The present height limitation is approximately 20 feet. However, new materials in the development stages will allow 30 foot heights in the near future. While theoretically there is no limitation on lengths, from the standpoint of economics in shipping and handling during installation, we suggest units should not exceed 400-500 feet in length. When requirements call for longer Fabridams, the procedure is to use vertical concrete abutments between each unit. In this manner, by installing separate controls to each unit, a greater flexibility of control can be attained. If concrete abutments are not desirable, individual Fabridam segments can be fastened together end to end and controlled as one unit.

Fabridam applications are practically endless. The following is a list of a few of the applications presently being used or being considered for future use:

(a) Diversion structures.
(b) Check structures for flow control.
(c) Flashboard replacement.
(d) Lock systems.
(e) Sluice gates.
(f) Salinity barriers.
(g) Tidal barriers.
(h) Raising heights of existing spillways.
(i) Raising heights of water reservoirs by adding to top of existing gates.
(j) Control gates for water treatment plants.
(k) Control gates for sewage plants.
(l) Replacement of steel gates on concrete structures.
(m) Replacement of low concrete dams to 30 feet in height.
(n) Barriers for beach erosion.
(o) Wave attenuators.
(p) Breakwaters.

To summarize, we can state briefly:

A. The continuously increasing demand for water conservation and flood control in the United States requires more than ever an economical and simple installation design and technique for damming, capable of being employed equally well by any Federal, State, or private enterprise.
B. The uniqueness and simplicity of the Fabridam lends itself perfectly to low intermittent damming.
C. The high strength to weight ratio, puncture, abrasion, and high weather resistance of the rubberized fabric developed by Firestone make this material ideal for the flexible requirements of a Fabridam.
D. The Fabridam accomplishes these ends with non-critical materials at costs below those resulting from use of critical materials.

Inasmuch as each Fabridam is individually designed, we have no standard price lists. However, the cost of a Fabridam installation on an existing suitable foundation, including the Fabridam, its attachment hardware and labor, and the necessary piping, valves, pumps, and automatic controls, has been found *to run about $35.00 per square foot of dammed area.* For example, to install a five-foot (5') Fabridam across a 100-foot channel on a suitable existing foundation would cost *approximately $17,500.00.*

CHEMICALLY TREATED WOOD FOR MODERN STRUCTURES

By C. MILES BURPEE
Secretary, American Wood Preservers Institute

New building materials usually are associated with modern structures such as tall office buildings of glass, metal, plastics, and concrete. But such structures seem out of place in typical park settings of grass, flowers, trees and lagoons. Modern wood is a new, chemically treated building material that, unlike other modern materials, is well adapted to all types of durable structures because it

is one of Nature's products that also fits best in the natural beauty of park surroundings.

Pressure preserved wood now is chemically protected against fire, rot, termites, all types of wood destroying insects and marine borers. Modern treatments provide wood products that are paintable, odorless, and water repellent; structural members can be built up in glued laminations to almost any desired shape or size and practicable methods have been developed for the preservative and fire retardant treatment of plywood. These important technical advances open the way to new uses and economies in the construction, maintenance, and service life of many different kinds of structures.

Pressure preserved wood in brown shades or natural finish requires neither initial painting nor periodic repainting, unless paint is desired for decorating purposes. Preserved wood also weathers and mellows to pleasing tones that blend with natural surroundings. It is readily understandable, for people not actively engaged in wood preservation, to assume that brushing or spraying wood preservatives on the surface of structural lumber or dipping individual pieces in preservative solutions will protect it from rotting, or from termite attacks.

WHY PRESSURE TREATMENT IS NECESSARY

The ineffectiveness of superficial applications was well demonstrated several years ago when a state highway department in the North Central states introduced roadside parks. For several years the early wooden buildings were brushed with creosote each year. When it was discovered that these structures soon had to be replaced because of early decay, brush coatings were abandoned in favor of pressure treated wood.

