

TECHNICAL NOTE NUMBER F-21

FOREST PRODUCTS LABORATORY · U. S. FOREST SERVICE · MADISON, WISCONSIN

CALCULATING THE VOLUME OF PILES AND POLES

To determine the amount of preservative per cubic foot of wood absorbed by piles and poles during treatment, a reliable estimate of the volume of the pieces is necessary. The most practical way of finding the volume of such timbers is to measure the diameter at a number of points and calculate the volume from a formula or volume table.

The volume table which follows has been adopted by the American Wood-Preservers Association and is included in standard 14b of that Association. It is absolutely correct only for poles of uniform taper, but errors from sources, such as irregular shape and large checks may be diminished if circumference measurements are taken at short intervals and the volume of each short section is computed separately. In using the table, an attempt should be made to secure the average diameter of ends which are not true circles.

The values in this table were calculated by the cone-frustum formula,

$$V = 0.2618 L \frac{(D^2 + d^2 + dD)}{144}$$

Where V is the volume in cubic feet, L the length in feet, D the top diameter in inches, and d the butt diameter in inches.

Two other formulas are offered below, either of which will give results sufficiently accurate for ordinary purposes.

One is the prismoidal formula,

$$V = \frac{L}{6}(A_1 + 4A_3 + A_2)$$

in which V is the volume, L the length, and A_1 , A_2 , and A_3 the two end areas and the middle area, respectively. This formula is correct for poles of regular shape or for those either larger or smaller in the middle than at either end.

The second is the mean-end-area formula,

$$V = L \frac{(A_1 + A_2)}{2}$$

in which V is the volume, L the length, and A_1 and A_2 the two end areas. In this formula the pole is assumed to be a frustum of a paraboloid, but having a basal area equal to the average of the areas of its two ends. Volumes may be more rapidly calculated by this formula, but values are somewhat large for poles other than those which are larger in the middle than at either end.

TABLE FOR CALCULATING CUBICAL CONTENTS OF POLES AND PILING

Find the average diameter at each end of the pile to the nearest half inch. Multiply the number in the table corresponding to these two diameters by the length of the pole or pile in feet. The result is in cubic feet.

