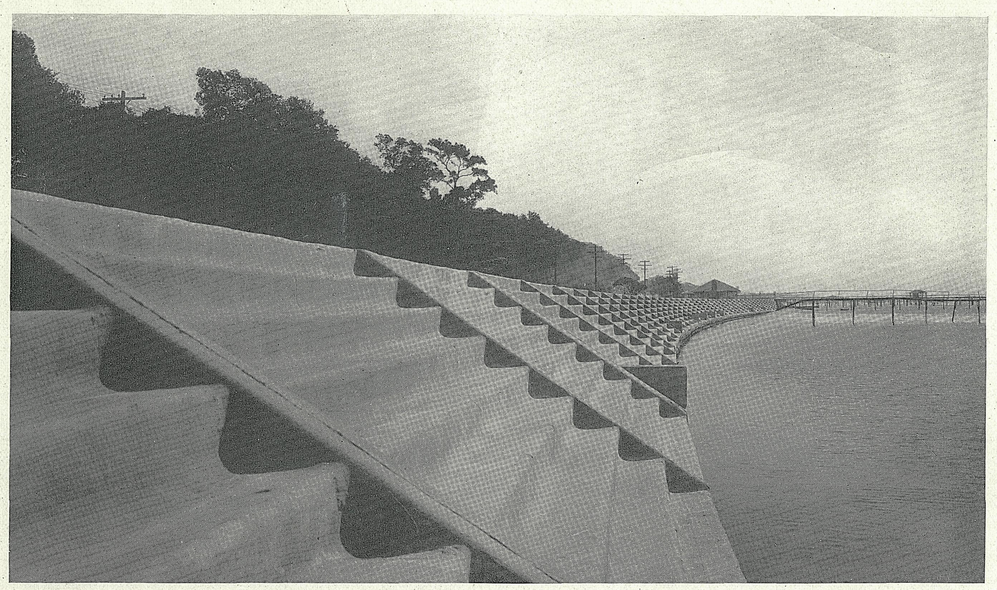
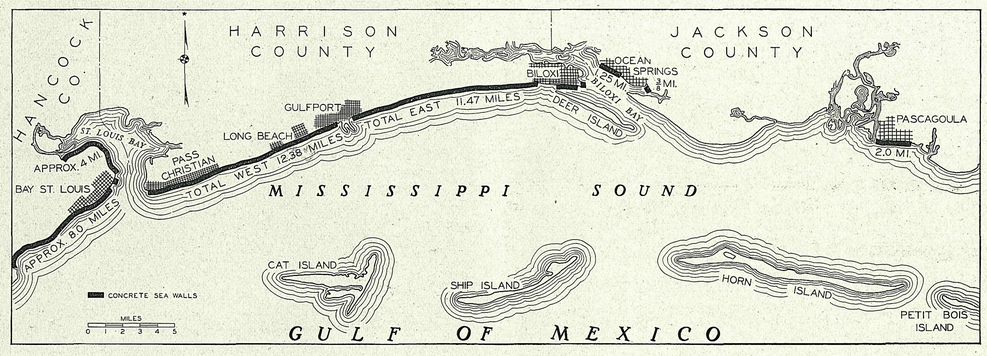


Stepped type of wall protecting the Gulf Boulevard through Harrison County, Mississippi. The protruding structures on the lower steps seen at irregular intervals are drainage outlets from the roadway. At alternate sections of the wall can be seen contraction and expansion joints containing compressible filler.

the paste, is the extent to which the chemical reactions are allowed to progress. The continuation of these reactions in portland cement requires favorable curing conditions; that is, moderate temperatures and the presence of moisture. It is through curing that the internal structure of the concrete is built up to provide strength and watertightness.

The full strength and watertightness of concrete is not attained as soon as the cement has set. In fact it continues to harden and become more watertight for an indefinite time, but the process is particularly rapid during the first 10 days or two weeks. During this period the presence of water is required. It can be understood readily that if the concrete is allowed to dry out, the



The heavy black line along the shores of Mississippi Sound indicates 39½ miles of concrete protective structures that have been completed. This is probably the longest piece of continuous concrete shore protection in existence.

chemical combination between the cement and water will cease further development. The strength and watertightness developed will be determined largely by the length of time favorable curing conditions are present. The concrete should be kept moist for a period of at least 10 days or two weeks. Longer curing is beneficial, while insufficient curing may defeat every other care exercised in making concrete.

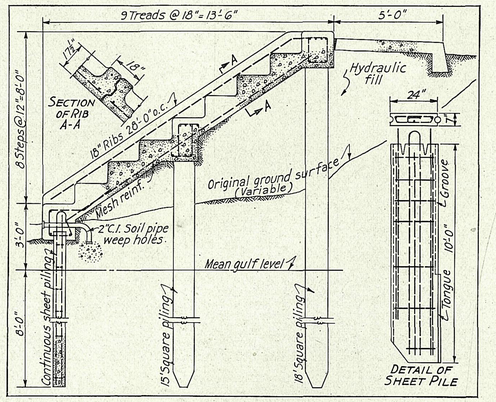
In shore protection structures, curing is of most vital importance, for inadequately cured concrete cannot long resist the extreme exposure to which these structures are commonly subjected.

Characteristics, Size and Grading of Aggregates

Without sound aggregates, durable and sound concrete cannot be made. Aggregates which will rapidly disintegrate under the influence of weathering agencies will not endure indefinitely in a concrete structure, even with the protection afforded by the cement paste by which they are surrounded.

Most of our common rocks and gravels are highly resistant to the ordinary processes of weathering and exposure. New and untried aggregates should be subjected to tests for soundness and durability before being used.

Grading and the size and shape of aggregate particles are commonly recognized as properties affecting permeability of concrete. A clear understanding of the true significance of these factors



Typical detail of the stepped type of concrete sea wall built along the Gulf in Harrison County, Mississippi. This wall was designed by H. D. Shaw, C.E., Gulfport, Mississippi.

is important to an economical design of concrete for durability.

The real importance of these factors lies in the fact that with the old method of specifying a certain fixed mix such as 1-2-4, aggregates of different properties required different amounts of water to produce the desired consistency. Thus different sizes or gradings gave widely different strengths and degrees of watertightness through the differences in the water-cement ratios resulting. As long as fixed mixes are made the basis of specifications, these will remain as factors of greatest importance, and since they are seldom properly controlled will cause wide variations in

Prior to construction of the concrete sea wall at Pass Christian, Mississippi, the fine old oak tree, as well as the roadway, was in constant danger of being washed away.

Contrasting picture with the one at the left. The greatly improved condition has been made possible by the stepped sea wall. The landscape now presented is one of the beauty spots along the Gulf Boulevard