C Y   C A R L B E R G

REGISTERED CONSULTING ARBORIST

MEMORANDUM

TO: Darrell Cozen, Planner

FROM: Cy Carlberg, Registered Consulting Arborist

DATE: February 8, 2005

SUBJECT: **Measuring multi-trunked trees**

Dear Darrell,

Thank you for the opportunity to explain how to calculate total trunk diameter when a tree has multiple trunks. Perhaps the clearest means is an illustration (see pages 2 and 3).

It is profound how distorted a figure can become when diameters are added rather than the correct approach, which is to convert individual trunk diameters (or circumferences) into square inches, add those figures, and convert that sum *back* into diameter inches. We are, after all, establishing square inches of wood tissue in a cross-sectional area when we describe a tree's diameter for appraisal or as a representation of tree size.

Another conversation is measuring the diameter of elliptical trunks. True diameter is only read when the trunk is a perfect circle, which it rarely is. The true number of square inches in elliptical cross section will differ from the number of square inches in a perfect circle, depending on how "out-of-round" the tree is. Diameter readings, and therefore calculations of cross-sectional areas, will be skewed artificially high because trees can be less than perfectly round, but not more. Unless a high-end appraisal is being performed on one or more elliptical trees, using a diameter tape is usually sufficient.[1]

I hope this helps. Please feel welcome to call if you'd like to discuss this further.

Very truly yours,

Cy Carlberg

Cy Carlberg
Registered Consulting Arborist

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[1] Dennis Yniguez, "*D-Tape Versus Tree Calipers*," 2003.

Guide for Plant Appraisal

Figure 4.5. In a multi-stem tree, measure the circumference of each trunk stem at 4.5 ft (1.4 m) above the ground. The cross-sectional square-inch area of each trunk stem is determined and then added together to obtain a total trunk area that is representative of the size of the tree, assuming each stem contributes its proportionate share to the canopy.

Scanned from *The Guide for Plant Appraisal, 9th Edition*, page 48. (Council of Tree and Landscape Appraisers, Savoy, Illinois: International Society of Arboriculture, 2000.) *Diameter* of trunk stem is typically used rather than *circumference*.

[2]

76.1 Inches

13.2 12.5 6.5 9.5 12.0 10.1 12.3

All numbers in the illustration represent diameter inches.

13.2 + 12.5 + 6.5 + 9.5 + 12.0 + 10.1 + 12.3 = 76.1 inches

A

"A" – If trunk diameters are added, the total is 76.1 inches. The large circle shown in the illustration above is the circle that is created if the diameters are added. It is obvious that the area within does not represent square inches of wood that make up the smaller trunk diameters.

"B" – Shows trunk diameters represented as square inches. To calculate total trunk diameter, individual diameters are converted to square inches of wood tissue. These figures are added together and the sum converted back into diameter inches. A sum of **675.4** square inches is **29.3** diameter inches – a far cry from **76.1** diameter inches.

76.1 Inches in Diameter

4548.4 Square Inches in Circular Cross-section

Circle area equals 76.1" x 76.1" x 0.785 = 4548.4 Square Inches

122.7

136.8

33.2

113.0

118.8

70.8

80.1

Numbers in the above circles total 675.4 square inches in cross section

B

[2] Illustrations courtesy of Dennis Yniguez