume, the top diameter is correlated with the total log length on the Half Volumes of Cylinders table (HVC). The point at which these two values intercept on the table is the volume. Next, the butt diameter is correlated with the total log length; this results in another volume. The sum of these two volumes is equal to the total gross volume of the log.

The total log length is used to obtain both volumes, and this is why the HALF Volumes of Cylinders table is used.

All volumes are 1000x until the summary stage; this is done to eliminate the task of compiling volumes to three decimal places. Once the summary stage is reached volumes are converted from 1000x to 1x. All volumes are recorded as whole numbers until the appropriate summary section is reached (see section 3.1.2).

### **3.1.3.3 Defect Recording**

Log defect data is recorded in a specific format for each log that has an allowable, deductible defect (allowable defects and defect calculation procedures are detailed in the beginning of this section).

Once a defect is identified its type code and deduction method code are recorded in the T and M columns respectively. Specific measurements are taken for each defect type, and these numbers are recorded in the three spaces under the SIZE column.

The three spaces under this header are referred to as the C1, C2, and C3 measurements. These values are used to calculate the defect volume, which is recorded under the VOL column.

The “C” values are necessary for check scaling so the check scaler can readily see how a given defect was measured and calculated. All defect volumes are recorded as whole numbers until the appropriate summary section is reached .

### 3.1.3.4 Volume Summary

Once all individual log measurements are complete, one proceeds to summarize the data. Both gross and defect data are summarized at the bottom of the front page and on the back of each page.

**FRONT PAGE SUMMARY** - All volumes are summarized by SPCDPR group; under each column of twenty trees there is room for three SPCDPR log groups.

**BACK PAGE SUMMARY** - Once volumes are compiled for each log group on the front of every page, they are transposed to the back of the last sheet of the load. If there are more than three log groups or more than twelve pages (480 logs) of log data, then separate sheets will be used to summarize the data.

Each log group’s SP, CD, and PR are recorded at the top of each column on the back page, then the summary data from the front of each page in the load is recorded. The number of logs, gross volume, and defect volume is recorded for each log group, each column of twenty logs (front page), and for each page in the load.

**FINAL SUMMARY** – the final summary is where gross scale volume 1000x is converted to netscale volume 1x. Each summary column is added and recorded in the TOTALS row. Next, the volumes are converted to 1x scale in the 1X SCALE (3 decimals) column; volumes are converted by dividing each by 1000.

Finally, a netscale volume is calculated by subtracting the defect volume from the gross volume. Netscale volumes are calculated for each log group, and the sum of all log groups is the total netscale volume for the load.



**SMALIAN  
LOG SCALE TALLY SHEET SUMMARY**

DISPOSITION HOLDER		MILL NAME OR LOCATION				MILL NO.	DISPOSITION	SUB-DISP	SOURCE (Non Disp)				
LOAD NO.	DATE WEIGH	WEIGHT	WET WEIGHT	WET WEIGHT	WET WEIGHT	WET WEIGHT	WET WEIGHT	WET WEIGHT	WET WEIGHT	WET WEIGHT	PAGE		
Year	Month	Day	kg	kg	kg	kg	kg	kg	kg	kg			
<b>Header information – same as front page</b>													
PAGE	CO.	SPCDPR			SPCDPR			SPCDPR			SPCDPR		
		LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT
1	1												
	2												
2	1												
	2												
3	1												
	2												
4	1												
	2												
5	1												
	2												
6	1												
	2												
7	1												
	2												
8	1												
	2												
9	1												
	2												
10	1												
	2												
1	1												
	2												
2	1												
	2												
3	1												
	2												
4	1												
	2												
5	1												
	2												
TOTAL													
TOTAL /1000													
NET SCALE													
SCALER				PERMIT #				SCALED DATE					

**Back page summary**

**Final summary**

**Figure 3.1 b – Smalian Log Scale Tally Sheet (Back Page)**

The following is an example of a completed **Smalian TM32** when scaling with **trim allowances**. The actual lengths are keyed into the Micro Log Scale program (Refer to Section 3.3) and the program will adjust for trim and determine the appropriate length class. Note: Where there is no SPCD values entered they are assumed to be the same as the primary codes entered (SPGR).

TM 32S (Rev. 10/04)																														
<b>SMALIAN LOG SCALE TALLY SHEET</b>																														
DISPOSITION HOLDER				MILL NAME OR LOCATION				MILL NO.		DISPOSITION		SUB-DISP		SOURCE (Non Disp)																
BLACK BEAR LUMBER				SLAVE LAKE				M00439		CTL S040001																				
LOAD NO.	DATE WEIGHED			POP	TOP	NET WEIGHT (KG)			TM9 NUMBER	PRIMARY CODES			BLOCK	TREES	MILL CODE	PAGE														
46	Year	M	D	1	0	2	12	35860			A13906409	SP	CD	PR	LGTH	21	75	BC	1											
	2003	1	17								SP	GR	01	4.8																
LOG NO.	SP	CD	PR	BUTT	TOP	LGTH	VOL	T	M	C1	C2	C3	VOL	F	LOG NO.	SP	CD	PR	BUTT	TOP	LGTH	VOL	T	M	C1	C2	C3	VOL	F	
1	SP	GR	01	26	20	5.03	127 75	2	8	26	12	1	U	b	1	SP	GR	01	28	24	3.18	99 72								
2			01	20	16	5.12	79 50								2			06	18	16	2.76	36 28								
3			01	20	16	4.66	72 46								3			01	28	22	5.02	148 91	4	4	1	1U		24		
4			01	22	18	3.62	68 46								4			01	24	20	5.31	118 82								
5	F	GR	01	20	18	5.04	75 61								5			01	20	16	3.17	50 32								
6			01	20	16	4.95	75 48	b	3	b			b		6	DF	GR	06	16	12	4.95	48 27								
7			01	26	24	3.02	80 68								7			06	12	12	1.49	8 8								
8			99	12	10	1.95	11 8								8			01	28	22	5.00	148 91								
9			01	20	16	4.95	75 48								9			06	16	14	4.94	48 37								
10			01	28	26	5.03	148 127	3	1	24	22		7b		10			06	18	14	4.13	51 31								
1			01	26	20	5.02	127 75								1			01	22	18	3.82	72 48	b	b	14	16	3.8	12U		
2			01	20	16	5.12	79 50								2	F	GR	06	16	14	4.02	40 31								
3			01	20	16	3.95	60 38								3			01	30	26	3.87	134 101								
4	F	GR	01	22	18	4.29	80 53								4			01	24	20	4.86	109 75	4	/	b			b		
5			01	28	20	4.81	148 75	1	b	1U	1U	4.8	3b		5			01	28	26	1.97	62 53								
6			06	16	14	3.25	32 25								6			01	36	32	4.90	244 193								
7			01	32	24	4.25	169 95								7	F	GR	01	42	38	4.32	291 238								
8			01	28	22	4.12	123 76								8			06	16	12	5.03	48 27								
9			06	14	12	3.23	25 18								9			01	22	18	3.52	65 43								
20			01	26	20	4.01	106 63								40			01	24	20	3.62	81 57								
LOG GROUP 1				SPGR01		2516		SUMMARIZE							125		LOG GROUP 1				SPGR01		2268		F - Incomplete tree or log flag				149	
LOG GROUP 2				SPGR06		100		TOTALS ON									LOG GROUP 2				SPGR06		322							
LOG GROUP 3				SPGR99		19		REVERSE									LOG GROUP 3				F GR01		529							
LOG GROUP 4				F GR01		269		SIDE OF									LOG GROUP 4				F GR06		71		T - Defect Type					
LOG GROUP 5								LAST PAGE									LOG GROUP 5				DFGR06		75							
LOG GROUP 6																	LOG GROUP 6													
<b>TOTAL</b>						<b>2904</b>									<b>125</b>		<b>TOTAL</b>						<b>3265</b>		M - Deduction Method				<b>149</b>	

SPECIES CODES				CONDITION CODES				PRODUCT CODES				DEFECT TYPES			
Aspen	A	Other Deciduous	OD	Blowdown	BD	Sawlog, Conif. Pulp	01	Heart Rot	1	Crook or Sweep	5				
Aspen/Balsam Poplar	AB	Pine	P	Beetle killed	BK	Deciduous pulp	02	Butt Rot	2	Shake or Crack	6				
Birch	B	Balsam Poplar	PB	Dead	D	Small Stem Conifer	06	Sap Rot	3	Crotch or Fork	7				
Douglas Fir	DF	Limber Pine	PF	Endangered	EN	Veneer	14	Cat Face	4						
Balsam Fir	F	Whitebark Pine	PW	Fire killed	FK	Oriented Strandboard	18								
Alpine Fir	FA	Spruce	S	Green	GR	Laminated Veneer Lbr.	19								
Incidental Conifer	IC	Black Spruce	SB	Insect Damaged	ID	Fuelwood	20								
Incidental Deciduous	ID	Engelmann Spruce	SE	Interior Rot	IR	Undersize	99								
Incidental Fir	IF	White Spruce	SW	Industrial Salvage	IS										
Larch	LT	Spruce and Pine	SP	Other Damaged	OD										
Other Coniferous	OC			Timber Damage	TD										

DEDUCTION METHODS			
Reduce diameter	1	Reduce length	2
Percent	3	Fraction	4
Blocking Out	5	Interior Cylinder	6
Cube Deduction	7	End Rot Options	8

Figure 3.1 c – Smalian Log Scale Tally Sheet with Trim (Completed Front Page)

The following is an example of a completed **Smalian TM32** when scaling with **no trim**. Log lengths are recorded to the nearest 0.2 metre length class.

