72-Inch Pipe Stabilized With Chemical Grout

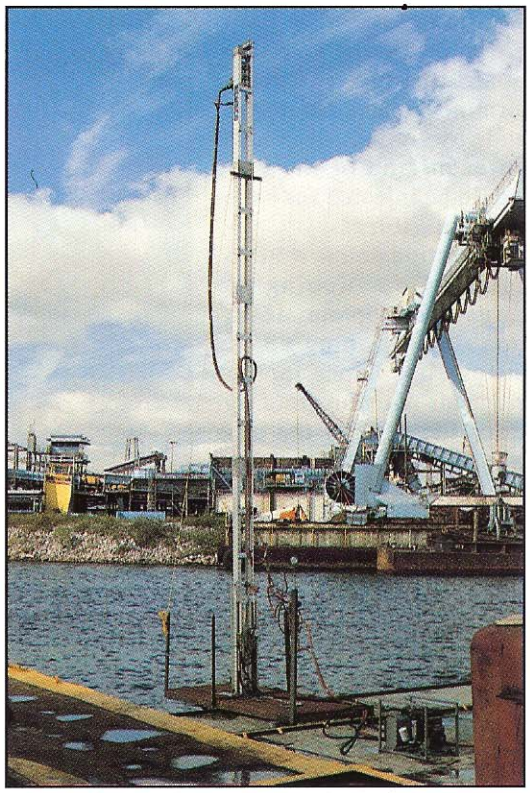
At a paper mill in Alabama, a weakened joint was found in a six-ft diameter pipe carrying more than two million gallons per hour of effluent. To make it even more of a problem, the pipe was buried under 40 feet of water and silt in Chickasaw Creek, a navigable artery of the Mobile River.

B.J. Schrock, P.E., JSC International Engineering, Carmichael, Calif., was called in to evaluate the problem. Along with Clay Griffin, project engineer from Rembco Engineering Corporation, Knoxville, Tenn; Don Mack, technical director, Avanti International, Webster, Texas; and George Vernon, site construction manager, Scott Paper, Everett, Wash., they were able to execute a plan that resulted in placing approximately 6500 gallons of acrylic grout at 72 locations along 70 feet of the pipe to stabilize it in its bed. The entire project took 27 days.

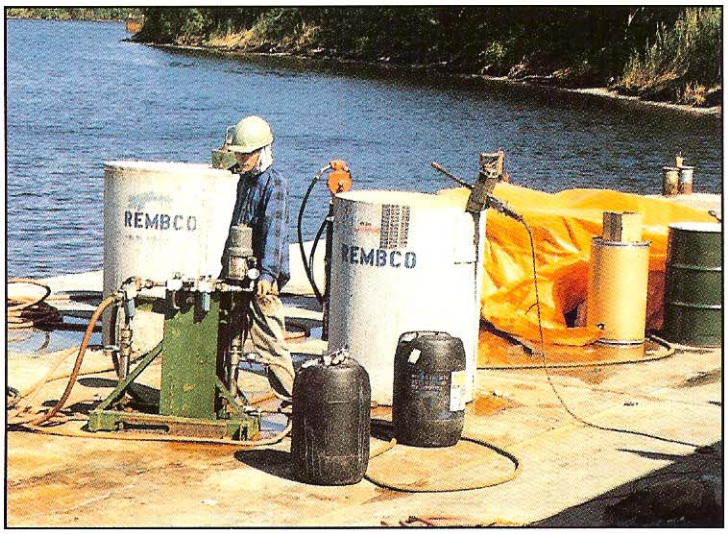
Scott Paper Company's plant in Mobile, Ala. was the site of the job. The pipe had been damaged and repaired during the original installation in 1977-78, and in 1991 the weakened joint was discovered. Further investigation revealed increasing levels of distress due to shifting of the bedding material. The joint was repaired using an internal seal which was installed by divers, but in 1992 it was proposed to replace the line at an estimated cost in excess of $6 million.

Scott Paper's policy is to investigate other options when an improvement of this magnitude is anticipated. Based on the recommendations of Schrock, it was determined that chemical grout stabilization was a viable option that would prevent further movement of the pipeline and eliminate the need to replace it.

