# TIMBER PRESERVATION—A FORM OF FOREST CONSERVATION

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Theodore Roosevelt and Clifford Pinchot did the people of the United States a great service by calling attention to the problem of conservation of our forests. The Forester now has his work well organized and under way; it remains for the work of the timber engineer to be recognized by the public and for his methods generally to be adopted, to complete the program of conservation.

Saving the supply of timber already grown is doubtless as important as growing a new supply. U. S. Bulletin of Agr. 112 is responsible for the statement that we are using 40 billion feet of lumber and 87 million hewed railroad ties annually, besides pulpwood and fuelwood. W. B. Greeley, chief of the U. S. Forest Service, urges preservative treatment of railroad ties, mine timbers, fence posts, telegraph poles, shingles and construction lumber. He endorses an estimate of 3,650,000,000 board feet as the annual saving by this method. The importance of saving becomes significant when we are told in the same bulletin that "We are taking about 26 billion cubic feet of material out of our forests every year and growing about 6 billion feet in them".

Our outgo in forest resources is more than our income. Bankruptcy of natural forest resources is inevitable unless we face the situation and save what we have. First, we can produce more; every state has its program of forestation, but without hope of catching up to increasing demand in an economically active country. We are now using one half of the consumption of forest products of the entire world. Yet in the state of New York, as reported by its conservation commissioner, the number of wood-using factories including furniture factories, agricultural implements plants, and concerns using lumber in the form of plank had shrunk from 3,300 plants in 1913 to 2200 in 1900, 1100 industries having gone out of business in six years.

We can use less timber; the older nations of the earth have reduced their consumption to a very low and stable

level; these countries are industrially stagnant; but industrially active countries such as England and Germany are great wood consumers. We must not consume less at the expense of useful industries. We can substitute other materials for wood, such as cement for water-troughs and piling, steel for bridges, implement frames and tongues. Galesburg's shale is being converted into paving bricks which are taking the place of wood blocks in her own streets and in the main streets between here and Panama, where a large consignment of Galesburg brick was used. But with all the substitution, important as it is, the saving affected is estimated by W. B. Greeley at only 150,000,000 cubic feet or about one-half of one per cent of the drain upon lumber. We can, by preservative treatment, effect the largest saving as indicated above. This saving of lumber is secured mainly along two lines, first by increasing the average life of timber four or five times, secondly by allowing the use of inferior woods, such as rapidly growing cotton wood, as railway cross ties in place of slower-growing relatively-important white oak.

Preservation was secured in the old days by applying tar to the outside surface with a brush. Nowadays, the same material is utilized in the form of creosote oil, a coal tar product forced into the wood under pressure and at a high temperature and made to penetrate into the heart-wood of the tie or pile, thus lengthening the life of the timber which is equivalent to increasing the visible supply. The following treatments are used at the Burlington Tie Plant, Galesburg, Illinois:

First: Straight Creosote

Second: Card Process (zinc chloride and creosote)

Third: Burnettizing Process (zinc chloride)

Mr. J. R. Waterman, Superintendent of timber preservation for the Burlington Road, recommends the first or creosoting process as being the most effective, but because of the lessened cost he recommends the card process, from an economical stand point. The relative merits of the above processes are submitted below from data compiled by Mr. Waterman.

One of the oldest examples of creosoting timber under conditions similar to the present practice is that of the New Orleans and North Eastern Railroad across Lake Pontchartrain, 5.82 miles in extent. The piling of yellow pine, having not less than 12 inches of heartwood at the head, were treated with from 10 to 12 pounds of creosote per cubic foot at a temperature of 175 degrees under a pressure of 150 pounds per square inch after steaming and vacuum treatment. A report of the Interstate Commerce Commission Valuation Division Engineer in 1918 makes the following comment, "A very remarkable state of preservation—The original timber in good condition and apparently carefully selected and well creosoted—Estimate remaining service life of this trestle thirty-five years". These pilings had already had a life of thirty-five years, making a total expected life of the trestle seventy years.