														TM 32S (Rev. 10/04)															
<b>SMALIAN LOG SCALE TALLY SHEET</b>																													
DISPOSITION HOLDER				MILL NAME OR LOCATION				MILL NO.		DISPOSITION				SUB-DISP		SOURCE (Non Disp)													
BLACK BEAR LUMBER				SLAVE LAKE				M00439		CTLS040001																			
LOAD NO.	DATE WEIGHED			POP		TOP		NET WEIGHT (KG)				TM9 NUMBER		PRIMARY CODES		BLOCK	TREES	MILL CODE	PAGE										
	Year	M	D	1	0	2	12	35860				A13906409		SP	CD					PR	LGTH	21	75	BC	1				
46	2003	1	17	1	0	2	12	35860				A13906409		SP	GR	01	4.8	21	75	BC	1								
LOG NO.	SP	CD	PR	BUTT	TOP	LGTH	VOL	T	M	C1	C2	C3	VOL	F	LOG NO.	SP	CD	PR	BUTT	TOP	LGTH	VOL	T	M	C1	C2	C3	VOL	F
1	SP	GR	01	26	20	4.8	127	2	8	26	12	11	U	6	1	SP	GR	01	28	24	3.2	99							
2			01	20	16	5.0	75								2		06	18	16	2.8	72								
3			01	20	16	4.6	79								3		01	28	22	4.8	36	4	4	1	1	U	24		
4			01	22	18	3.6	50								4		01	24	20	5.2	28								
5	F	GR	01	20	18	4.8	72								5		01	20	16	3.2	148								
6			01	20	16	4.8	46	5	3	5			6		6	DF	GR	06	16	12	4.8	91							
7			01	26	24	3.0	68								7		06	12	12	1.4	8								
8			99	12	10	2.0	8								8		01	28	22	4.8	118								
9			01	20	16	4.8	75								9		06	16	14	4.8	82								
10			01	28	26	4.8	148	3	1	24	22		75		10		06	18	14	4.0	50								
1			01	26	20	4.8	127								1		01	22	18	3.8	48	6	5	14	16	3	8	12	U
2			01	20	16	5.0	79								2	F	GR	06	16	14	4.0	40							
3			01	20	16	3.8	60								3		01	30	26	3.8	134								
4	F	GR	01	22	18	4.2	80								4		01	24	20	4.8	101	4	7	5					5
5			01	28	20	4.8	53	1	6	1	U	1	U	4.8	5		01	28	26	2.0	109								
6			06	16	14	3.2	148								6		01	36	32	4.8	62								
7			01	32	24	4.2	32								7	F	GR	01	42	38	4.2	244							
8			01	28	22	4.0	75								8		06	16	12	4.8	291								
9			06	14	12	3.2	95								9		01	22	18	3.4	238								
20			01	26	20	4.0	123								20		01	24	20	3.6	48								
LOG GROUP 1							SPGR01	2516		SUMMARIZE				125	LOG GROUP 1							SPGR01	2268		F - Incomplete tree or log flag				149
LOG GROUP 2							SPGR06	100		TOTALS ON					LOG GROUP 2							SPGR06	322						
LOG GROUP 3							SPGR99	19		REVERSE					LOG GROUP 3							F GR01	529						
LOG GROUP 4							F GR01	269		SIDE OF					LOG GROUP 4							F GR06	71		T - Defect Type				
LOG GROUP 5										LAST PAGE					LOG GROUP 5							DFGR06	75						
LOG GROUP 6															LOG GROUP 6										M - Deduction Method				149
<b>TOTAL</b>							<b>2904</b>						<b>125</b>	<b>TOTAL</b>							<b>3265</b>						<b>149</b>		

SPECIES CODES			CONDITION CODES			PRODUCT CODES			DEFECT TYPES		
Aspen	A	Other Deciduous	OD	Blowdown	BD	Sawlog, Conif. Pulp	01	Heart Rot	1	Crook or Sweep	5
Aspen/Balsam Poplar	AB	Pine	P	Beetle killed	BK	Deciduous pulp	02	Butt Rot	2	Shake or Crack	6
Birch	B	Balsam Poplar	PB	Dead	D	Small Stem Conifer	06	Sap Rot	3	Crotch or Fork	7
Douglas Fir	DF	Limber Pine	PF	Endangered	EN	Veneer	14	Cat Face	4		
Balsam Fir	F	Whitebark Pine	PW	Fire killed	FK	Oriented Strandboard	18				
Alpine Fir	FA	Spruce	S	Green	GR	Laminated Veneer Lbr.	19				
Incidental Conifer	IC	Black Spruce	SB	Insect Damaged	ID	Fuelwood	20				
Incidental Deciduous	ID	Engelmann Spruce	SE	Interior Rot	IR	Undersize	99				
Incidental Fir	IF	White Spruce	SW	Industrial Salvage	IS						
Larch	LT	Spruce and Pine	SP	Other Damaged	OD						
Other Coniferous	OC			Timber Damage	TD						

Figure 3.1 d – Smalian Log Scale Tally Sheet No Trim (Completed Front Page)

**SMALIAN  
LOG SCALE TALLY SHEET SUMMARY**

DISPOSITION HOLDER <b>BLACK BEAR LUMBER</b>				MILL NAME OR LOCATION <b>SLAVE LAKE</b>				MILL NO. M00439		DISPOSITION CTLS040001		SUB-DISP		SOURCE (Non Disp)	
LOAD NO. 46	DATE WEIGHED Year M D 2003 1 17			POP 102	TOP 12	NET WEIGHT (KG) 35860		TM9 NUMBER A13906409		PRIMARY CODES SPCDPR LGTH SPGR01 4.8		BLOCK 21	TREES 75	MILL CODE BC	PAGE 1

PAGE	Total	SPCDPR SPGR01			SPCDPR SPGR06			SPCDPR SPGR99			SPCDPR F GR01			SPCDPR F GR06			SPCDPR DFGR06		
		LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT	LOGS	GROSS	DEFECT
1	1	15	2516	125	2	100	0	1	19	0	2	269	0						
1	2	12	2268	149	5	322	0				1	529	0	1	71	0	1	75	0
2	1																		
2	2																		
3	1																		
3	2																		
4	1																		
4	2																		
5	1																		
5	2																		
6	1																		
6	2																		
7	1																		
7	2																		
8	1																		
8	2																		
9	1																		
9	2																		
10	1																		
10	2																		
1	1																		
1	2																		
2	1																		
2	2																		
3	1																		
3	2																		
4	1																		
4	2																		
5	1																		
5	2																		

<b>TOTAL</b>	27	4784	274	7	422	0	1	19	0	3	798	0	1	71	0	1	75	0
--------------	----	------	-----	---	-----	---	---	----	---	---	-----	---	---	----	---	---	----	---

<b>TOTAL /1000</b>	4.784	0.274	0.422	0.000	0.019	0.000	0.798	0.000	0.071	0.000	0.075	0.000
--------------------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

<b>NET SCALE</b>	<b>4.510</b>	<b>0.422</b>	<b>0.019</b>	<b>0.798</b>	<b>0.071</b>	<b>0.075</b>
------------------	--------------	--------------	--------------	--------------	--------------	--------------

SCALER	PERMIT #	SCALED DATE
SCALER LAKE	404	JAN 23, 2003

**Figure 3.1 e – Smalian Log Scale Tally Sheet (Completed Back Page)**

### 3.1.4 Defect Calculation

Trees may have many different kinds of defects that render wood unsuitable for production, and some defects may be deducted from a tree or log's gross volume. The gross volume of a log minus any defect volume is the net volume. In order to be considered valid and therefore allowable, the scaling cylinder must be affected by the defect.

A defect's type code and deduction method code are recorded as well as the C1, C2, and C3 measurements. Some logs only require a C1 or C2 measurement, and when using Mscale, the program will indicate which measurements are required.

Some logs have more than one defect present, and in such cases the scaler will calculate the volume loss for all defects. The actual defect recorded will be the defect resulting in the greatest volume loss, and the recorded defect measurements will therefore be adjusted to account for all lost volume.