Diameter of Small End—Inches																								
	4	4½	5	5½	6	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15		
4	.087																							
4½	.099	.110	.122	.138	.156																			
5	.111	.123	.137	.150	.165	.180																		
5½	.124	.137	.150	.165																				
6	.138	.151	.165	.180	.196																			
6½	.153	.167	.181	.197	.213	.230																		
7	.169	.183	.198	.214	.231	.249	.267																	
7½	.186	.200	.216	.232	.249	.268	.287	.307																
8	.202	.216	.231	.248	.265	.283	.302	.326	.349															
8½	.222	.238	.254	.271	.289	.309	.326	.351	.394															
9	.242	.258	.276	.292	.311	.330	.351	.372	.418	.442														
9½	.262	.279	.297	.315	.334	.353	.374	.396	.442	.467	.492													
10	.282	.300	.318	.337	.356	.375	.396	.420	.468	.493	.519	.545												
10½	.306	.323	.341	.360	.380	.401	.423	.446	.470	.494	.520	.545	.573	.601	.630									
11	.329	.347	.365	.385	.405	.427	.449	.472	.496	.521	.547	.574	.602	.630	.660	.690	.721	.753	.785	.819	.852	.887	.922	
11½	.353	.371	.390	.410	.431	.453	.476	.500	.524	.550	.576	.603	.631	.660	.690	.721	.753	.785	.819	.852	.887	.922	.954	
12	.378	.397	.416	.437	.458	.480	.504	.528	.553	.579	.605	.633	.662	.691	.722	.753	.785	.819	.852	.887	.922	.954		
12½	.404	.423	.443	.464	.486	.509	.532	.556	.582	.609	.636	.664	.693	.723	.754	.786	.819	.852	.887	.922	.954			
13	.431	.450	.471	.492	.515	.538	.562	.587	.613	.640	.667	.696	.725	.756	.787	.819	.852	.887	.922	.954				
13½	.459	.479	.500	.521	.544	.568	.592	.618	.644	.671	.700	.729	.759	.790	.821	.854	.888	.922	.956					
14	.487	.508	.529	.551	.575	.599	.624	.650	.676	.704	.733	.762	.793	.826	.860	.890	.924	.959	.994	.1031	.1069			
14½	.517	.538	.560	.582	.606	.630	.656	.682	.710	.738	.767	.797	.828	.860	.892	.926	.960	.995	.1032	.1069	.1108	.1147	.1187	
15	.547	.569	.591	.614	.638	.663	.689	.716	.744	.772	.802	.832	.864	.898	.933	.969	.1004	.1041	.1071	.1109	.1147	.1187	.1227	
15½	.579	.600	.623	.647	.671	.697	.723	.750	.778	.806	.836	.868	.900	.933	.969	.1004	.1041	.1071	.1109	.1147	.1187	.1229	.1269	
16	.611	.633	.656	.680	.705	.731	.758	.786	.815	.844	.875	.908	.938	.974	.1008	.1040	.1076	.1113	.1151	.1189	.1229	.1269	.1311	
16½	.644	.667	.690	.715	.740	.767	.794	.822	.851	.881	.912	.944	.977	.1010	.1045	.1080	.1117	.1154	.1192	.1231	.1271	.1312	.1354	
17	.678	.701	.725	.750	.776	.803	.831	.860	.889	.920	.951	.983	.1016	.1050	.1085	.1121	.1158	.1196	.1234	.1274	.1314	.1356	.1398	
17½	.713	.737	.761	.787	.813	.840	.867	.895	.924	.954	.985	.1018	.1052	.1087	.1123	.1160	.1198	.1236	.1276	.1316	.1357	.1399	.1441	
18	.748	.773	.798	.824	.850	.877	.904	.932	.960	.989	.1019	.1051	.1084	.1119	.1155	.1192	.1230	.1268	.1307	.1347	.1388	.1429	.1471	
18½	.784	.810	.836	.862	.890	.918	.947	.977	.1008	.1039	.1072	.1106	.1140	.1176	.1212	.1249	.1288	.1327	.1367	.1408	.1449	.1492	.1535	
19	.824	.849	.876	.901	.929	.958	.987	.1018	.1049	.1081	.1114	.1148	.1184	.1220	.1256	.1294	.1332	.1372	.1413	.1454	.1496	.1539	.1584	
19½	.862	.888	.914	.940	.967	.995	.1024	.1054	.1085	.1118	.1152	.1186	.1222	.1258	.1296	.1334	.1374	.1415	.1456	.1498	.1541	.1584	.1630	
20	.902	.928	.954	.981	.1009	.1039	.1070	.1102	.1134	.1168	.1202	.1237	.1273	.1309	.1347	.1386	.1425	.1466	.1507	.1549	.1593	.1637	.1682	
20½	.942	.969	.996	.1024	.1053	.1083	.1114	.1146	.1179	.1212	.1247	.1283	.1319	.1356	.1394	.1433	.1473	.1514	.1554	.1596	.1642	.1687	.1732	
21	.984	.1010	.1038	.1067	.1098	.1127	.1158	.1190	.1224	.1258	.1293	.1329	.1365	.1403	.1442	.1481	.1522	.1563	.1605	.1649	.1693	.1738	.1784	
21½	.1028	.1053	.1081	.1110	.1140	.1171	.1203	.1236	.1269	.1304	.1339	.1376	.1413	.1451	.1490	.1530	.1571	.1613	.1656	.1699	.1744	.1789	.1836	
22	.1072	.1098	.1126	.1155	.1185	.1217	.1249	.1282	.1316	.1351	.1387	.1424	.1462	.1500	.1540	.1580	.1622	.1664	.1707	.1751	.1796	.1842	.1889	
22½	.1117	.1141	.1170	.1200	.1231	.1263	.1296	.1329	.1364	.1399	.1436	.1473	.1511	.1550	.1590	.1631	.1673	.1716	.1759	.1804	.1849	.1895	.1943	
23	.1163	.1187	.1216	.1247	.1278	.1310	.1344	.1378	.1413	.1449	.1485	.1523	.1562	.1601	.1642	.1683	.1725	.1769	.1813	.1858	.1903	.1950	.1998	
23½	.1204	.1233	.1263	.1294	.1326	.1359	.1392	.1427	.1462	.1498	.1535	.1574	.1613	.1653	.1694	.1736	.1779	.1822	.1867	.1912	.1958	.2005	.2054	
24	.1251	.1280	.1311	.1342	.1374	.1408	.1442	.1477	.1513	.1548	.1587	.1626	.1665	.1705	.1747	.1789	.1833	.1877	.1922	.1968	.2014	.2062	.2111	
24½	.1298	.1329	.1360	.1391	.1424	.1458	.1492	.1528	.1564	.1601	.1639	.1679	.1719	.1759	.1801	.1844	.1888	.1932	.1978	.2024	.2071	.2119	.2168	
25	.1347	.1378	.1409	.1441	.1474	.1509	.1544	.1579	.1616	.1654	.1693	.1732	.1773	.1814	.1856	.1899	.1943	.1988	.2034	.2081	.2129	.2178	.2227	