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WHEN PRESERVATIVE TREATMENT OF WOOD IS AN ECONOMY

Although any set of timbers may be made more resistant to decay by preservative treatment, such treatment may not always be economical, even though the timbers are to be exposed to the most severe fungus attack. If the timbers are to be in service for a short time only, durability is unimportant, and any kind of preservative treatment would obviously be a waste of money. If, on the other hand, the wood is naturally of low durability and is to be used in a permanent location, it is easy for preservative treatment to show great savings. Between these two extremes there are any number of instances in which it is a more difficult problem to determine whether or not preservative treatment will pay.

If a timber user knows the average life that treated and untreated timbers are giving and the cost of each in place, he can easily compute, with the use of the following table, the relative annual costs of maintaining the two. A mine operator may have found, for example, that untreated timbers are giving an average life of two years and that their cost in place is $6 per set. Assuming an interest rate of 4 percent, the table shows that timbers which need replacement every 2 years cost annually $0.5302 on every dollar of their cost in place. For the $6 set, then, the annual maintenance cost would be 6 times $0.5302, or $3.18. Treated timbers, the user may find, gave an average life of 14 years and cost $7.50 per set in place. The annual charge on timbers with a 14-year life is found in the table to be $0.0947 on each dollar of their cost in place. The annual cost of maintaining the $7.50 treated set, therefore, would be 7.5 times $0.0947, or $0.71. Preservative treatment, then, would save this user annually $2.47 per set.

If a timber user knows the cost of treated and untreated timber and the average life of the untreated timber only, he can estimate how long treated timber would have to last to be as cheap as untreated timber. In the case discussed above, the untreated timber cost \$6 in place; the treated, \$7.50; and the untreated timber was lasting 2 years. The annual charge on the untreated set was found to be \$3.18, and since the annual charge on the \$7.50 treated set is to equal this, we may set up the equation (7.5) (X) = 3.18, then X (the annual charge on one dollar expenditure) = \$3.18 ÷ 7.5, or \$0.4240. Referring again to the table and looking down the 4 percent interest rate column, we find that an annual charge of \$0.4240 on the dollar falls between the 2 year and 3-year line and evidently at a point equivalent to a life of about 2-1/2 years. It can readily be seen from this that if treatment adds only 1/2 of a year to the life of the timbers, it would pay for itself, and the user could be sure from experience of others that it would add much more than this and would therefore be profitable.

The table can also be used to find the percentage of the cost of the untreated material that can be expended for treatment without increasing the annual charges for the untreated wood. In other words, making the annual charge the same for treated as for untreated timbers.

