BASIC INFORMATION ABOUT CUBIC SCALING

The primary reason for scaling logs is to establish log value, which is then used as a basis for payment. The most important secondary reason for scaling logs is to predict the quantity of end-products that can be recovered from a log. The major end-product produced from logs is lumber. Lumber is manufactured in a variety of sizes, each size having different applications. Besides lumber, additional end-products are produced from logs, each also having different applications. Veneer, chips, and sawdust are all used in the manufacture of many engineered lumber products – plywood, oriented strand board (OSB), high-density particle board, etc.

The predominant log scale rule used today – Scribner decimal "C" – does a pretty good job in reflecting log value, but has inherent limitations. Scribner predicts volume in board feet, based on boards that are one-inch thick, within a cylinder equal to the small-end log diameter. Other procedures become necessary to determine product recovery not predicted by the design of the Scribner decimal "C" log rule.

Cubic scale does not predict a specific product volume. Instead of reflecting board feet, cubic scale reflects log volume in cubic measure. Since it doesn't reflect a specific end-product, a cubic scale rule design can reflect volume differences due to varying log sizes and taper.

The design of a cubic scale rule is based on a formula. The Smalian cubic log rule is one of the most common cubic measurement systems, probably because it is easy to use. As applied by the United States Forest Service in their Cubic Scaling Handbook, it reflects the volume of a log in cubic feet.

Procedures for determining the gross cubic scale of a log are somewhat similar as any scaling system – determine a log length and a log diameter for the scaling segment. In cubic scaling, that diameter measurement is needed for both ends of the scaling segment.

Log lengths are measured to the nearest tenth-of-a-foot (to include trim allowance), and recorded to the nearest foot length. The maximum scaling segment length considered is twenty feet. Log lengths exceeding 20 feet, plus trim, are scaled as multiple-segment logs.

Log diameters are measured to the nearest inch, following the same procedures as used in Scribner scaling. Diameter measurements are needed for both log ends of the scaling segment. The large-end diameter measurement for butt-cut logs is determined at four feet up from the butt, or by using standard taper tables.

The gross cubic scale of a log is calculated by using the Smalian formula:

$$V = 0.002727 (D^2 + d^2) L$$

where:
- V = volume in cubic feet
- D = large-end diameter (in inches)
- d = small-end diameter (in inches)
- L = scaling segment length (in feet)

Cubic scale volumes may be figured by working the formula, using look-up tables, or most commonly by using a handheld scaling recorder device. Cubic scale volumes are recorded to the nearest tenth of a cubic foot.

Net cubic scale is determined by reducing the gross scale for losses due to scaling defects. A scaling defect is any unsound wood or abnormal shape in a log that reduces the amount of volume available for the manufacture of lumber or veneer. There are five defect deduction methods:

1) Squared area
2) Length deduction
3) Percent deduction
4) Diameter deduction
5) Rings

Each defect deduction method has specific procedures in its application and more than one method may be used in scaling any particular log. Defect volumes are determined and recorded to the nearest tenth of a cubic foot.

Table 1 shows terminology and abbreviations used in cubic scaling that differ from what many people are familiar with after years of working with board foot scale.

Table 1

Board Foot Expressions		**Cubic Foot Expressions**	
Abbreviation	**Volume Unit(s)**	**Abbreviation**	**Volume Unit(s)**
BF	1 board foot 12O x 1O x 1N	CF	1 cubic foot 12O x 12O x 1N
		CCF	100 cubic feet (1 cunit)
MBF	1,000 board feet	MCF	1,000 cubic feet

A conversion ratio of board feet to cubic feet is often cited as 6 BF/CF (six board feet per cubic foot). However, this conversion ratio expresses an average for a mixed population involving both small and large sized logs. Conversion ratios between board foot and cubic foot vary with log size, taper, and length. Table 2 illustrates, as a general rule, that small-sized logs will have a lower BF/CF ratio than large-sized logs.

Table 2

Volumes Comparisons for 16-foot Logs			
Small & Large Log end-diameters	**Board feet**	**Cubic Feet**	**BF/CF Ratio**
6” – 8”	20	4.4	4.55
8” – 10”	30	7.2	4.17
12” – 14”	80	14.9	5.37
16” – 18”	160	25.3	6.32
24” – 26”	400	54.6	7.33

Smalian cubic scale offers many advantages, but its application in Idaho is very limited at the present time. Although some USFS scaling south of the Salmon River has been done using Smalian cubic scale, the Idaho Department of Lands, Industry, and Private Sector continue to use board foot scale. In the future, cubic log scaling method may become more common in Idaho. For the present, the primary method to establish log value remains with board foot log scaling, by means of the Coconino Scribner decimal "C" log rule.