The effectiveness of standard wood preservatives properly applied by the pressure treating process has been proved by thousands of service records during the last 75 years. Those records have been attained by impregnating wood with a sufficient quantity of toxic standard preservatives, properly distributed throughout the wood and in sufficient depth to provide adequate protection against attacks of wood-destroying fungi, termites and marine borers.

Park structures of wood, because of their surroundings, year-round exposure to the elements, and frequently direct ground contact, may be exposed to severe decay and insect damage, as well as to fire hazards from careless or thoughtless visitors. The savings in maintenance and redecorating of pressure preserved structural wood effected over a long period of years offset by a wide margin its slightly higher initial cost.

Because building costs have increased so much during the last few years adequate protection of structural investments is now more important than ever. The long accepted practice has been to take out insurance against property damage or destruction by fire, high winds, or lightning. Home owners, for instance, take out such insurance and carry it for years, knowing that their homes may go 40 years or more without being destroyed or damaged.

However, there is another natural hazard about which building professionals are becoming increasingly aware. Fire, lightning, and high winds strike only on rare occasions in a specific neighborhood. Decay and termites, however, work around the clock, day in and day out, most of the year, in hundreds of communities throughout the United States. Damage by these destroyers of untreated wood often goes unnoticed until the owner is faced with very heavy structural repairs. With today's high cost of construction, the replacement of sills and studding often far exceeds the cost of protective measures. Surveys in several states have shown that thousands of homes less than 10 years old have been severely damaged.

Architects, builders, and owners are learning that the most effective, most economical insurance against these destructive agencies is the use of properly pressure preserved lumber in the structural danger zone of buildings. Modern lumber properly treated will not rot and will resist termite attacks for generations.

ADEQUATE PROTECTION NOT COSTLY

Contrary to general misconceptions, pressure preserved lumber is not expensive. The amount required for a house varies with geographical location, size and design. Limited protection may cost as little as $20 to $40 for the average size house in areas where termite and decay activity range from slight to moderate. Similarly in areas of moderate to heavy incidence of attack, comprising parts

or all of 28 states and the District of Columbia, minimum protection costs may range from $120 to $150. Very heavy incidence of decay and termite attack is found in Alabama, California, Florida, Georgia, Louisiana, Mississippi, South Carolina and Eastern Texas. Drywood termites, in addition to the subterranean type, are found in several of these states and are particularly active in Florida and California. Full protection comprising the treatment of all structural lumber is advisable in most communities of this eight-state area, especially in Florida and California.

Construction costs of homes recently built with pressure treated lumber from sills to roof boards indicate the additional cost ranges from 2 to 2½ percent. This amounts to about one-sixth the price of fire insurance during the life of a long-term mortgage. Actually in many areas it costs less to use modern treated lumber than to pay bills for replacing untreated lumber that has been destroyed.

MARINAS NEED GOOD PLANNING

Although lumber and timber are among the most popular and economical structural materials for marinas, they require preservative treatment because of the severity of exposure. Because large multi-million-dollar developments usually are designed and built by experienced engineers and architects, their specifications call for wood adequately pressure treated with standard preservatives.

During the next few years hundreds of relatively small marinas will be built by individals, clubs or social organizations. Wherever these undertakings lack experienced guidance they may be exposed to the advertising blandishments of packaged wood preservatives. These products are intended for brush, spray or dip applications and, regardless of the effectiveness of the preservative, cannot provide the long life required for marina structures. That can be attained only through thorough pressure impregnation of wood in a sealed cylinder.

Wood piles properly preserved by pressure treatment are more appropriate than steel or concrete for marina support, in the opinion of many authorities on the design and construction of modern facilities for the berthing and servicing of pleasure craft. These authorities also recommend pressure preserved timbers and decking plank for durability because the additional service life imparted by good treatment will more than outweigh the added cost.

Fifty-nine years in marine borer-infested waters of San Francisco Bay and still usable was the inspection record of pressure creosoted wood piles and timber in a ferry slip built at Sausalito by the Northern Pacific Railway Co., in 1898. Thirteen engineers, specializing in waterfront structures in New York City area, inspected creosoted wood piles during the dismantling of Pier 3 in the East River near the foot of Fulton Street, Brooklyn, in 1957. Despite abrasion caused by flotsam in the tidal zone, those 68-year-old piles were found to be structurally sound and in the opinion of the inspection party were good for many more years of service.

