

# PROJECT PROFILE

## BLUFF STABILIZATION ALONG MISSISSIPPI RIVER NEAR HICKMAN, KENTUCKY

Gradual erosion of a 100-foot-high, 500-foot-long section of a loess bluff located above the Mississippi River was progressively encroaching on residential and public properties in Hickman, Kentucky. As part of an open-end contract for the US Army Corps of Engineers, Memphis District, D'Appolonia was retained to conduct preliminary analyses of suitable alternatives for stabilizing the bluff and to prepare final design drawings and specifications for the selected alternative.

Based on geotechnical information supplied by the COE, two modes of instability were identified. The first mode involved shallow failures of the loess comprising the upper bluff, as large quantities of ground water exited the bluff from an approximately 10-foot-high sand and gravel layer located at about mid-slope. The seepage eroded the colluvial material covering the slope and subsequently undercut the loess. The second mode of instability related to deep-seated movement of the berm area at the toe of the bluff along the top of a highly plastic clay layer.

The selected design consisted of a tiered soil-nailed (1H:1V) slope. The



*150-foot-high bluff situated along the Mississippi River during construction of a 95,000-square-foot stabilization system that incorporates soil nails and prestressed soil anchors.*

soil-nailed slope was tiered to allow for construction of a reinforced soil slope in order to re-establish the crest of the bluff and to allow for reconstruction of the road at the crest. The design incorporated horizontal drains to control the ground water in the sand and gravel stratum and prestressed soil anchors to provide additional stability against global slope failures.



*Pre-production soil nail load test.*



*Drilling for installation of one of over 1,500 soil nails used in the stabilization system.*

During wall construction, D'Appolonia field personnel visited the construction site periodically to observe field activities. As a result of this monitoring effort, the wall design was modified to address slope erosion that developed following a period of heavy precipitation. The heavy precipitation events consisted of a 100-year-recurrence-interval storm and a separate 50-year-recurrence-interval storm occurring in the same week. The heavy rainstorms caused a portion of the temporary bench to fail. The alignment of the wall was modified somewhat to allow for construction to continue.