In order to understand what has happened to the tie or pile when treated according to the specifications sketched above, a description of an up-to-date plant and processes used, follows. The main features of a modern wood preserving plant are, first, the ten or twelve huge cylinders, 6 or 7 feet in diameter and 120 feet to 140 feet long. These retorts are mounted on heavy concrete bases which are not continuous but allow more or less access below the retorts. There are doors at one or both ends, which, after the admission of timber to be treated, are closed by fifty large steel eye bolts. Tracks extending from the storage yards approach the entrance to each retort, where a gap of about 8 feet is bridged by a movable car in a pit. This car bears a section of track, continued in a well at the bottom of the retort. When the door of the retort is to be opened, the carriage bearing a section of the track is removed, allowing it to swing open readily. The well contains pipe connections to tanks of treating fluids, air compressors, steam pipes, etc. The engine room, which contains all necessary pumps and generating machinery, is located in an adjoining room on re-enforced concrete foundations. One of the most interesting of its varied equipment is an elaborate system of automatic recording apparatus, a steam meter show-

ing steam consumed, thermometers, pressure gauges, and the like. By means of these ingenious devices a complete record of temperature and processes is made on circular discs from day to day and filed away for future reference. (By courtesy of Mr. Shinn, Superintendent of the Galesburg plant, I am able to exhibit a card showing temperature and pressure record.) Adjacent to the main plant is to be found huge tanks having a capacity, in case of the Galesburg plant, of one half million gallons each. In addition, the Galesburg plant has a mixing tank into which creosote, zinc chloride, etc. may be pumped in desired proportions. The treating fluids are obtained from standard dealers, such as The Tar-Via Company. Much of the creosote has been produced as a bi-product in Germany.

Timber to be treated is seasoned by piling in the open for about one year. The ties are stacked cob-house fashion so that air will circulate freely and rain water will run off readily. No successful method of treating green timber has yet been devised. The tie is next placed on low cars or cradles in compact form so that the encircling hoops when packed full will fill approximately the bore of the retort. A series of the cradles are coupled together and drawn into the treating chamber by a wire cable, the power being supplied from winding a drum. The retort is closed, and steam is admitted for a period of one or more hours according to the size and nature of the material treated. This process effects an even distribution of moisture and ensures uniform drying, while excess water which accumulates is forced into outside tanks, since the pressure in the retort is greater than in the tanks.

The second step in the treatment is the creation of a partial vacuum. This is a real drying process, as evaporation goes on rapidly where a vacuum of twenty inches or more is maintained. The third step is the admission of creosote oil, at first without pressure: afterward the pressure is brought up to 175 pounds or more; later the oil is forced back to the working tanks from the retort by compressed air, the door is opened and the load drawn. The wood has absorbed about 12 pounds of creosote oil per cubic foot and has been made so heavy that it will

sink in water. How complete is the penetration of the fluid is shown in the cross section (Exhibit 1) of a pile which shows that every portion of the pile has been affected, with small areas at the side of the center showing less pronounced effect.

The charge after being with-drawn is stacked in the open in the material yards until it is needed. Power derricks, which lift the entire content of a cradle, are used in loading and unloading ties. Where the loading of ties in a box car precludes the use of power, an ingenious trolley system facilitates the rapid loading by hand.

The results obtained by Mr. Waterman in timber preservation are set forth in his recent report to the officials of the Burlington Road, from which report the following conclusions are presented:—That there are two causes for the failure of ties, 1st., decay due to moisture, etc., 2nd, failure due to mechanical causes. Since moisture is a great factor in decay, observations by the above authority show that ties last longer, other things being equal, west of Nebraska points than east. Observations of recorded portions of track show that such woods as hickory, poplar, cottonwood, elm and red-oak compare favorably with white oak, as ties, when given preservative treatment, whereas the tendency of each of these woods to decay when in contact with damp soil is common knowledge. The accompanying chart (after F. S. Shinn, Superintendent of the Galesburg Plant) shows that, of 3200 zinc-treated ties, only 15% had been removed after 17 years, while 26% yet remained in service after 22 years, whereas untreated ties are shown to last about 5 years, in case of white oak, and less time in case of the woods mentioned above. The preservative treatment, then, conserves both timber supply and replacement costs.

