

### Milwaukee Harbor Project

The Judy Company, Inc. used a fast setting sodium silicate-cement grout to rescue a crumbling breakwater in Milwaukee Harbor for the Corps of Engineers. The rehabilitation contract was valued at \$2.4 million, and was completed 45 days ahead of schedule. An alternative rehabilitation plan, to put new steel sheet piling on the structure, would have cost \$50 to \$60 million.



The North Detached Breakwater was rehabilitated using grouting as a unique means of repair. The existing structure consisted of stone filled timber cribs constructed in the 1890's, which were encased in steel sheet piling and capped with a concrete superstructure in the 1950's. Over the years, the stone fill within the timber cribs had settled, creating a 3 to 4 foot void between the bottom of the concrete cap and the top of the stone fill. This void condition resulted in settlement of the concrete superstructure and subsequent failure of the steel sheet piling.



## **SOLUTION**

As a means of resupporting the concrete cap and relieving the stress on the steel sheet piling, a two-phase grouting concept was used. After drilling approximately 3200 holes in the concrete cap, 2600 cubic yards of quick-set grout was injected along the outer edge of the structure to form a barrier wall. The quick-set grout was formed by the combination of a sodium silicate solution and a cement solution, which when mixed in the proper proportions became a solid in less than one minute. The quick-set barrier walls served to confine the second type of grout, a sand/cement grout, of which 9,250 cubic yards were injected into the center of the structure to fill the remaining void.

