Proper Preservative Treatment Prevents Premature Failures

Untreated wood piles entirely embedded in the earth and cut off below ground water table or those submerged in fresh water cannot decay or be damaged by insects and will last perpetually if their surrounding conditions remain unchanged. The real hazard to untreated foundation piles properly installed is an unforeseen lowering of the ground water level and the consequent exposure of the upper portions of the piles to decay. Untreated wood piles, however, are always exposed to decay whenever they project above the water level. Conservative engineering practice therefore restricts their use in permanent foundations to locations where they will be cut off below the ground water level or where their tops, if they do project above the mud line, will be in fresh water.

Wood-destroying agencies comprising decay, termites and other insects, marine borers, mechanical wear and fire are well-known. Effective methods for their elimination have been developed by modern research. Pressure preservative treatment with standard wood preservatives properly applied to timber piles provides today's engineers and builders with one of the most efficient items for basic foundations for permanent construction.

How untreated wood decays

All decay of wood is caused by fungi, low forms of plant life that develop and grow from spores just as higher plants do from seed. These microscopic spores abound everywhere in open air. Lodging in favorable places on untreated timber with which they come in contact, they germinate, sending out hyphae, or strands, that spread through the wood. These plant-like growths break down the wood substance, converting it into food required by fungi for development. However, like all forms of plant life, the spores of wood-destroying fungi must have air, suitable moisture and favorable temperature as well as food if they

THIS untreated oak pile failed because of decay above ground water level after 17 years in the foundation of a building of The Dow Chemical Co. at Midland, Michigan. The extent of decay is apparent from the cut-off and knife blade pushed in to its hilt.

are to develop and grow. Deprived of any one of these four essentials, the spores cannot develop and the wood remains sound, retaining its full strength for many years of useful, low-cost service.

Wood submerged in fresh water cannot decay, because the necessary air is excluded; decay also will not progress in wood with moisture content less than 20 percent of its weight. Advancement of decay is progressively checked as temperatures drop below those generally favorable for plant growth, and all fungus activity stops as freezing temperatures are approached. Progress will resume, however, once favorable climatic conditions are restored. Because it is impracticable to exclude air and moisture from, or to control temperatures in, most outdoor or exposed structures, effective preservation is attained by impregnating the wood with chemicals which are poisonous to fungi, insects and marine borers.

Spores of fungi may lie dormant in the crevices of untreated wood for years while conditions for development remain unfavorable, only to spring to life and begin their destructive activities whenever favorable growth conditions are restored. This explains why the tops of untreated wood piles decay when the table recedes. Where there is any likelihood of changes in the water levels during the predicted life of the structure, such changes should be anticipated by insisting that the piles be pressure-treated in accordance with recognized standards, such as the specifications of the American Wood-Preservers' Assn., which are incorporated in the specifications of the Federal Government and those of the railways.

Foundation failure

Evidence of the serious decay to which untreated wood piles are subject was found recently when contractors removed a concrete floor while remodeling a metallurgical laboratory building of The Dow Chemical Company at Midland, Mich. Two 25-ft. red oak foundation piles were uncovered, cut off slightly below the existing water level and examined for decay as shown in the accompanying photographs. Tops of all the other piles involved in this remodeling also were found to be seriously decayed, although the wood below the water table was sound. These piles had been in place for only 17 years. Some of them were spaced four to six ft. apart and supported the foundation for heavy manufacturing equipment; others supported columns of the building. This laboratory was constructed hurriedly during World War II as a temporary project when properly pressure-treated piling was not readily available.

Many foundation failures

Unexpected lowering of ground water levels which exposed the heads of untreated piles and permitted them to decay has necessitated costly underpinning of many prominent structures. All of these untreated piles when installed were submerged, but subsequent changes in adjacent drainage systems depressed ground water levels to such an extent that the pile heads protruded above the water line. Decay soon set in, causing settlements that threatened disaster unless repairs were made speedily and at considerable expense.

Recently in discussing the variety of subterranean conditions encountered in different areas of New York City, one of the country's leading foundation authorities referred to serious settlements that occurred in the New York Produce Exchange Building several years ago. A drop of several feet in the ground water level followed the construction of subways and deep cellars. Exposed tops of the untreated piles rotted, causing settlement and necessitating costly repairs.

Another instance occurred in Boston, where the public library, supported by untreated piles cut off under water level, had stood for many years. The construction of deep drainages nearby lowered the water table; consequently, the pile tops decayed and the foundations had to be repaired to prevent failure. Similar instances have been reported in San Francisco, Milwaukee, and several other cities where unforeseen changes in ground water levels occurred.

Threat of receding levels

The big question in many foundation projects is where will the ground water level be in 10, 20 or 30 years? A broad survey of the nation's water resources conducted by Fortune magazine, and reported in its issue of March 1954, declared that in the preceding 20 years the nation had increased its withdrawals of ground water more than 300 percent, until it obtained about 30 billion gallons daily, or nearly one-fifth of its total supply, from wells. The U.S. Materials Policy Commission estimated that between 1950 and 1975 the total national demand for water may nearly double. More than 85 percent of the new demand is expected to come from industry and from cities.

After a study of water resources in the Minneapolis-St. Paul area, the United States Geological Survey published Circular 274, "Water Resources of the Minneapolis-St. Paul Area, Minnesota," which in commenting on natural fluctuations in ground water levels says in part: "Under natural conditions the amount of water in underground storage is constantly changing. The changes are reflected by fluctuations of water levels and artesian pressures . . . at South St. Paul water levels were between 50 and 100 feet below the surface, whereas 25 years ago they were near the surface."

Similar surveys and reports are available for many parts of the country because of the drastic lowering of ground water levels in many industrial and agricultural areas during recent years, and foundation engineers are advised to consult them carefully, particularly if untreated wood piles are to be considered. Caution also should be exercised in determining the actual level of the existing water table because in some instances holes dug in cohesive soils at a construction site may collect entrained water which may be mistaken for the water table. If surveys and reports are not available, the safe course should be taken and no risks run. Pressure-treated-timber piles should be used.