Some log conditions are not deductible as defect. Stain, for example, may be present, but the wood may still be solid and suitable for production. Stain is therefore not a deductible defect.



**Figure 3.2 – Example of Stain**

Similarly, logs that have been damaged by loading, hauling, or any other handling activity, the damage is deemed mechanical damage and is therefore not deductible as defect.



**Figure 3.3 – Example of Mechanical Damage**

Logs that have greater than or equal to 67% defect are cull logs. A cull log is treated as having no merchantable volume. Cull logs are eliminated from the scale by having the defect volume equal to the gross volume.

As a defect is encountered the type of defect must first be recorded. This is entered under the **T** or Type column under the Deductions fields. A numerical code is used to represent the defect type. They are as follows:

<b>Code (Type)</b>	<b>DEFECT TYPE</b>
<b>1</b>	<b>Heart Rot</b>
<b>2</b>	<b>End Rot</b>
<b>3</b>	<b>Sap Rot</b>
<b>4</b>	<b>Cat Face</b>
<b>5</b>	<b>Crook or Sweep</b>
<b>6</b>	<b>Shake or Crack</b>
<b>7</b>	<b>Crotch or Fork</b>

**Table 3.3 – Defect Type Codes**

There are eight methods used for calculating the defect volume. For each method a corresponding numerical code is entered under the **M** column of the deductions field. The codes used are:

<b>Method Code</b>	<b>DEFECT DEDUCTION METHOD</b>
<b>1</b>	Diameter Reduction
<b>2</b>	Length Reduction
<b>3</b>	Percentage Reduction
<b>4</b>	Fractions Reduction
<b>5</b>	Blocking Out
<b>6</b>	Internal Log Reduction
<b>7</b>	Cube Reduction
<b>8</b>	End Rot Reduction

**Table 3.4– Defect Method Codes**

The selection of the deduction method will determine which defect measurements are required in order to calculate the defect volume. The measurements are entered in one or more of the C1, C2, or C3 columns. Enter only whole numbers. A table of the required defect measurements for each of the cull methods is shown below:

<b>Defect Method</b>	<b>(#)</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>
Diameter Reduction	(1)	Sound Wood Butt Diameter (cm)	Sound Wood Top Diameter (cm)	N/A
Length Reduction	(2)	Cull Length (dm)	N/A	N/A
Percentage Reduction	(3)	Cull Percent (%)	N/A	N/A
Fractions Reduction	(4)	Numerator	Denominator	N/A
Blocking Out	(5)	Cull Height (cm)	Cull Width (Cm.)	Cull Length (dm)
Internal Log Reduction	(6)	Cull Top Diam. (cm)	Cull Butt Diam. (Cm.)	N/A
Cube Reduction	(7)	Cull Volume (Cu.M. x 1000)	N/A	N/A
End Rot Reduction	(8)	Large End Diameter (cm)	Cull Diam. @ Large End (cm)	Cull Length (dm)

**Table 3.5 – Defect Fields to be entered for Each Defect Method**

The following table shows the common deduction method used for a given defect type as well as all allowable defect deduction methods for each defect type:

<b>Defect Type</b>	<b>Common Deduction Method</b>	<b>Allowable Deduction Methods</b>
3 – Sap Rot	1 – Diameter Reduction	1, 2, 3, 4, 5, 7
7 – Fork	2 – Length Reduction	2, 3, 4, 5, 7
5 – Sweep and Crook	3 – Percent Reduction	2, 3, 4, 7
4 – Catface 6 – Spiral Check	4 – Fraction Reduction	2, 3, 4, 5, 7
6 – Shake 2 – Irregular End Rot	5 – Blocking Out	2, 3, 4, 5, 7
1 – Heart Rot	6 – Internal Log Reduction	2, 3, 4, 5, 6, 7
4 – Catface	7 – Cube Deduction	2, 3, 4, 5, 7
2 – End Rot	8 – End Rot Options	3, 4, 5, 7, 8

**Table 3.6 – Deduction Methods Allowed for each Defect Type**

The next table shows what types of defects may be scaled depending on the product for which the timber is to be used:

<b>Species</b>	<b>Product</b>	<b>Allowable Defect</b>
<b>Coniferous</b>	Roundwood Products, Lumber, and Pulp	All
	Veneer	All
	Laminated Veneer Lumber	All
	Oriented Strand Board	Soft rot and missing wood only
	Fuelwood	Soft rot and missing wood only
<b>Deciduous</b>	Sawlogs	All
	Veneer	All
	Laminated Veneer Lumber	All
	Oriented Strand Board	Soft rot and missing wood only
	Pulp	Soft rot and missing wood only

**Table 3.7 – Allowable Defect Types based on Species and Product**



### Defect Calculation Examples

The following examples provide details on the calculation and completion of log scale tallies for some of the more common allowable defects.

**Note:** All gross and defect volumes shown in the following examples are expressed in deci cubic metre (dm<sup>3</sup>) which is equal to 1/1000<sup>th</sup> of a cubic metre. For simplicity, the examples shown are scaled with no trim.

#### 3.1.4.1 Diameter Reduction

Diameter reduction is used for defect that affects to the outer portion of the log such as sap rot. For example:

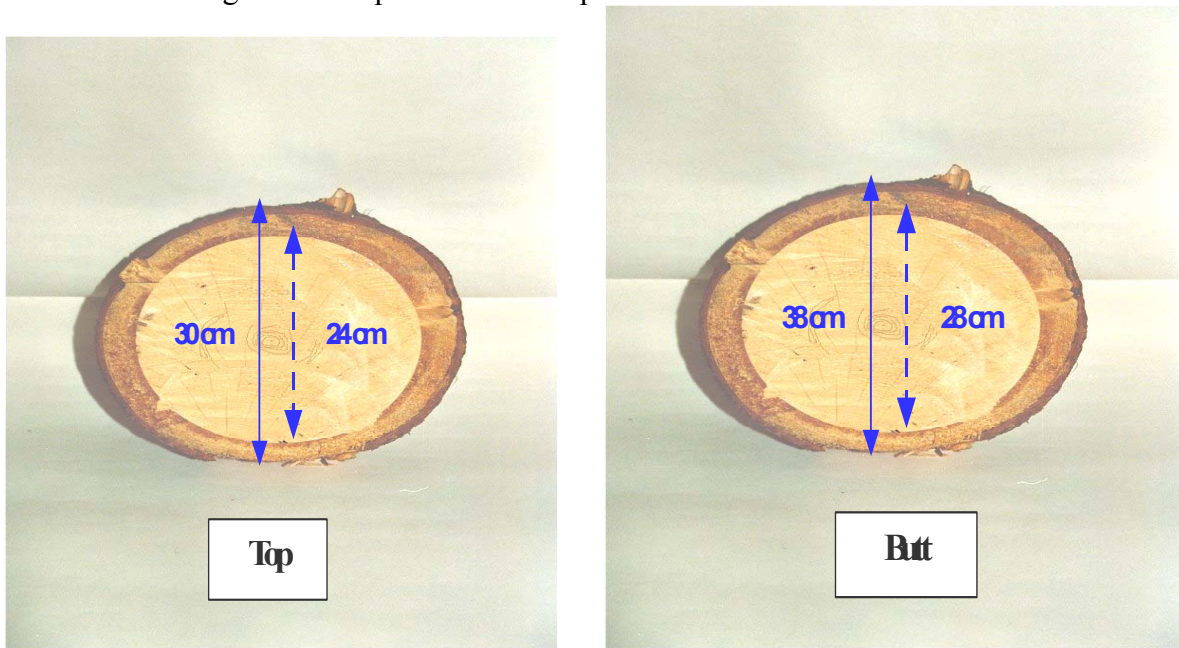


Figure 3.4 a - Diameter Reduction Method - Measurements for Sap Rot

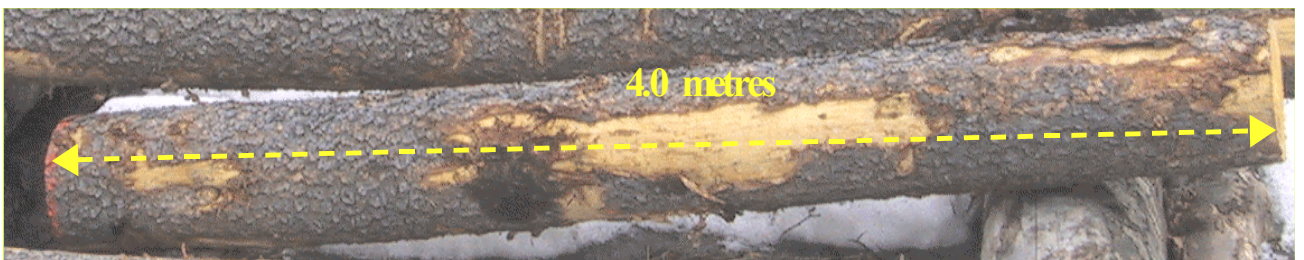


Figure 3.4 b – Length Measurement for Sap Rot

The log's gross volume is first determined. The defect type and deduction method is then recorded as type 3 and method 1, and the required defect measurements are obtained. For sap rot, the butt and top diameters of the sound wood are required, and these diameters are recorded in C1 and C2 respectively. The volume of sound wood is then determined, and the sound wood volume is then subtracted from the log's gross volume; the result is the defect volume. Because sound wood is being measured, 2cm is NOT added as when measuring soft rot.