An examination of the table appended will make apparent how inferior woods, by treatment, may be made to do the work of the more expensive and relatively-scarce white oak ties.

When treated by the most commonly used card process the following show that other woods compare favorably with similarly treated white oak ties, in serviceability, where under similar conditions, 8.8% of a number

of white oak ties were removed on account of decay and 11.8% for other causes. There were removed:

| | From decay. | Other causes. |
|---|---|---|
| Elm | 2.5% | 6.8% |
| Cottonwood | 2.7% | 15.5% |
| Red Oak | 3% | 11.3% |
| Hickory | 6 % | 21 % |
| Poplar | 7.3% | 30.1% |

*Untreated,* the score for the same woods is very poor in comparison with white oak. There were removed from trial sections of track after exposure; untreated

| | From decay. | Other causes. |
|---|---|---|
| White oak | 61.5% | 10.3% |
| Hickory | 92.3% | 7.7% |
| Elm | 93.8% | 6.2% |
| Poplar | 95.1% | 3.71% |
| Red oak | 96.1% | 3.1% |
| Cottonwood | 96.5% | 5.5% |

There follows a more complete report on these woods as ties subjected to identical usage in observed portions of track:—

| Process | Number of Ties | Removed | Percent Decay | Percent Other Causes |
|---|---|---|---|---|
| **EAST.** | | | | |
| Creosote | 2027 | 140 | 2.8 | 4.1 |
| Card | 10259 | 2003 | 5.9 | 13.6 |
| Burnettizing | 1584 | 526 | 19. | 14.2 |
| Untreated | 2040 | 1963 | 88.9 | 7.3 |
| **WEST.** | | | | |
| Straight Creosote | 1117 | 107 | 7 | 8.8 |
| Card | 4929 | 1099 | 5.9 | 16.4 |
| Burnettizing | 842 | 273 | 9.5 | 22.9 |
| Untreated | 1075 | 1033 | 89.4 | 6.9 |
| **ELM.** | | | | |
| Creosote | 206 | 13 | 2.9 | 3.4 |
| Card | 597 | 56 | 2.5 | 6.8 |
| Burnettizing | 224 | 28 | 7.2 | 5.3 |
| Untreated | 112 | 112 | 93.8 | 6.2 |
| **HICKORY.** | | | | |
| Creosote | 10 | 0 | 0 | 0 |
| Card | 185 | 50 | 6 | 21 |
| Burnettizing | 16 | 0 | 0 | 0 |
| Untreated | 65 | 65 | 92.3 | 7.7 |

| Process | Number of Ties | Removed | Percent Decay | Percent Other Causes |
|---|---|---|---|---|
| **COTTONWOOD.** | | | | |
| Creosote | 88 | 3 | 1.1 | 2.3 |
| Card | 296 | 54 | 2.7 | 15.5 |
| Burnettizing | 56 | 56 | 96.5 | 3.5 |
| **RED OAK.** | | | | |
| Creosote | 164 | 4 | 0 | 2.4 |
| Card | 777 | 111 | .3 | 11.3 |
| Burnettizing | 159 | 35 | 6.3 | 15.8 |
| Untreated | 128 | 127 | 96.1 | 3.1 |
| **POPLAR.** | | | | |
| Creosote | 50 | 2 | 0 | 4.1 |
| Card | 396 | 148 | 7.2 | 30.1 |
| Burnettizing | 50 | 20 | 20. | 20. |
| Untreated | 81 | 80 | 95.1 | 3.71 |
| **WHITE OAK.** | | | | |
| Creosote | 15 | 0 | 0 | 0 |
| Card | 136 | 28 | 8.8 | 11.8 |
| Burnettizing | 15 | 3 | 6.7 | 13.3 |
| Untreated | 39 | 28 | 61.5 | 10.3 |

Data furnished by F. S. Shinn, Supervisor of Galesburg Tie Plant, and J. H. Waterman, Supt. of Timber Preservation, C. B. & Q. R. R.