Sinkhole Occurrence in Mississippi's Earth Dams

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More than two hundred floodwater retarding structures have been built in the Southern Mississippi Valley Silty Uplands in the Northern part of Mississippi. Sinkholes, also called jugholes, have formed in many of these dams, making them unsafe for the intended use.

The problem area is in the Southern Mississippi Valley Silty Uplands in an area of soils formed in loess. The area begins on the east bluff of the Mississippi River Valley. Here the wind-deposited silt is several feet thick. It thins rapidly toward the east. The topography is steep with narrow ridges and narrow valleys. Drainage is toward the Yazoo-Mississippi Valley to the west. Elevation ranges from about 150 feet at the base of the bluffs to 300 feet in the bluff hills. Rainfall is about 52 inches annually. Sinkholes have been observed in a 20-mile wide band along the bluff line.

Typically the holes are about 18 inches in diameter and 4 feet deep, although they range from less than 4 inches across for newly developed holes to as much as 5 or 6 feet for old ones. The holes eventually turn to the horizontal and surface again several feet below the entrance. The holes form a tunnel which finally collapses and leaves an open gully. Sinkholes are most likely to occur within 2 to 5 years after construction of the dam. Although sinkholes in dams have received most of the attention, they have also been observed along road cuts and road fills. One airport has been severely damaged.

Theories as to the cause of these holes have been as varied as the people who have observed them. Local explanations are that they are caused by plant roots, ants, snakes, rodents, or other burrowing animals. None of these appear likely.

Studies of individual sinkholes suggest a combination of at least two factors that influence their development. They are the inability of small cracks to reseal and the dispersive nature of the soil. The holes are believed to begin as small cracks, probably caused by settlement or drying. Because of the low clay content and uniform soil particle size, there is a tendency for the cracks not to completely reseal after wetting. Clay content ranges from about 7 to 22% and averages about 16%. Sand content is generally low. These soils are nonplastic or have a low plasticity index.

Since the soils are dispersive, it is postulated that the clay fraction becomes deflocculated and individual particles go into suspension in water. This allows them to be carried about by water flowing through the cracks. The cracks gradually enlarge as more and more of the particles are removed. The convergence of several small cracks can cause water to accumulate in certain areas within the dam, sometimes along horizontal planes, and begin moving the suspended soil particles out at a more rapid rate. For this reason some holes are well established inside the dam before

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