PERMANENCE: PROVED BY MORE THAN 75 YEARS OF SERVICE

First it was Untreated Round Timber Piles
Then came Pressure-Treated Timber Piles
And only *after* their proven success did any other kind of piling dare to enter the field

The need for round timber pile foundation support goes back at least 100 years ago and in some isolated cases beyond 1860. At first it was untreated timber piling that did the job for the immediate purpose. Whether or not considered for long service, the heavy construction industry needed an improved pile to give still better service and exhibit more durability through the years. One important result was development by the wood preserving industry of a creosote pressure-treated timber foundation pile very similar in appearance and quality to a creosote-preserved marine pile. It wasn't until decades later that other materials—concrete, steel and composite—made their appearance in the field. Now, after more than 75 years of successful performance by treated timber piling the industry is on the brink of introducing a Quality Mark timber foundation pile which can be guaranteed by the producer.

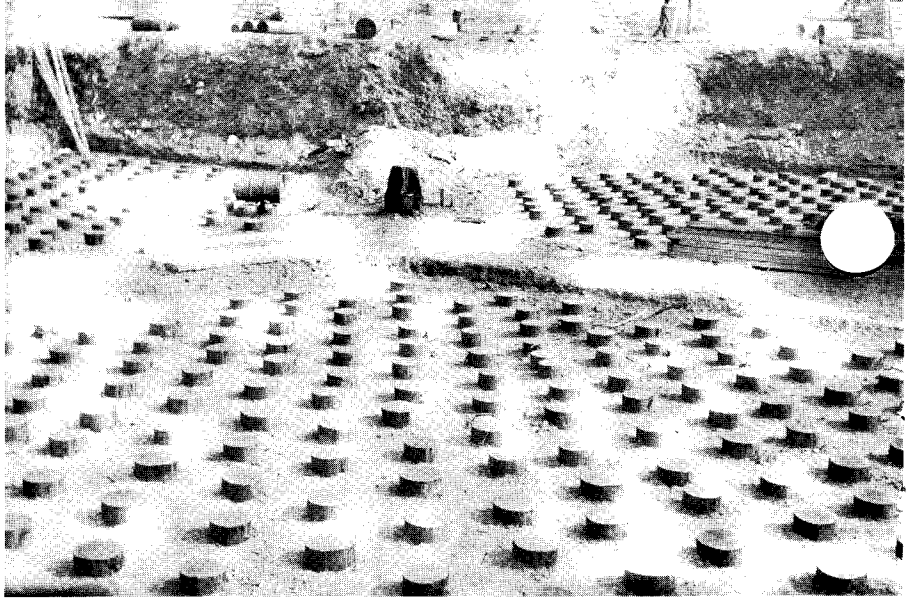
The first recorded use of pressure-creosoted timber piles in permanent foundations, where they were cut off above the ground water, dates back to about 1890. Profiting by their long experience with creosoted ties, trestle piles, and other members of treated structural timber, railway engineers began driving pressure-creosoted piles for footings which were at levels where the supporting piles would not be wet at all times. Their use in such structures antedates that of any of other types of permanent piles, because concrete piles were not introduced until about 1900 and steel piles some eight years later.

For more than 70 years the Southern Pacific Railroad has been driving creosoted timber piles successfully to support the footings of buildings, bridges, and various other structures that were designed to last indefinitely. Today many of the most important buildings on the Southern Pacific Lines are supported by creosoted wood foundation piles where the tops are above ground water level or where subsidence of the water table may expose the piles in the future.

Inspections prove efficiency

Inspections of foundations with piles driven in the ground water level are rare except in instances where additions or changes are made to existing structures. An exceptional instance occurred several years ago on the Illinois Central Railroad, where pressure-creosoted piles have been used for such foundations since 1900. Because these piles have proven so economical and so practical for so many of their structures, engineering officers decided upon a field inspection to determine the condition of these foundations after

AWPI Senior District Engineer Ralph H. Mann, at the site of the 1939 Perisphere, New York World's Fair, is shown taking an increment boring from one of three piles at a point about 10 in. below bottom face of concrete base slab which rests upon the pressure-creosoted piles. Tops of the piles extend about 3 ft. above permanent ground water level.