Let P be the cost of the untreated timber,

P_1 = percentage that can be spent for treatment,

A_u = annual charge for untreated material,

A_t = annual charge for treated material,

then we may write,

$$P_1 = 100 \left[\frac{A_u - A_t}{A_t} \right]$$

ANNUAL CHARGES ON EACH DOLLAR OF COST OF TIMBERS IN PLACE

Life in years before replacement	INTEREST RATE				
	2%	3%	4%	5%	6%
1	1.0200	1.0300	1.0400	1.0500	1.0600
2	0.5150	0.5226	0.5302	0.5378	0.5454
3	0.3467	0.3535	0.3603	0.3672	0.3741
4	0.2626	0.2690	0.2755	0.2820	0.2886
5	0.2121	0.2183	0.2246	0.2310	0.2374
6	0.1785	0.1846	0.1908	0.1970	0.2034
7	0.1545	0.1605	0.1666	0.1728	0.1791
8	0.1365	0.1424	0.1485	0.1547	0.1610
9	0.1225	0.1284	0.1345	0.1407	0.1470
10	0.1113	0.1172	0.1233	0.1295	0.1359
11	0.1022	0.1081	0.1141	0.1204	0.1268
12	0.0945	0.1004	0.1065	0.1128	0.1193
13	0.0881	0.0940	0.1001	0.1064	0.1130
14	0.0826	0.0885	0.0947	0.1010	0.1076
15	0.0778	0.0838	0.0899	0.0963	0.1030
16	0.0736	0.0796	0.0858	0.0923	0.0989
17	0.0700	0.0759	0.0822	0.0887	0.0954
18	0.0667	0.0727	0.0790	0.0855	0.0923
19	0.0638	0.0698	0.0761	0.0827	0.0896
20	0.0611	0.0672	0.0736	0.0802	0.0872
21	0.0588	0.0649	0.0713	0.0780	0.0850
22	0.0566	0.0627	0.0692	0.0760	0.0830
23	0.0547	0.0608	0.0673	0.0741	0.0813
24	0.0529	0.0590	0.0656	0.0725	0.0797
25	0.0512	0.0574	0.0640	0.0709	0.0782
26	0.0497	0.0559	0.0626	0.0696	0.0769
27	0.0483	0.0545	0.0612	0.0683	0.0757
28	0.0470	0.0533	0.0600	0.0671	0.0746
29	0.0458	0.0521	0.0589	0.0660	0.0736
30	0.0446	0.0510	0.0578	0.0650	0.0726
32	0.0426	0.0490	0.0559	0.0633	0.0710
34	0.0408	0.0473	0.0543	0.0617	0.0696
36	0.0392	0.0458	0.0529	0.0604	0.0684
38	0.0378	0.0444	0.0516	0.0593	0.0673
40	0.0365	0.0433	0.0505	0.0583	0.0665
42	0.0354	0.0422	0.0495	0.0574	0.0657
44	0.0344	0.0412	0.0487	0.0566	0.0650
46	0.0334	0.0404	0.0479	0.0559	0.0644
48	0.0326	0.0396	0.0472	0.0553	0.0639
50	0.0318	0.0389	0.0465	0.0548	0.0634
52	0.0311	0.0382	0.0460	0.0543	0.0630
54	0.0304	0.0376	0.0455	0.0539	0.0627
56	0.0298	0.0371	0.0450	0.0535	0.0624
58	0.0293	0.0366	0.0446	0.0531	0.0621
60	0.0288	0.0361	0.0442	0.0528	0.0619

Based on the formula,

$$A = P\left[\frac{r(1 + r)^n}{(1 + r)^n - 1}\right]$$

In which,

- A = Annual charge.
- P = Amount of initial investment.
- n = Number of years in service (the average life of the timbers when a group is considered).
- r = The rate of interest expressed decimally.

In the sample given, where the untreated timbers are assumed to cost $6.00 and last 2 years and the treated timbers last 14 years, when the interest rate is 4 percent,

$$P_1 = 100 \left[\frac{0.5302 - 0.0947}{0.0947}\right] = 460 \text{ percent of}$$

the cost of the untreated material. The total amount that could be spent for the treated timber to give the same annual charge would then be, $P\ (1 + \frac{P_1}{100})$.

In the computation shown this amount = 6 (1 + 4.6) = $33.60 since (33.60) (0.0947) = $3.18, the annual charge for untreated timbers lasting 2 years. Any expenditure for treatment only, which is less than (6) (4.6) or $27.60, would of course represent a saving from the use of treated material. In this case the annual saving being, [27.60 - (7.5 - 6)] 0.0947 or $2.47 as previously indicated.

If untreated timber is giving long life, treatment might not result in great savings. However, very often it might be possible to substitute for such timber a treated lower-grade material that would give as long or longer life with an annual maintenance charge which would compare very favorably with that of the better-grade untreated timber.

There are several advantages arising out of the use of treated timber which should not be overlooked, although they may not seem so important as cutting down maintenance costs. As decaying timbers are highly inflammable when dry, preservative treatment, by keeping the wood sound, reduces the fire hazard. Furthermore, a well-preserved timber maintains high strength over a long period of time, while a decaying timber rapidly loses its strength. Preservation, by lengthening the life of timber and by permitting the use of low-grade material, also helps conserve a timber user's resources and the nation's timber supply.