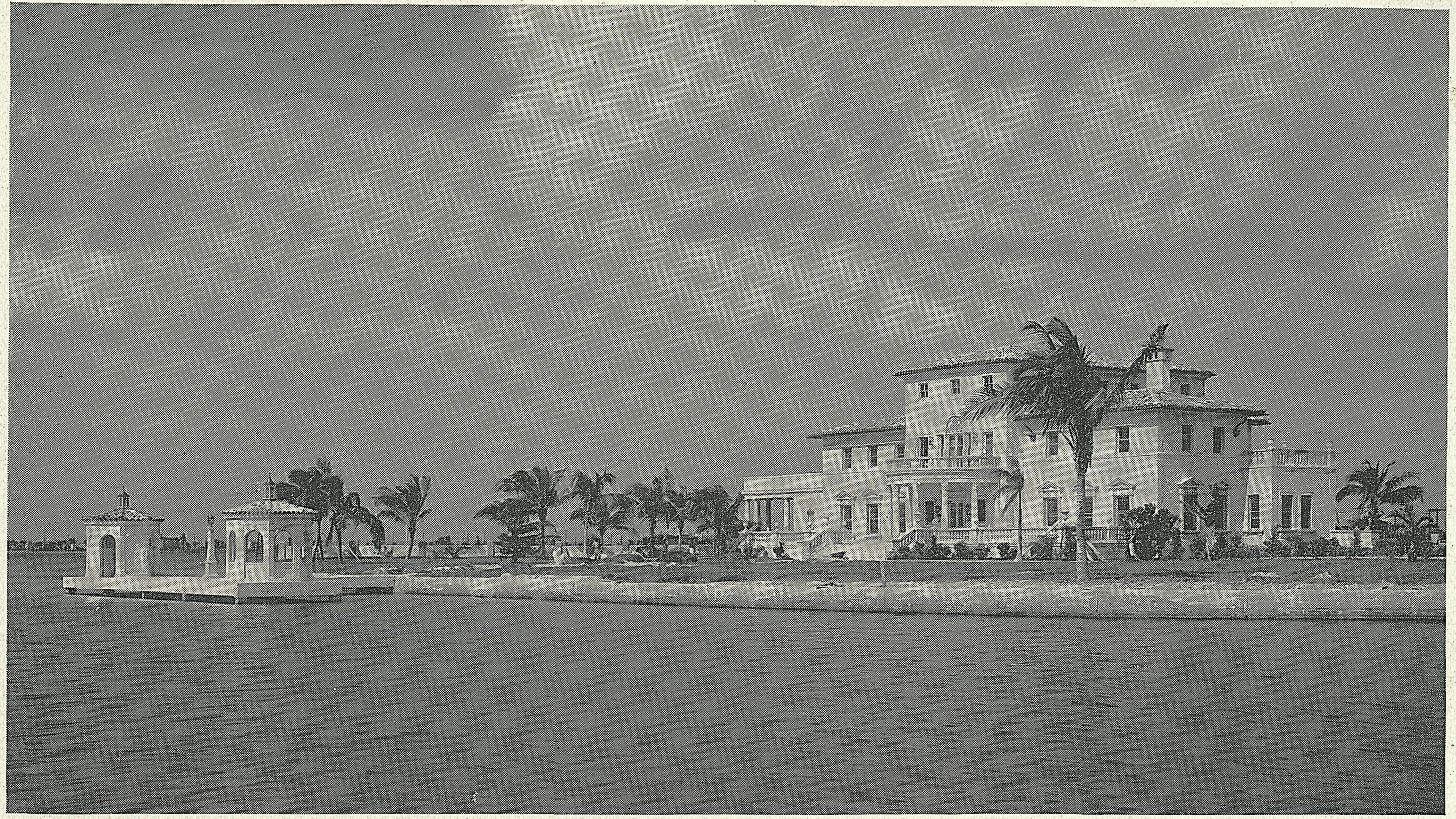

A cast-in-place concrete sea wall made possible the location of the beautiful residence of Carl Fisher at Miami Beach, Florida. This wall was constructed in 1927. August Geiger, Architect. The pleasure-boat landing dock is concrete also.

placed will add greatly to the appearance of the wall. Where conditions warrant, the general type of structure can be made to harmonize with the architectural scheme of the property development. These possibilities for architectural treatment may be best realized with concrete. No other material so readily expresses the ingenuity of the designer.

Structural Design

While conditions peculiar to individual locations cannot be discussed in general terms, there are, however, certain basic factors that should always be considered.

Wave Action

The force of wave action, especially during onshore storms, is particularly severe. Unfortunately wave motion is such a complex action that it has been impossible to deduce any general mathematical relationships that have application in every location. The impact force of a wave depends upon five things: 1—the nature of the wave; 2—its length; 3—its velocity; 4—the nature of the body the wave strikes; 5—the size, position and shape of that body. These indicate that each coastal condition presents a problem in itself and must be studied and treated individually.

The impact exerted by a single wave has been known to exceed 6000 pounds per sq. ft. Impacts of 5000 to 6000 pounds have been recorded along the Atlantic Coast. Waves on the Great Lakes have shown impacts of 1500 to 2500 pounds per sq. ft. This shows the importance of designing structures with sufficient strength to arrest wave force in successive attacks. No other force of equal intensity so severely tries each part of a structure, and so relentlessly seeks out the weak spots or faulty details of design and construction.

Earth Pressure

Earth pressure with superimposed loads on the reverse side of a wall must be considered in the design. This problem is the same as considered for any retaining wall and should never be overlooked.

Contraction and Expansion

In walls of any length, contraction and expansion must be considered. Like most building

materials, concrete contracts as the temperature falls, and expands as it rises. The volume of concrete is also affected when it hardens; shrinkage taking place when hardened in air, and some expansion when hardened in water. Definite joints should be provided to allow for these variations in volume.

The average value of the coefficient of expansion due to temperature changes is 0.0000055 per degree Fahrenheit, which is very nearly that of steel. When steel is embedded in concrete, the two materials will, to all practical purposes, act together under changes of temperature.

For average concrete mixtures, shrinkage due to drying in ordinary indoor atmosphere may amount to .06 per cent, two-thirds of which will occur in from 30 to 60 days. Only about one-half this amount is likely to occur in outdoor exposure. In a period of time permitting a drop in temperature of 100 degrees F., the contraction due to atmospheric change would amount to 0.00055 in. per inch of length and due to drying out of the mass, 0.0003 in., or a total of 0.00085 in. per inch of length when the two act together. In a structure 50 feet long, this total contraction would amount to approximately ½ inch. This is the range in length that should be provided for by expansion joints.

If joints are not provided at suitable intervals, contraction will manifest itself in cracks. While cracks from this cause may effect no structural weakness, they will permit the entry of water and destructive agents. In reinforced walls this is particularly undesirable, as water and air reaching the embedded reinforcement, start cor-

Yacht basins and small boat harbors in protected locations are frequently made with the use of concrete sheet pile bulkheads with cast-in-place coping. The piling is jetted or driven, forming the desired landscape pattern, after which the made-land is hydraulically placed. This attractive basin is in front of the Mirasol Hotel, Davis Islands, Tampa.