TOPS of piles shown (photographed in 1937) are some of the 528 that supported the Perisphere. After being found completely sound in a recent inspection, they were used again to support the 1964 Unisphere.

many years of service. The results of that inspection were presented by Frank R. Judd, engineer of buildings, in a paper entitled "Creosoted Pile Foundations for Railway Building Structures." The author declared that in no instance was there the slightest indication of change in the preservative condition of the treated wood since the time of installation.

The proposed revamping of the deck structure on a long intercity viaduct at Kansas City, Mo., in 1936 led to a detailed examination of foundation piles which had been driven under the pier footings when the viaduct was erected 31 years before. The proposed expenditure for the new deck amounted to more than $1,000,000 and plans involved using the existing footings to be depended upon for a long period of future service. Of the 326 footing pedestals founded on piles, 2,573 were creosoted timber piles cut off 5 ft. or more above the water table. A close examination of these piles, which had been pressure-treated with 12 lb. of grade one creosote per cubic foot, disclosed no signs of deterioration, and the use of the orginal footings was approved by the engineers.

The Atchison, Topeka & Santa Fe Railway in 1905 constructed the first unit of a large grain elevator near Kansas City on 2,078 creosoted timber piles. Although the piles were cut off beneath the surface of the ground, they ranged to as much as 20 ft. above the fluctuating ground water level. Additions were built in 1913 and 1915 on 4,175 and 6,688 similarly treated piles, respectively. A new headhouse added in 1925 required 2,700 additional pressure-creosoted timber piles. The latest addition, which increased storage capacity to 10,529,400 bushels of grain, was erected in 1931 on 7,501 pressure-creosoted timber piles after a careful examination had shown that the original piles were in as sound condition as when first driven. It is certain that had there been any indication of deterioration in the first or succeeding installations, this type of pile would not have been driven for the founding of the later additions.

Experienced construction engineers have found that, when pressure-creosoted wood piles are pulled after 40 or 50 years of service, the portions from below ground are as black and unchanged in appearance as the day the piles were driven, visual proof of their virtually unlimited life.

Investigation at New York

The famous Unisphere which dominated the central plaza and symbolized the New York World's Fair was the largest stainless steel structure ever erected. The 120-foot edifice was 13 stories high. It weighed 900,000 pounds and perches on a 20-foot base.

The foundation for that base comprised 528 pressure-creosoted Douglas fir piles 95 to 100 feet long that were driven into the marshy soil of Flushing Meadows Park 28 years ago as the foundation for the Perisphere, symbol of the 1939 World's Fair. Although the piles were cut off several feet above permanent ground water level and have been exposed to organic acids ever since in the marshy subsoil, they were selected as the basic foundation of the Unisphere after careful examination by competent engineers. Plans also provided that the giant stainless steel sphere would remain as a permanent structure and American landmark, such as the Eiffel Tower in Paris.

Several years ago General William Whipple, Jr., chief engineer of the New York World's Fair 1964-65 Corporation, decided to investigate the possibility of re-using the old creosoted pile foundation. Accordingly, Andrews & Clark, a consulting engineering firm of New York City, was employed to investigate and report on the condition of the piles which had been partially exposed by excavation for inspection purposes. A subsequent investigation also was made by members of the New York consulting engineering firm of Moran, Proctor, Mueser & Rutledge (now Mueser, Rutledge, Wentworth & Johnston). Reports of both investigations agreed that the pressure-creosoted Douglas fir piles were completely sound and capable of satisfactorily supporting the great Unisphere as a permanent structure.

Three timber piles, selected at random, were sounded and each was found to be firm and solid. Wooden core borings taken from sections of each of the three piles, well above ground water level, revealed sound wood throughout the length of the cores.

