THE STRENGTH OF NORTHERN WHITE-CEDAR POSTS

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It has been observed that the durability of northern white-cedar (Thuja occidentalis) posts is closely correlated with diameter. Small (2- to 3-inch), medium (3- to 5-inch), and large (5- to 7-inch) posts are generally considered to have service lives in the following ranges: 3-8, 6-12, and 10-15 years, respectively. This variation in durability is directly traceable to the amount of durable heartwood present at the groundline. Cedar sapwood decays rapidly and loses all of its strength within 2-3 years after a post is set. It is evident, therefore, that sapwood thickness and groundline heartwood diameter determine the strength and durability of cedar posts.

The purpose of this study was to determine the sapwood thickness of representative cedar posts and from this information to compute the strength losses and remaining strength of posts of different diameters, assuming complete elimination of sapwood at the groundline.

Top and butt inside bark and heartwood diameters were measured on 371 northern Minnesota posts taken as they came from diameter class piles in one concentration yard at St. Paul, Minnesota. Posts were classified by sizes on the basis of top diameter. The 3-inch class, for example, included all posts from 3.0 through 3.9 inches across the top. Most of the posts were seven feet long, but a few 8-foot posts were included.

The groundline of 7-foot posts was considered to be two feet, and that of 8-foot posts to be three feet, from the butt. The inside bark and heartwood diameters at the groundline were calculated by subtracting 2/7 or 3/8, respectively, of the taper from the butt diameters.

Since posts are classified commercially on the basis of top diameter, correlations have been made with this measurement. Figure 1 shows the relationship between top diameter inside bark and diameter at the groundline, and between top diameter inside bark and diameter of the heartwood at the groundline. Figure 1 curves were fitted by the correlation method. The correlation coefficient was in each case 0.988 or greater, showing a high degree of correlation. The number of posts in each diameter class is shown on the curves.

The groundline diameter of the heartwood was found to be about equal to the top diameter of the post and ranged from approximately 3.1 inches for a 3-inch post to 7.2 inches for a 7-inch post. The per cent of heartwood at the groundline, based on the area of the cross section, ranged from approximately 62 per cent for a 3-inch post to 79 per cent for a 7-inch post. The relationship between top diameter and the per cent of heartwood at the groundline is shown in Figure 2.
As the sapwood decays, the diameter of the post is reduced which, in turn, reduces the post's strength. Assuming that the load is applied at a distance of 4.5 feet from the ground, that the cross section of the post is a perfect circle at the groundline, and using a modulus of rupture of 4200 pounds per square inch, the approximate load required to break the post can be calculated.

The approximate percentage reduction in strength of posts of different top diameters, assuming complete elimination of sapwood at the groundline by decay, is shown in figure 2. The reduction in strength for a post with a 3-inch top diameter is about 51 per cent while that for a 7-inch post is approximately 31 per cent. The loads required to break posts of 3-, 4-, 5-, 6-, and 7-inch top diameters following sapwood decay are approximately 225, 530, 1040, 1800, and 2850 pounds respectively.

These results indicate that the original strength of small northern white-cedar posts may be so greatly reduced by elimination of sapwood that they may fail when loads of the type that commonly occur are applied. The general dissatisfaction with small northern white-cedar posts is no doubt directly traceable to this fact. Treatment of small (3- to 4-inch) northern white-cedar posts with a good preservative is essential in order to insure retention of groundline diameter and reasonable service life.