1. Gross volume = 38cm butt, 30cm top, 4.0m length = 368dm<sup>3</sup>
2. Defect type = 3, deduction method = 1
3. C1 = butt diameter of sound wood = 28cm  
C2 = top diameter of sound wood = 24cm
4. Volume of sound wood = 28cm butt, 24cm top, 4.0m length = 213dm<sup>3</sup>
5. Defect volume = 368dm<sup>3</sup> – 213dm<sup>3</sup> = 155dm<sup>3</sup>

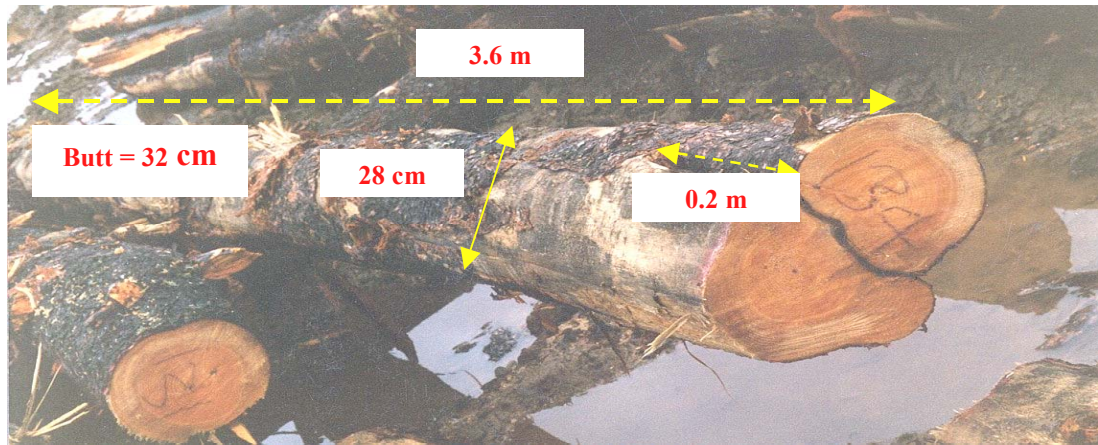
LOG NO	GROSS										DEDUCTIONS									
	SP		CD		PR		BUTT		TOP		LGT		VOL		T	M	SIZE			VOL
	S	P	G	R	0	1	3	8	3	0	4	0	227	141	3	1	C1	C2	C3	
1	S	P	G	R	0	1	3	8	3	0	4	0	227	141	3	1	28	24		155

Note: The Micro Log Scale program will assume the defect is full length and will use the log length recorded in the LGT field.

### 3.1.4.2 Length Reduction

Length reduction is a method used when there is a large defect at the end of the log and a whole section could be deducted, such as a fork. Length reduction is also a method employed for severe end rot, and these procedures will be covered under End Rot Options.

When measuring the top diameter of a log that is affected by fork, it is often not possible to obtain an accurate top diameter measurement. In such cases the scaler will measure the diameter at the point immediately below the point that the log begins to swell (as in the example below). The scaler will also mark the point at which the diameter was measured.



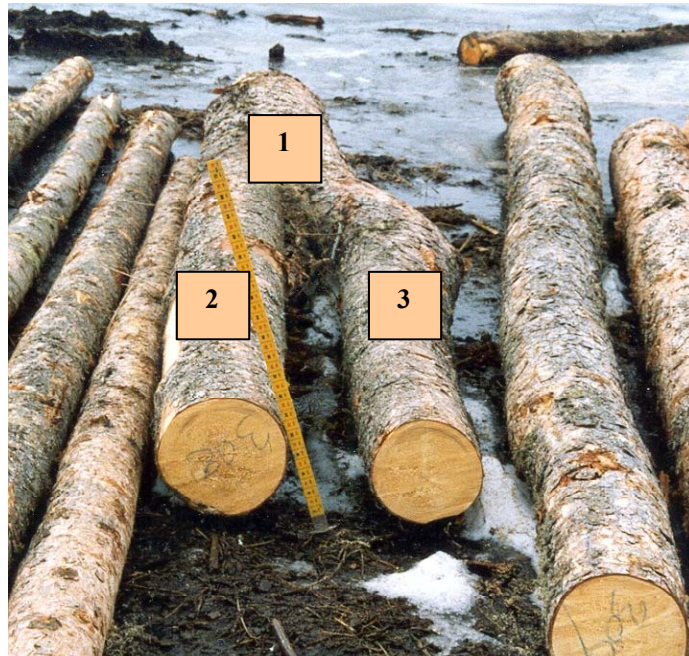
**Figure 3.5 – Length Reduction Method – Measurements for Fork**

After determining the gross volume of the log, the defect type and deduction method are recorded as type 7 and method 2. The length to be deducted is then measured and recorded in C1. The log volume is then recalculated using the adjusted length, and this volume is then subtracted from the original gross volume; the result is the defect volume.

1. Gross volume = 32cm butt, 28cm top, 3.6m length = 256dm<sup>3</sup>
2. Defect type = 7, deduction method = 2
3. C1 = length to be deducted = 0.2m
4. Revised volume = 32cm butt, 28cm top, 3.4m length = 242dm<sup>3</sup>
5. Defect volume = 256dm<sup>3</sup> – 242dm<sup>3</sup> = 14dm<sup>3</sup>

LOG NO								DEDUCTIONS										
	SP		CD		PR		BUTT	TOP	LGT	VOL	T	M	SIZE			VOL		
	S	P	G	R	0	1	3	2	2	8	3	6			C1	C2	C3	
2	S	P	G	R	0	1	3	2	2	8	3	6			02			14

Forks that have been bucked improperly sometimes result in two scaleable pieces still attached to the primary log. In such cases, a length reduction may be applied to the primary log to account for the lost volume in the transition zone between the primary log and the two logs above; however, both of the logs above the fork must be numbered and scaled as well.



**Figure 3.6 – Poorly Bucked Piece**

In the example above, the bucking results in three scaleable pieces. Piece 1, the primary log, may have a length deduction to account for the lost volume in between the point where the top diameter is measured and the two scaleable “forks” depart from the main stem. Pieces two and three must be numbered and scaled.

Often the fork has been bucked off so close to departure from the main stem that very little or no defect is present. In such cases a scaler will make no deduction, or use another deduction method that will, in this case, provide a more accurate representation of the lost volume. Cube deduction is a more appropriate method in such cases.

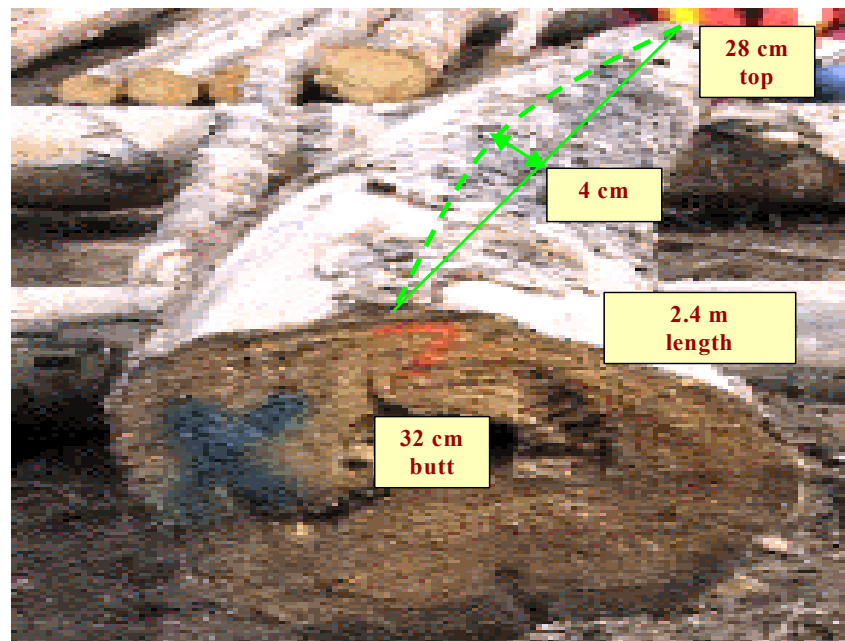
### **3.1.4.3 Percent Reduction**

This method may be used when log measurements can be calculated as a percent loss from the gross. Sweep and crook are both calculated using this method, and there are two main considerations to take into account when evaluating an affected log:

1. No deduction is allowed if the sweep/crook is the result of poor bucking. If bucking the log into different product lengths could have eliminated the defect then the scaler shall not make a deduction.
2. Sweep and Crook is evaluated in 2.4m lengths (an eight foot piece). For sweep, if a log is longer than 2.4m, then the sweep shall be measured over 2.4m, but the percent loss will be adjusted to take into account the total log length. For example, if a log is 4.8m and sweep affects 10% of a 2.4m section, then 5% will be applied to the entire log. The formula for crook already takes into account the length affected.

