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B.F. Sisk Dam and San Luis Reservoir are located on San Luis Creek and Cottonwood Creek, about 12 miles west of Los Banos, California. The dam was built between 1963 and 1967 to provide off-stream water storage for a variety of water usages, including irrigation. The dam is a zoned earthfill structure with a maximum structural height of about 380 feet and a crest length of 18,600 feet. Dynamic deformation analyses were completed to assess the performance of the existing dam and develop modification alternatives for seismic risk reduction.

The dam is divided into four representative sections: (1) an abutment section founded on bedrock; (2) an abutment section founded on clayey slopewash material with low undrained shear strength; (3) a North Valley section founded on potentially liquefiable cohesionless deposits; and (4) a South Valley section founded on about 100ft of clayey alluvial deposits with a potential for strength loss during an earthquake. Because the slopewash and alluvial soils were not excavated from beneath the shells of the dam, it was anticipated that the seismic deformations would be largely controlled by the seismic strengths for the foundation materials and recent investigations had been primarily focused on characterization of those materials. The characterization for the well compacted Zone 1 clay core and the similar Zone 3 clay material in the upstream slope was based on construction era documentation and limited laboratory strength testing.

Preliminary dynamic deformations analysis of the section on bedrock resulted in larger crest settlements than expected due to significant deformations through the Zone 3 clay in the upstream slope of the embankment. These results were inconsistent with historic performance of well compacted clay cores and the associated risk reduction modification alternatives were costly to construct for the length of the dam. Therefore, an extensive field and laboratory testing program was conducted to better characterize the Zone 1 and Zone 3 shear strengths. The test results supported the use of higher strength values in the upper portions of Zone 1 and 3, which resulted in smaller seismic deformations within the embankment dam and significant cost savings for the modification alternatives.