A detailed investigative program was developed which included independent laboratory analysis of grout and grout/soil compressive testing. Soil samples used in the testing were taken from the creek bed adjacent to the pipe. Avanti contracted with Southwest Laboratories in Houston to conduct compressive tests on the various ratios of the grout and soil mixes.



Grout rig tower on work platform.



Material proportioning equipment in front of the grout (left) and water supply tanks. The grout was injected every two feet.

Based on this testing it was determined that 50 to 75 percent grout to total volume would provide optimum strength. More importantly, it would lock the sand grains together, minimizing soil movement.

Rembco Engineering injected the chemical grout from a floating platform which was supported using two barges. One of the barges was secured parallel to the pipeline along a surveyed line corresponding with the area to be grouted. The second barge, on which the grout rig was mounted, was held alongside the primary barge using cables and winches. As grouting progressed along the pipeline, the grout barge was moved along the primary barge, allowing precise positioning with minimal surveying.

The grout used in the project was AV-130, a low viscosity acrylic grout distributed by Avanti. AV-130 was selected as the most suitable grout based on cured strength, material cost, viscosity, gel time control and environmental concerns. The final formulation produced a stiff material with a gel

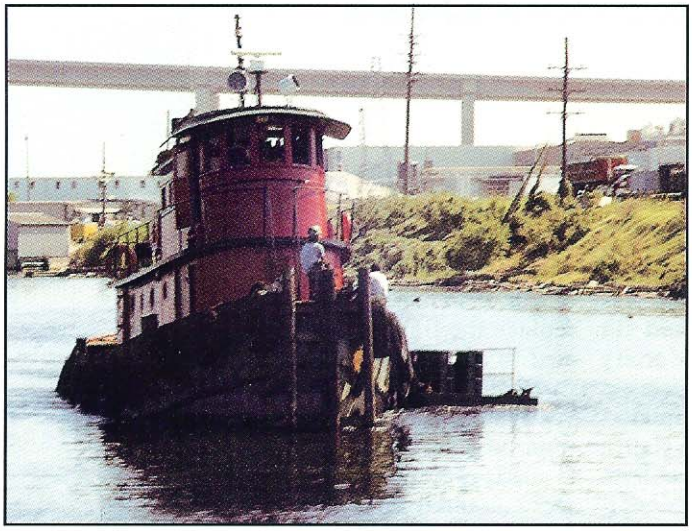
This article is extracted from a paper presented by B. Jay Schrock, JSC International Engineering, Carmichael, Calif., at No-Dig '94, Dallas, Texas.

time of about seven minutes. Based on injection tests, a maximum flow rate of two and one-half gallons per minute was used in all injections. Considering the rate of flow into the soil, and the gel time of seven minutes, the injection points were positioned two feet apart.

To insure the stabilization of the pipe it was determined that a three-foot wide by six-foot deep band on each side of the pipe would be injected for a distance of 70 feet.

Injection points were located by positioning the barge at the appropriate station, then probing across the pipeline in one foot increments with the grout rig. Once the edge of the pipe was established, grout was continuously injected in a top-down manner from one foot above the top of the pipe to one foot above the bottom of the pipe, for a grouted depth of six feet. This process was repeated for each of the 72 injection locations.

Following the placement of the grout, standard penetration tests were conducted by the Geotechnical Engineering-Testing Company, Mobile. The penetration tests were performed approximately every ten feet along the pipeline within the grout zone. The soil samples from each test location contained grout, verifying the complete saturation of the area.



Work tug transporting chemical grout containers to work platform. All of the work on this project was done from floating platforms secured parallel to the pipeline.

The summary report which was submitted to Scott Paper stated that the volume of chemical grout used was greater than expected, due primarily to grout migration at each injection point and through loss at the top and bottom of the soil adjacent to the pipe. The on-going core sampling indicated that the sandy soil adjacent to the pipeline was fully grouted, and that acceptable stabilization had been attained. These benefits were achieved at a cost that was less than eight percent of the estimated cost for complete replacement.

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