Sweep and crook are the most overestimated defects in the province. A scaler should watch affected logs being processed in the mill in order to gauge the recovery. Most sweeps and crooks are virtually eliminated once the log is slabbed, so scalers must carefully evaluate these defects.

**SWEEP** – the following example outlines the procedures for calculating volume loss due to sweep:



**Figure 3.7 – Percent Reduction Method – Measurements for Sweep**

The following formula is used to determine the percent loss for sweep:

$$\% \text{ loss} = \left( \frac{\text{max deflection} - 2}{\text{top diameter}} \right) \times 100$$

$$\% \text{ loss} = \left( \frac{4 - 2}{28} \right) \times 100 = 7\%$$

Measure the defect over the allowable 2.4m section. The deflection is measured as the maximum perpendicular distance (cm) from a point on the straight line connecting geometric log centres to the line which follows the natural log curvature (as in the above diagram).

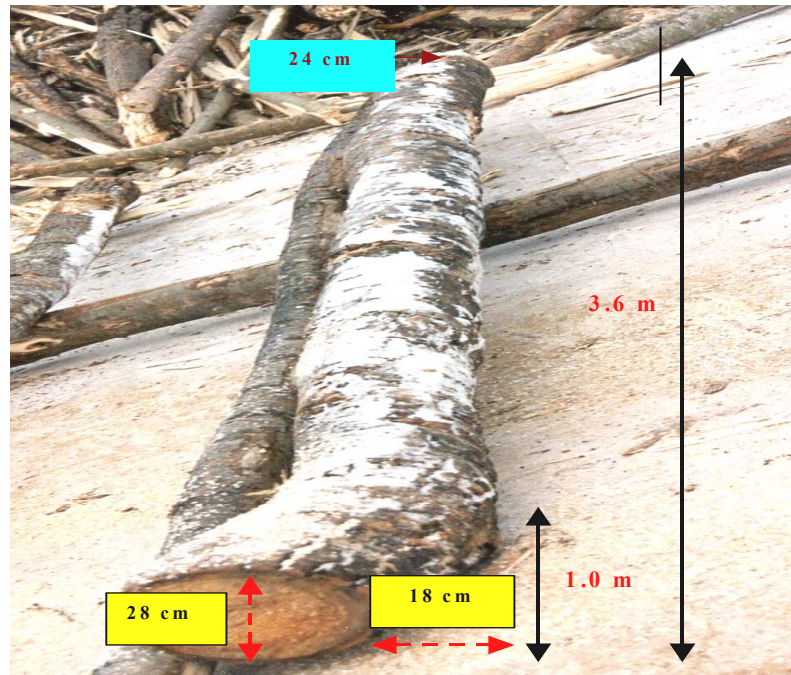
1. Gross Volume = 32cm butt, 28cm top, 2.4m length = 171dm<sup>3</sup>
2. Defect type = 5, deduction method = 3
3. C1 = the calculated percent loss = 7%
4. Defect volume = 171dm<sup>3</sup> x 0.07 = 12dm<sup>3</sup>

LOG NO								DEDUCTIONS												
	SP		CD		PR		BUTT		TOP		LGT		VOL		T	M	SIZE			VOL
																	C1	C2	C3	
3	S	P	G	R	0	1	3	2	2	8	2	4	97 74	5	3	7				12

**CROOK** – To calculate the defect volume for an abrupt curvature in the log (crook) the following formula is used:

$$\% \text{ loss} = \left( \frac{\text{deflection}}{\text{diameter at end affected}} \right) \times \left( \frac{\text{length affected}}{\text{total length}} \right) \times 100$$

The following example outlines the procedures for calculating volume loss due to crook:



**Figure 3.8 – Percent Reduction Method – Measurements for Crook**

Once the gross volume is determined, the percent loss is taken into account using the formula:

$$\%loss = \left(\frac{18}{28}\right) \times \left(\frac{1.0}{3.6}\right) \times 100 = 18\%$$

It is important to note that when the crook affects the butt end of the log, it is the diameter of the butt end that is factored into the formula.

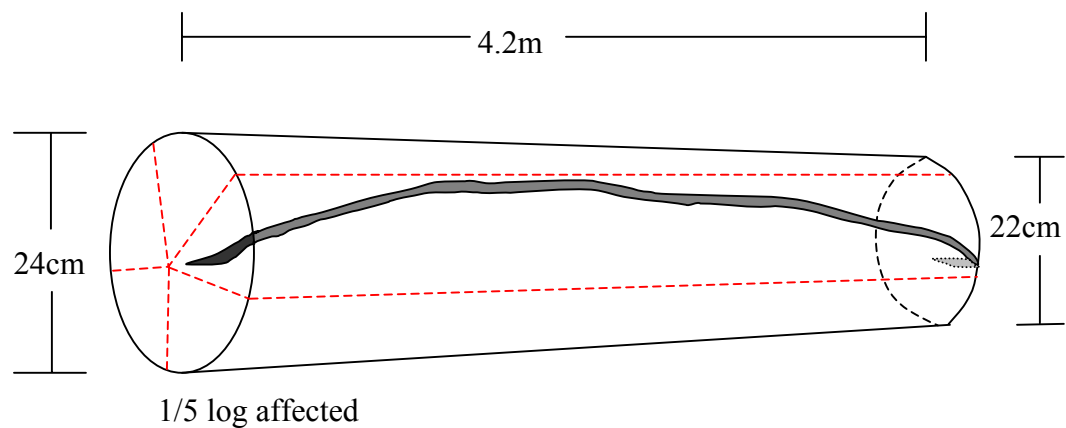
1. Gross Volume = 28cm butt, 24cm top, 3.6m length = 192dm<sup>3</sup>
2. Defect type = 5, deduction method = 3
3. C1 = the calculated percent loss = 18%
4. Defect volume = 192dm<sup>3</sup> x 0.18 = 35dm<sup>3</sup>

LOG NO	GROSS							DEDUCTIONS					
	SP	CD	PR	BUTT	TOP	LGT	VOL	T	M	SIZE			VOL
										C1	C2	C3	
4	A	G R	0 1	2 8	2 4	3 6	$\frac{111}{81}$	5	3	18			35

### 3.1.4.4 Fraction Reduction

This method may be used as an alternative to percent and vice versa. Catface and spiral check are two examples where this deduction method is most appropriate.

**SPIRAL CHECK** – the following example outlines the procedures for calculating volume loss due to spiral check:



**Figure 3.9– Fractional Reduction Method – Measurements for Spiral Check**

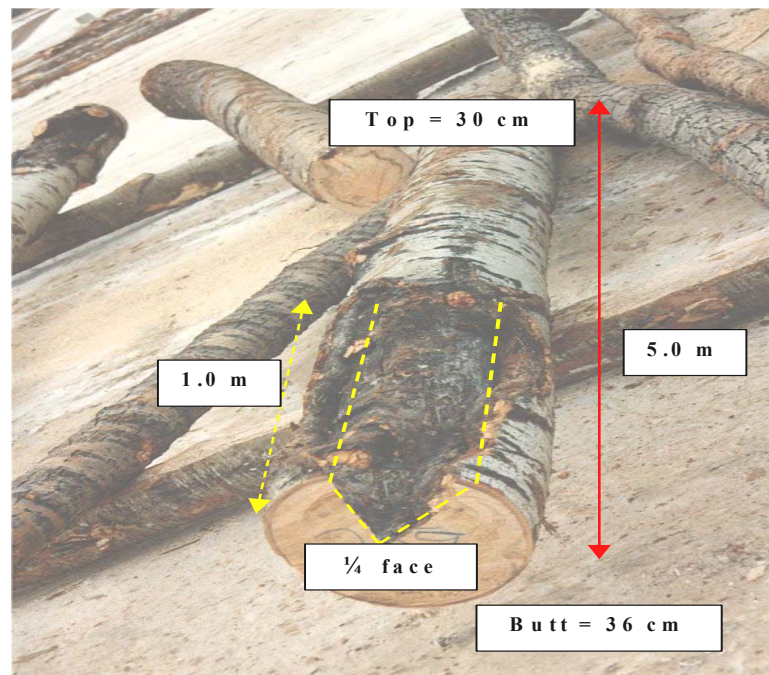
1. Gross volume = 24cm butt, 22cm top, 4.2m length = 175dm<sup>3</sup>
2. Defect type = 6, deduction method = 4
3. Examine the log end and determine what fraction will longitudinally enclose the defect. In this example, 1/5<sup>th</sup> of the log is affected for the full length.
4. C1 = fraction numerator  
C2 = fraction denominator
5. Defect volume = gross volume x fraction affected  
= 175dm<sup>3</sup> x 1/5 = 35dm<sup>3</sup>

LOG NO	GROSS							DEDUCTIONS											
	SP	CD	PR	BUTT	TOP	LGT	VOL	T	M	SIZE			VOL						
										C1	C2	C3							
5	S	P	G	R	0	1	2	4	2	2	4	2	95 80	6	4	1	5		35



If the defect extends the full length of the log then this fraction remains unchanged. If, however, the check does not extend the full length, then the fraction of the length affected must be multiplied by the longitudinal fraction; for example, if 1/5 of the longitudinal section is affected, and 2/3 of the length, then the resultant fraction will be 2/15.