Creosote was found to have penetrated inward approximately one inch in depth from the surface of each pile, which represents normal pressure preservative treatment for Douglas fir piles in long lengths as delivered in 1927.

Although the surfaces of the piles, where the borings were taken, were completely dry, heavy deposits of free creosote were found, in each instance, on the shaft of the hollow bit after the cores had been removed. The cores were taken from the critical section of the piles, well above permanent water table where decay, if present, would have been found. None was discovered. The 1937 treatment was in accordance with standards of the American Wood-Preservers' Association with a retention of 12 pcf of creosote.

Used for more than 110 years

Creosote distilled from coal tar is one of the most effective toxic chemicals used for wood preservation and it has been in continuous use in Europe and in this country for more than 110 years. It is very stable and, when injected into the wood by an approved pressure process, remains effective for long periods of time, depending on the degree and type of exposure. When a sound timber pile has been pressure-creosoted by approved processes, all fungi spores on the surface or in crevices have been completely destroyed and, because spores cannot survive near creosote, the pile is still sterile when driven.

Although freely circulating air causes some evaporation loss of the preservative constituents of creosote, when a treated pile is entirely embedded in the earth, it is effectively shielded from air currents. There are no drastic changes in temperature to produce loss of preservative by volume changes and bleeding. Centuries will elapse before the preservative can be depleted to the extent that remaining concentrations will no longer be lethal to fungi, termites or other deteriorating agencies.

BORING from second piles shows deep penetration of the creosote and complete soundness of boring in Douglas fir pile which served as foundation for 1939 Perisphere at the New York World's Fair.

Penta also is used

Among the more recently developed standard preservatives, pentachlorophenol has been used to a relatively limited extent for the pressure preservative treatment of timber foundation piles. Pentachlorophenol is a chemical that is dissolved in petroleum fuel oil or other suitable oils to form carrier solutions for injecting it into the wood. It is highly toxic to wood-destroying fungi, termites and other insects.

Penta is recognized as a standard preservative, for the treatment of foundation piles, by the American Wood-Preservers' Association and is included in AWPA specifications for that purpose.

Among the older installations approximately 236,000 lin. ft. of timber foundation piles pressure-treated to a final net retention of 12 lb. per cu. ft. minimum of 5 percent by weight solution of pentachlorophenol, were driven for structural foundations for the Monsanto Chemical Co. in 1951 at plant in Texas City, Texas. Engineering inspections of the structures at the end of the 16-year period since installation, it is reported, have shown no indications of settlement or foundation failures. Hence there has not been any reason to excavate around or to extract any of the penta-treated piling for observation.

Immune to acids and alkalies

Among the outstanding advantages of pressure-creosoted piles is the fact that they are not affected by acid and alkaline wastes from manufacturing plants. Alkali in strengths such as are found at many semi-arid sites and the weak concentrations of acids usually encountered in ground seepage have no deteriorating effect on pressure-creosoted wood. In fact, there are many cases of record where designing engineers have selected pressure–creosoted timber for structural foundations because of its immunity to such attack.

Typical examples are the piles in alkaline soil under the U.S. Veterans Hospital in Grand Junction, Colo., and those driven in 1922 in animal acid refuse under the American Royal Stock Show Building in Kansas City.

Furthermore, pressure-treated wood piles are not damaged by electrolysis or anaerobic bacteria.

Cinder fills have no effect

Recently a pile-driving contractor, whose rig, already set up on a new building site, was ordered to hold up driving pressure–creosoted timber piles because an officer of the owning company questioned their durability in a cinder fill.

Railway engineers were the first to begin using pressure-creosoted timber piles about 70 years ago. During the following 55 years millions of tons of coal cinders were disposed of in fills on railway properties and others all over the country. Consequently thousands of creosoted timber piles have been driven in cinder fills. A recent search of service records fails to reveal a single instance of where such piles have been adversely affected by the relatively weak acid which customarily leaches from cinder fills.