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Model testing of biotechnically reinforced slopes in geotechnical centrifuge

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Soil bioengineering is the use of live plant materials to stabilize eroding slopes and streambanks. In many cases, soil bioengineering approaches may provide cost effective solutions to slope stabilization against shallow slides. Unlike other technologies in which plants are mainly used for aesthetic purpose, soil bioengineering utilizes live plant parts to provide soil reinforcement and prevent shallow slides. Live staking, live fascines, brushlayers, branchpacking, and live gully repair are soil bioengineering techniques that use stems or branch parts of living plants as initial and primary soil reinforcing and stabilizing material.

Unlike traditional geotechnical structures, the design of biotechnical reinforcement is primarily based on experience and empirical methods. This is mainly because of lacking quantitative laboratory and field test data. Full scale tests are usually rather costly. The geotechnical centrifuge provides an attractive possibility to test biotechnically reinforced slopes in small scale models. The present paper reports several model tests on biotechnically reinforced steep slopes in a geotechnical centrifuge. The plant reinforcement is modelled by jute fibres. The frictional behaviour between the jute fibres and soil is determined by pull-out tests. The model slopes are about 60˚ steep and 10 cm high. The models are brought to failure by applying a radial acceleration of up to 90 times Earth gravity. The factors of safety are then back calculated based on the slice method of Bishop. The implications for the design practice of soil bioengineering structures are discussed.