**CATFACE** – Catface is defect that occurs on the surface of a tree or log resulting from a wound where healing has not re-established the natural cross section. Care must be taken when examining catface; only when the scaling cylinder is affected can it be deducted as defect. The following example outlines the procedures for calculating volume loss due to catface:



**Figure 3.10 – Fractional Reduction Method – Measurements for Catface**

1. Gross volume = 36cm butt, 30cm top, 5.0m length = 431dm<sup>3</sup>
2. Defect type = 4, deduction method = 4
3. Examine the affected log end and determine what fraction of the face is affected. Next, the length affected is determined as a fraction of the total length. If the catface tapers, then a taper factor of 1/2 must be included in the formula below:

4. Defect fraction = log face affected x length affected  
=  $1/4 \times 1/5 = 1/20$
5. C1 = fraction numerator  
C2 = fraction denominator
6. Defect volume = gross volume x defect fraction =  $431\text{dm}^3 \times 1/20$   
=  $22\text{dm}^3$

LOG NO	GROSS							DEDUCTIONS										
	SP	CD	PR	BUTT	TOP	LGT	VOL	T	M	SIZE			VOL					
										C1	C2	C3						
6	A	G	R	0	1	3	6	3	0	5	0	$\frac{254}{177}$	4	4	1	20		22

The taper factor of  $\frac{1}{2}$  is required only when the catface tapers out as in the example above. When the catface does not taper out, then the  $\frac{1}{2}$  is not necessary.

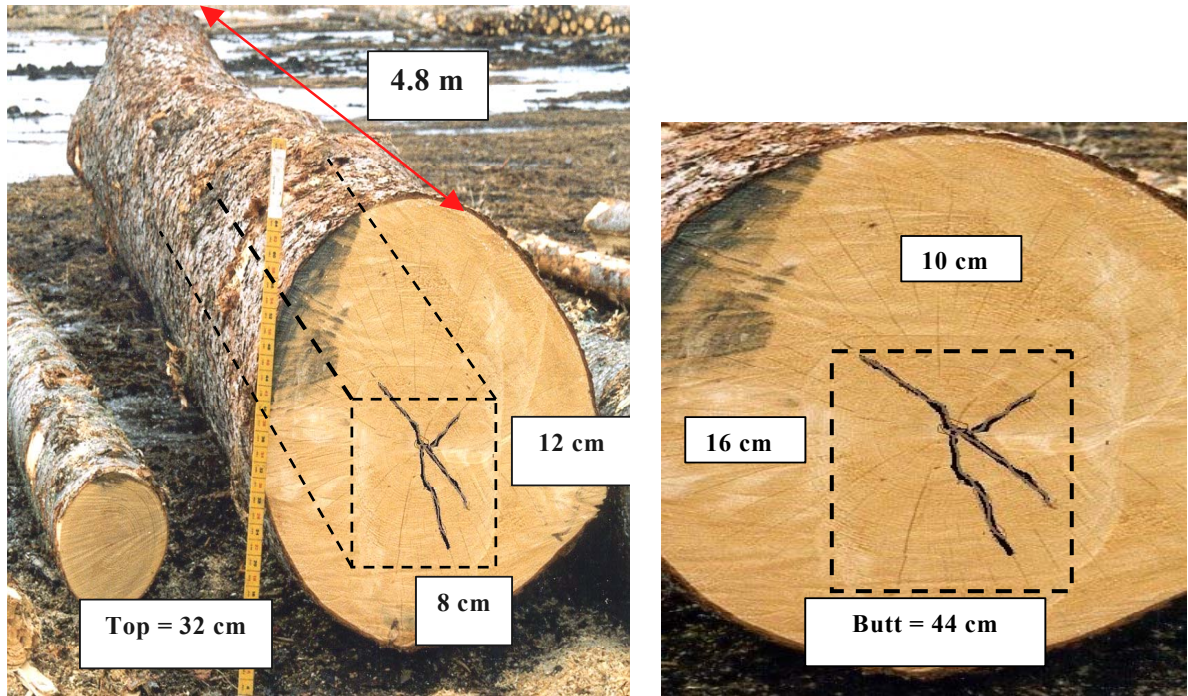
### 3.1.4.5 Block Deduction

This method is used for defects such as shake where the defect can be deducted by blocking out the affected area.

Shake is a separation along the grain of a log or tree, occurring between or across the annual rings but not extending from one surface to another. There are two types of shake, but both are deducted by blocking out:

1. Heart Shake – a shake that originates at the pith of a log and extends across the annual rings.
2. Ring Shake – a shake that partially or completely encircles the pith.

The following example outlines the procedures for calculating volume loss due to shake:



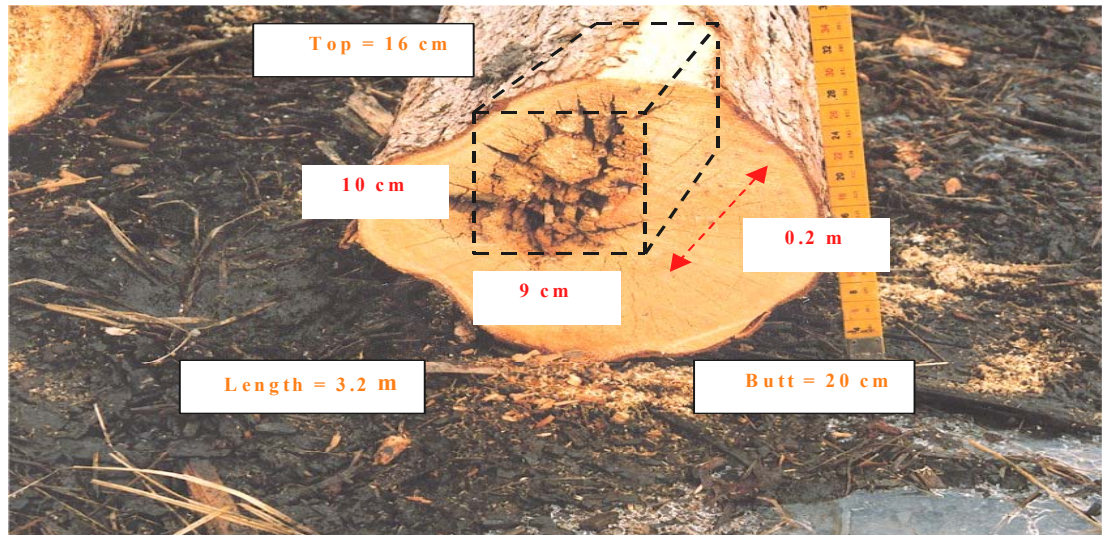
**Figure 3.11 – Block Deduction Method – Measurements for Shake**

1. Gross Volume = 44cm butt, 32cm top, 4.8m length = 558dm<sup>3</sup>
2. Defect type = 6, deduction method = 5
3. Measure the width and height of the defect at both ends. The width at both ends is averaged to a whole number, as are the lengths. In the example above, the widths average to 9cm and the heights to 14cm.
4. C1 = average width (cm)  
C2 = average height (cm)
5. Defect volume= avg. width (m) x avg. height (m) x length (m) x 1000  
= 0.09m x 0.14m x 4.8m x 1000 = 60dm<sup>3</sup>

LOG NO	GROSS							DEDUCTIONS								
	SP	CD	PR	BUTT	TOP	LGT	VOL	T	M	SIZE			VOL			
										C1	C2	C3				
6	S	P	G	R	0	1	4 4	3 2	4 8	$\frac{365}{193}$	6	5	09	14	48	60

**IRREGULAR END ROT** – this type of rot affects the end of a log and it typically off center (not originating from the pith) and irregular in shape. It can be accounted for using method 5. When blocking out an irregular end rot, Smalian allows the defect to be coded as defect type 2, deduction method 5.

