Title
Centrifugal Modeling of Subsidence of Landfill Covers [abstract]

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A symposium on Recent Advances in Geotechnical Centrifuge Modeling was held on July 18-20, 1984 at the University of California at Davis. The symposium was sponsored by the National Science Foundation's Geotechnical Engineering Program and the Center for Geotechnical Modeling at the University of California at Davis.

The symposium offered an opportunity for a meeting of the International Committee on Centrifuges of the International Society for Soil Mechanics and Foundation Engineering. The U.S. participants also met to discuss the advancement of the centrifuge modeling technique in the U.S. A request is being transmitted to the American Society of Civil Engineers to establish a subcommittee on centrifuges within the Geotechnical Engineering Division.

"Centrifugal Modeling of Subsidence of Landfill Covers"

by

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Volume reduction and settlement of wastes in controlled and uncontrolled burial sites may result in subsidence of the soil cover system. Following subsidence, water flow through the cover may rise dramatically due to piping through tension cracks in the cover and ponding over depressed areas. This water, which becomes contaminated, can then pose a hazard to the local groundwater if leakage through the bottom liner system takes place. The design and construction of cover systems which reduce the adverse effects of subsidence is an important step in reducing the potential for groundwater contamination.

A centrifugal modeling procedure for laboratory study of landfill cover subsidence was developed at the University of Kentucky in an EPA-sponsored investigation of the hydrologic integrity of multi-layered landfill covers under stable and subsidence conditions. During the summer of 1983, funds from the study were used to construct a 1.14 m (3.75 ft) radius centrifuge capable of accelerating a 27 kg (60 lb) sample to 100 G's. Two field scale landfill covers were constructed in central Kentucky and serve as prototypes for the centrifugal modeling.

The prototypes' 61 cm (24 in.) thick cover layer is modeled in the laboratory at 1/24 scale. While being accelerated, the clay model layer is supported on a 28.5 cm (11.5 in.) diameter, rigid aluminum disk within a cylindrical container constructed of aluminum and plexiglass. Several molds have been formed to simulate depressions (and thus subsidence) of various amounts. These depressions simulate cavities ranging from 0.61 m to 4.9 m (2 to 16 feet) in diameter. The mold is beneath the model layer and connected to the aluminum disk. The container is equipped with a gauge to determine the magnitude of subsidence with time.

The testing procedure consists of: 1) preparing the 28.5 cm (11.5 in.) diameter, 2.5 cm (1 inch) thick model cover layer to a specified moisture content and compaction density; 2) selection and placement of a mold into the cylindrical container; 3) filling the depression in the mold with lead shot and then placing the model layer on it; 4) measuring the surface profile of the clay layer; 5) placing lead shot onto the top of the model layer to simulate other soil layers above it; 6) attaching the container and a counterweight to opposing arms of the centrifuge; 7) accelerating the specimen to 24 G's and maintaining this acceleration for a period of time sufficient to allow the excess pore pressures to dissipate; 8) simulating subsidence by releasing (using a solenoid valve) the lead shot in the depression of the mold; 9) measuring, with the gauge, the movement of the clay layer surface with time; 10) decelerating the container; 11) removing the container; 12) taking a profile of the surface; and 13) photographing both sides of the specimen and taking samples for determination of the soil's properties. The studies are being conducted to investigate the effects of soil moisture content and density, soil composition, soil chemistry, and cavity diameter on subsidence.