Sample Scale Frequency Calculations

Sample Scale.  Forest products are normally 100% scaled; however, a sample scale may be employed if it meets established guidelines for accuracy.  Sample scaling conversion or frequency may not be provided in the contract or permit, but it should be specified in the logging plan if it isn’t in the contract or permit.    Sample scaling is most applicable in sales that include large volumes of small, low-valued forest products, or when the harvested forest products are generally uniform in species, grade and amount of defect. Sample scaling can be used for one species, while 100% scaling can be used for the remainder. If truckloads of logs are being scaled, then load volume is the sampling unit.  Load variability, individual species volume, value of forest products and acceptable sampling error all influence sample frequency, but total sale volume by species usually has the most influence.  Small sales, highly variable forest products, or sales with high value forest products will have to be sampled more heavily than large sales or 100% scaled.

1. Acceptable Sampling Error (E).  Acceptable sampling error is the difference between a sample estimate of total sale volume and the volume that would result from 100 percent scaling, divided by the estimated total volume.  Sampling error must not exceed + or – 2% at a 95% confidence interval.
2. Coefficient of variation (CV). A measure of sample variability and is the ratio of the standard deviation to the mean, expressed as a percent.

1. Number of Samples Required for the Sale (N). The number of samples required for a given sale is calculated by the following formula:

**Formula No. 1**



**Where:**

t = 2 (2 standard deviations – represents a 95% confidence level). Student’s t-test for degrees of freedom in a very large sample.

N = total number of loads of the species.  This may be approximated by dividing the estimated total sale volume of the species by the average net volume per load of the species.

E = 2 (acceptable sampling error); normally 2 percent.

CV = coefficient of variation. Derived from the following formula:

**Formula No. 2**



**Where:**

= mean load volume or value

SD = standard deviation.  Standard deviation can be calculated using the following formula:

**Formula No. 3**



 **Where:**

n = the number of loads in the sample.

x = the volume or value of each sample.

In practice, sample frequencies are calculated based on the first 30 or more sample loads and should be re-computed at least quarterly. The initial sample frequency is determined by the OIC.  The OIC should consider past sale records, expected log truck capacities, and sale volume.  It is better to over-sample rather than under sample during this phase of scaling.

When the first 30 sample loads have been scaled use Formula No. 1 to find the number of samples required for the entire sale.  The sample frequency is simply N/n and can be stated as 1 load in (N ÷ n).  If the sale was over or under sampled during the initial sampling, then an adjustment based on the number of samples over or under can be made. However, do not bias the sample. The total number of samples during the life of the sale is the important parameter.

Sample scale loads are determined by use of pull tab cards, random number generators or other non-biased methods authorized by the Approving Officer.