When blocking out an irregular end rot, unlike blocking out a shake, 2cm are added to the defect’s actual width and height measurements to account for unseen rot, as is done when measuring all soft rot.



**Figure 3.12 – Block Deduction Method – Measurements for End Rot**

1. Gross volume = 20cm butt, 16cm top, 3.2m length = 82 dm<sup>3</sup>
2. Defect type = 1, deduction method = 5
3. Measure the width and height of the rot; the interior dimensions of the rot are assumed to be the same as the visible measurements
4. C1 = rot height (12cm, with +2cm added)  
C2 = rot width (11cm, with +2cm added)  
C3 = rot length
5. Defect volume= rot height (m) x rot width (m) x rot length (m) x 1000  
= 0.12 x 0.11 x 0.2 x 1000 = 2.64 = 3 dm<sup>3</sup>

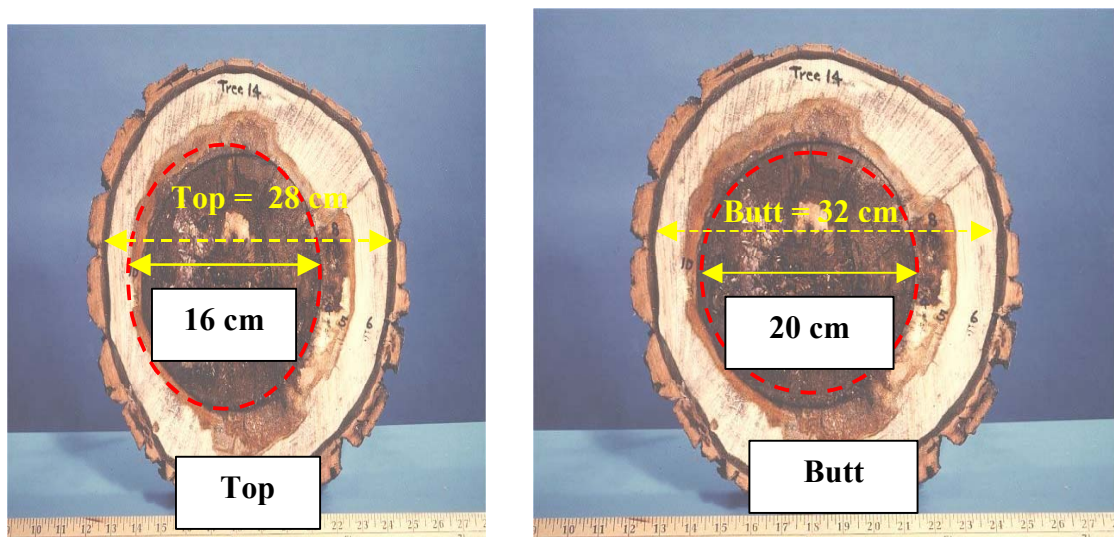
LOG NO	GROSS							DEDUCTIONS						
	SP	CD	PR	BUTT	TOP	LGT	VOL	T	M	SIZE			VOL	
											C1	C2	C3	
8	S	P	G R	0 1	2 0	1 6	3 2	50 32	2	5	12	11	02	3

### 3.1.4.6 Interior Cylinder Deduction

This method is used for circular end defects such as heart rot, and applies to defect which runs the full length of the log.

Heart rot may be described as any soft rot characteristically confined to the heartwood.

The following example uses heart rot to outline the procedures for deducting volume using the interior cylinder method:



**Figure 3.13 – Interior Cylinder Method – Measurements for Heart Rot**

1. Gross volume = 32 cm butt, 28cm top, 4.2m length = 298dm<sup>3</sup>
2. Defect type = 1, deduction method = 6
3. Measure the top diameter of the rot (in diameter class) and **add 2cm to account for unseen rot**, as is done when measuring all soft rot. Then measure the butt diameter of the rot (in diameter class) and add 2cm to account for unseen rot.
4. C1 = top diameter of rot (2cm added)  
C2 = butt diameter of rot (2cm added)  
C3 = length affected
5. The defect volume is the average of the basal areas (BA) of the rot at each end, multiplied by the length affected:

$$defect\ volume = \left( \frac{rot\ BA(top) + rot\ BA(butt)}{2} \right) \times log\ length$$

$$\begin{aligned} rot\ BA\ (top) &= 16cm\ diameter + 2cm = BA\ 25m^2\ (1000x) \\ rot\ BA\ (butt) &= 20cm\ diameter + 2cm = BA\ 38m^2\ (1000x) \end{aligned}$$

$$defect\ volume = \left( \frac{25 + 38}{2} \right) \times 4.2 = 132dm^3$$

LOG NO	GROSS							DEDUCTIONS										
	SP	CD	PR	BUTT	TOP	LGT	VOL	T	M	SIZE			VOL					
										C1	C2	C3						
9	A	G	R	0	1	3	2	2	8	4	2	$\frac{169}{129}$	1	6	18	22	42	132

Note: The Micro Log Scale program will automatically fill in the C3 field with the log length recorded in the LGT field.

When the rot is only visible at one end of the log the scaler must use an alternative method of deduction such as end rot options or blocking out

### 3.1.4.7 Cube Deduction

This method is used for very small defects that can be visually blocked out using cubes. One cube is equal to 1/1000 of a cubic metre (10cm x 10cm x 10cm). No more than ten cubes may be deducted when using this method.

Catface is the most common defect type that this method is used for; some catfaces occur as very small defects, and deducting cubes is the most efficient way to account for this small volume loss. Scalers must keep in mind that the scaling cylinder must be affected before catface can be deducted.

As mentioned in section 3.1.4.2, forks that are bucked off very close to the point of departure from the primary stem should be deducted using a method that more appropriately accounts for volume loss. In such cases cube deduction is appropriate.

The following is an example of cube deduction for catface and fork:



**Figure 3.14 – Cube Deduction Method – Measurements for Catface**

Four cubes enclose the defect.

Once the gross volume is determined, the number of cubes that will block out the defect is estimated, and this number is entered in C1. Since all volumes are compiled 1000x, the number of deducted cubes is equal to the defect volume.

1. Gross volume = 26cm butt, 20cm top, 3.6m length = 153dm<sup>3</sup>
2. Defect type = 4, deduction method = 7
3. C1 = estimated number of cubes
4. Defect volume = estimated number of cubes

LOG NO								DEDUCTIONS										
	SP		CD		PR		BUTT	TOP	LGT		VOL	T	M	SIZE			VOL	
														C1	C2	C3		
9	S	P	G	R	0	1	2	6	2	0	3	6	$\frac{96}{57}$	4	7	4		4

### **3.1.4.8 End Rot Options**

This method is used to deduct for soft rot occurring at one end of a log. End rot may be described as any decay or rot developing in, and characteristically confined to, the base or lower stem of a tree.

It is very important for a scaler to closely examine this type of defect to ensure that there is rot present.

Some logs have stain, yet the wood is solid and in such cases there is no deduction made. To check for the soundness of the wood the scaler can compare the suspect log to another log that is obviously sound. By using the tines on the scale stick to tap into the wood, one can determine relatively well how sound the wood is; if the wood is firm and the tines stick, then the wood is probably sound. If the wood feels soft, makes a hollow sound, the tines do not stick, and wood readily flakes off, then there is probably rot present.

Sometimes one can see evidence of white spots on the log face, and although this can very indicate rot or incipient rot, there is no deduction if the wood is still solid.

Sometimes a log end will exhibit a rough, splintery texture, especially when a feller buncher felled the tree. A scaler can easily mistake this condition for rot, but if the wood is sound then no deduction may be made.

When estimating rot length there are some considerations to take into account. Sometimes a scaler can insert the scale stick into the rot and get a good idea of the length affected. When this is not possible the scaler must use experience and judgment to estimate the length.

The scaler should watch affected logs go through the mill to get a good idea of how much length is typically affected. Alternatively, a scaler could take a few affected logs and buck up the log to see the rot profile; this may be done only if the total log is scaled and the proper defect deduction made.

Typically end rot is often characterized as butt rot however this method of defect deduction may also apply to heart rots which appear at only one end of the log. The length of defect estimate will vary with the type of end rot. Butt rots are often sharp tapering cones whereas heart rots are more gradually spread through the stem often tapering out to stain.

There are two methods that may be used to account for end rot; one for regular end rot, method 8, and one for irregular end rot, method 5.



**REGULAR END ROT** – this defect occurs when there is circular soft rot affecting an end of the log. There are two ways to deduct for this defect depending on its size. One method for when the basal area of the rot is less than the basal area of the log end, and another when the basal area of the rot is greater than or equal to the basal area of the log end.