When a Southern community built a 60-boat marina, pressure preservative treatment of the wood was eliminated to cut costs. Although the marina reportedly paid for itself in two years, it collapsed during the third year because of rapid decay and marine borer attack. Such flagrant misuse of wood and the superficial application of preservatives can lead to early failure.

POLE BUILDINGS PARE BUDGETS

The growing popularity of pole-type buildings throughout the nation is well emphasized by the fact that some 50,000 now are in use in this country and Canada. They got their start on the farms because of their low first cost and the fact that pressure preserved wood is long-lasting and requires very little upkeep. Pole buildings cost less because usually the grading of the site is limited, excavation is restricted to boring holes for poles, and costly masonry foundations are not required. The entire framework of the building is supported by pressure preserved poles, which are available from lumber supply yards in standard sizes, ready for installation. Little if any framing is required because the girts, rafters, purlins, or other lumber members usually are employed in their standard sizes. The contractor requires no heavy erection equipment because of the relatively light weight of the various building components.

Because pole-type buildings are America's best answer to high construction costs, the last few years have seen their adaptation to a great variety of uses, some of which would have been considered impossible a short time ago. Park

and business-type pole buildings have ranged in cost from a low of $1.90 to high of $4.50 per sq. ft. with an average for the majority between $2 and $3 per sq. ft.

A REPORT FROM NPS

The qualifications of pole-type buildings for hurricane belts are revealed in a letter to *Wood Preserving News* from John B. Cabot, supervising architect, eastern office, Division of Design and Construction, National Park Service, United States Department of the Interior. The department's properties include all types of structures that are used by park visitors, and by administrative and service personnel, ranging from hotels, cottages, and camping areas, to office, service and storage buildings. Mr. Cabot wrote:

"Hurricane Donna seemed to have a particular affinity for National Park Service areas as it came through Florida and up the East Coast. I thought you would be interested in knowing how well wood pole buildings came through. When I first arrived in Florida, within a day or two of the end of the storm, the places that Hurricane Donna hit with full force, such as our area at Flamingo in Everglades National Park, looked like a complete shambles. Concrete block buildings, though stoutly built and fully in accordance with hurricane codes, suffered worse than other types of construction. Reinforced concrete construction came through well. I was amazed though that wood pole construction, which can be achieved so much more reasonably than reinforced concrete, came through as well as any other form of construction.

"At Flamingo we have an old fisherman's house that has been scheduled for demolition for years. When we schedule a building for demolition, it has the effect of preventing a park from doing any major maintenance work on the structure. Before the storm this building was in poor shape. After it, however, its condition was relatively unchanged.

"At Cape Hatteras, where we have consistently used pole-type construction along the entire Outer Banks in our comfort stations and residences, the effect of the storm was hardly noticeable. New inlets were created, roads were lost, and sand dunes disappeared; but in some 15 pole-type structures, the damage consisted of a small amount of roofing on one comfort station and two screen doors. This is testimony enough to me that this type construction is admirably qualified for the hurricane belt."

PROTECTION AGAINST FIRE

Designing architects and engineers who like inherent qualities and economies of wood are more and more extensively specifying use of fire retardant treated (FRT) wood products as construction materials.

Adding fire retardant treatment to wood's basic characteristics of beauty, warmth, acoustical and insulating qualities, high strength-to-weight ratio and stability when exposed to high temperature reduces heat contribution, flame spread, smoke development, and eliminates afterglow in the material.

In a recent article, entitled "Wood With a Future," the *Journal of American Insurance* described the material in these words:

"Fire retardant wood is as unlike natural wood as steel is unlike pig iron. Expose a piece of it to a blow-torch and the surface slowly chars but does not burst into flame. Splash it with blazing gasoline and the flames will flicker out as soon as the gasoline is consumed. Rot and mold shun its fibers, and insects find it an unpalatable meal."