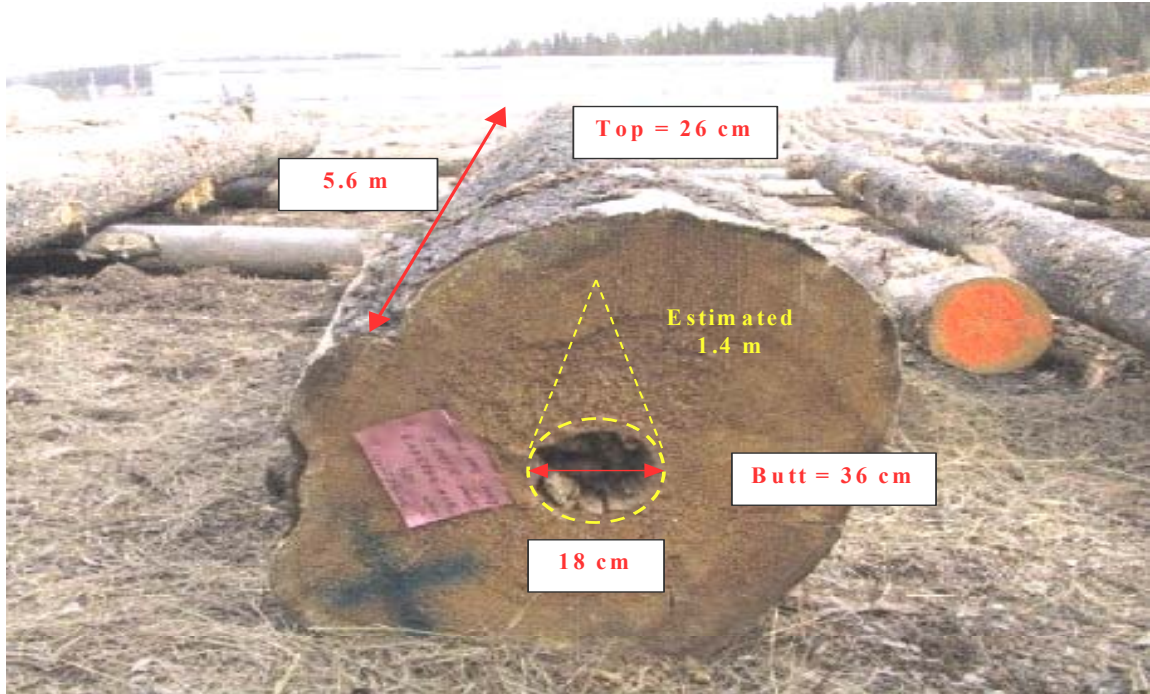
**END ROT <50% BASAL AREA** – the following example outlines the procedures for making a deduction using this method:

Once the gross volume is determined, the defect type and deduction method is recorded as type 2 and method 8. The scaler will then do a basal area comparison to determine whether or not the defect is greater than/equal to or less than 50% of the basal area of the log end.

The defect in the example above is <50% BA, so the following procedures are used. The scaler will record the butt diameter in C1. The diameter of the rot will be recorded in C2, but only after 2cm are added to account for unseen rot.

**The basal area comparison is done prior to adding the 2cm.** When using MScale, the rot diameter + 2cm is entered in C2. The program will automatically subtract the 2cm and do the basal area comparison.

The length affected is then recorded in C3. To calculate the defect volume, the basal area of the rot (+2cm, as recorded on the TM32S) is averaged with zero and multiplied by the length affected. The BA of the rot is averaged with zero to account for the fact that the rot will taper out.



**Figure 3.15 – End Rot Options Method – Measurements for End Rot (<50%)**

1. Gross volume = 36cm butt, 26cm top, 5.6m length = 434dm<sup>3</sup>
2. Defect type = 2, deduction method = 8
3. Basal area comparison:      36cm butt diameter = 102m<sup>2</sup> (1000x)  
   18cm rot diameter = 25m<sup>2</sup> (1000x)  
   Rot BA is therefore <50% of butt BA

4. C1 = butt diameter  
C2 = rot diameter (+2cm added)  
C3 = rot length

5. Defect volume =  $\left(\frac{\text{rot BA}}{2}\right) \times \text{rot length}$   
  

$$= \left(\frac{31}{2}\right) \times 1.4 = 22\text{dm}^3$$

LOG NO	GROSS							DEDUCTIONS						
	SP	CD	PR	BUTT	TOP	LGT	VOL	T	M	SIZE			VOL	
										C1	C2	C3		
8	S	P	G	R	0	1	36	26	56	285	36	20	14	22
							149							

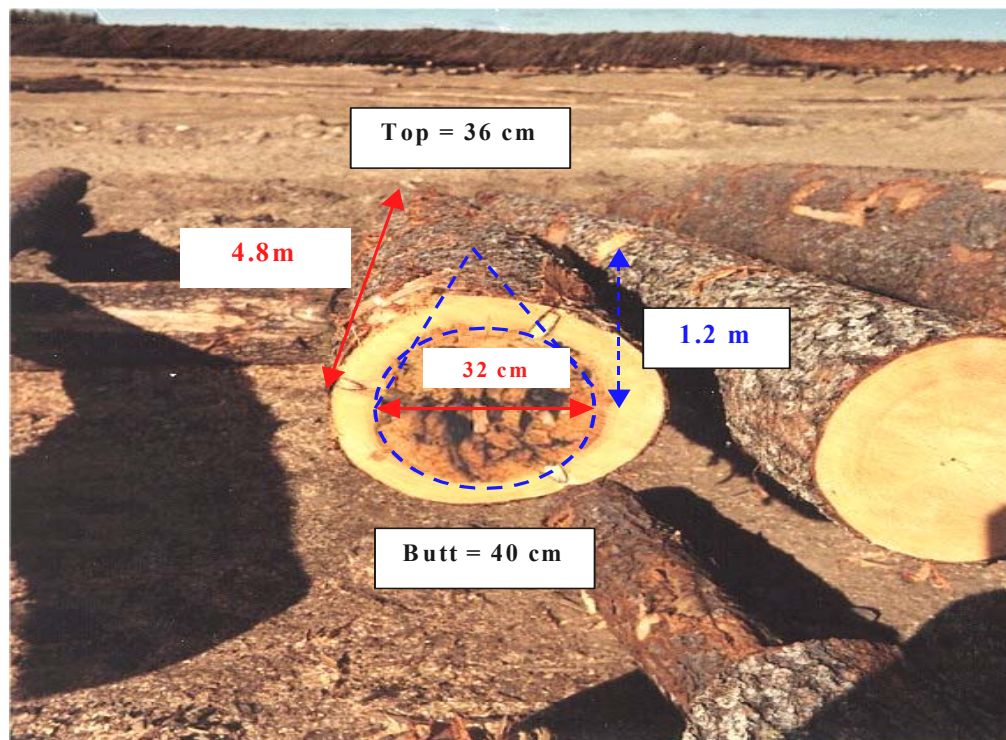
END ROT  $\geq 50\%$  BASAL AREA - the following example outlines the procedures for making a deduction using this method:

Once the gross volume is determined, the defect type and deduction method is recorded as type 2 and method 8. The scaler will then do a basal area comparison to determine whether or not the defect is greater than/equal to or less than 50% of the basal area of the log end.

The defect in the example above is  $\geq 50\%$  BA, so the following procedures are used. The scaler will record the butt diameter in C1. The diameter of the rot will be recorded in C2, but only after 2cm are added to account for unseen rot.

**The basal area comparison is done prior to adding the 2cm.** When using MSscale, the rot diameter + 2cm is entered in C2. The program will automatically subtract the 2cm and do the basal area comparison.

The length affected is then recorded in C3. To calculate the defect volume, the scaler will reduce the log length by half of the defect length and determine a volume. The difference between the original gross volume and the recalculated volume is the defect volume.



**Figure 3.16 – End Rot Options Method – Measurements for End Rot (>50%)**

1. Gross volume = 40cm butt, 36cm top, 4.8m length = 546dm<sup>3</sup>
2. Defect type = 2, deduction method = 8
3. Basal area comparison:
  - 40cm butt diameter = 126m<sup>2</sup> (1000x)
  - 32cm rot diameter = 80m<sup>2</sup> (1000x)
  - Rot BA is therefore >50% of butt BA
4. C1 = butt diameter  
C2 = rot diameter (+2cm added)  
C3 = rot length
5. Since the rot is >50% BA, the log length is recalculated after reducing the log length by half of the rot length. The recalculated gross volume is therefore: 40cm butt, 36cm top, 4.2m length = 478dm<sup>3</sup>
6. Defect volume = 546dm<sup>3</sup> – 478dm<sup>3</sup> = 68dm<sup>3</sup>

LOG NO	GROSS												DEDUCTIONS							
	SP		CD		PR		BUTT		TOP		LGT		VOL		T	M	SIZE			VOL
	S	P	G	R	0	1	4	0	3	6	4	8	302 244		2	8	C1	C2	C3	68
9	S	P	G	R	0	1	4	0	3	6	4	8	302 244		2	8	40	34	12	68