Many fire insurance companies have accepted FRT wood and wood products at the same rates as noncombustible steel, concrete and masonry because these firms, in cooperation with Underwriters' Laboratories, Inc. (UL), have developed a qualification standard for treated materials.

Progressive communities have amended their building codes to allow use of fire retardant treated forest products in specific instances where noncombustible materials are required. Included in this group are Baltimore, Cincinnati, Cleveland, Dayton, Denver, Kansas City, New York, Houston, Sacramento, Evanston, South Bend, Ann Arbor, Atlanta and Seattle; the California State Fire Marshal's Regulations; Anne Arundel, Baltimore, Montgomery, Prince George's and Howard counties, Maryland; and Arlington and Fairfax counties, Virginia.

Approval for use of FRT wood in roof assemblies and decking wherever steel is required in the state of Indiana has been announced by Bert J. West-

over, administrative building code director. The material also may be used in partitions that the Indiana code requires to be noncombustible.

These treated wood products can be used in schools, hospitals, farm buildings, hotels, motels, bowling alleys, supermarkets, office buildings and all other types of commercial and industrial structures.

Today's permanently fire-protected lumber is manufactured by the use of tested and selected chemicals. These are impregnated in wood under high pressure in sealed cylinders. During this process the protective chemicals are driven deeply into the wood to provide permanent protection against fire. The chemicals will remain in the wood indefinitely as long as the surface is not exposed to running water. These new products should not be confused with mere fire-retardant surface coatings which provide protection for relatively short periods of time and which also require periodical reapplication.

After pressure impregnation, fire-protected lumber is kiln dried to remove excess moisture and the chemicals are left imbedded deep in the wood. When the lumber is shipped from the treating plant, its moisture content does not exceed 19 percent and it is ready for any building purpose.

The chemical salts fill the air spaces in the wood and thus reduce the amount of oxygen available for combustion. When the wood is exposed to sufficient heat the salt crystals melt and release noncombustible gases that smother the flames and retard their spread. Then as the area of the wood exposed to the fire begins to char, other salts fuse to form an insulating glaze over the wood.

Structural members of FRT wood retain a large part of their strength even under very high temperatures, thus preventing sudden collapse of the building. FRT wood also helps to keep contents fires small and localized until they burn themselves out or firemen arrive. Also smoke and heat are reduced to a large extent.

During World War II, because of steel shortages, the U. S. Navy built several huge blimp hangars of fire-retardant wood. That at Tillamook, Oregon, later was converted to a plywood factory. It caught fire in 1955 when shavings ignited in an exhaust duct and the flames raced up the asphalt roof. Despite the fact that fire department water streams were too weak to reach the fire, wooden rafters and decking resisted the flames until they went out leaving the building and equipment intact. Replacement would have cost approximately $7.5 million, but actual repair bills amounted to only $21,000.

Contrast that fire with the blaze that destroyed General Motors' Livonia transmission plant in 1953. That so-called "fireproof" building comprised a metal roof supported by steel trusses. In minutes the roof deck buckled and collapsed under heat of fire. The entire 34½-acre building and its contents were ruined with a loss of $55 million.

Factory Mutual Laboratories recently erected roof assemblies of (a) insulated metal and (b) fire-retardant wood for test purposes. These were subjected to direct flames from gasoline burners for 60 minutes. The metal deck began to buckle after 8 minutes and 10 seconds with ultimate distortion so severe that it would have caused a building to collapse. The wood deck remained structurally sound throughout the test although the decking charred through after 53 minutes.

A FEDERAL-AID PROJECT TO DEVELOP WATERFOWL WINTERING HABITAT IN A SOUTHERN MARYLAND WOODLAND

By G. NELSON BEVARD
Engineer
Maryland Game and Inland Fish Commission

For the past ten or twelve years the Maryland Game and Inland Fish Commission has carried on a program of development projects to increase the value of its tidal marshland as wintering habitat for waterfowl. All of this previous work has been accomplished on lands located on the lower portion of Maryland's Eastern Shore. In reviewing work done and opportunities for additional projects