A Large Scale Test System to Investigate MSE Soil Reinforcement-Backfill Interaction

P.W. Jayawickrama[1], W.D. Lawson[2] and T.A. Wood[3]

Mechanically Stabilized Earth (MSE) retaining wall systems represent by far the most widely used type of retaining wall used by the transportation industry in the United States. These retaining walls have three primary components: (a) wall facing, (b) soil reinforcement and (c) select granular backfill. Precast concrete panels with typical dimensions of 5ft×5ft are most commonly used as wall facing while galvanized steel strips and grids are most common among soil reinforcement. The integrity of these wall systems relies heavily on proper interaction between soil reinforcement and the granular backfill. More specifically, pullout resistance of the reinforcement that is embedded in the backfill is an important design parameter that controls the internal stability of the wall system. In routine design practice, the pullout resistance is estimated based on semi-empirical equations that have been developed based on available test data. However, there are several drawbacks in the use of such semi-empirical equations. First, these semi-empirical relationships represent a broader range of backfill including some low quality material. Therefore, they generally provide pullout resistance estimates that are too conservative. Secondly, most of the pullout test data have been obtained from small scale test systems and therefore may not correctly simulate actual reinforcement-soil interaction that may occur under field conditions. Finally, none of the testing conducted to date has investigated alternative reinforcement configurations used in the field to circumvent obstructions behind the wall facing. This paper will describe a large-scale pullout test program conducted at Texas Tech University to fill the gaps in existing knowledge base. This pullout test system used has dimensions of 12ft ×12ft in plan and 4ft in height. It can accommodate 3 layers of soil reinforcement in a single filling. The pullout test system has the capability to simulate 40-ft of soil overburden. This is accomplished by placing 9 pressure plates, each 4ft ×4ft in size over the soil and by pressurizing a series of hydraulic jacks between the plates and reaction beams. The test program included two different types of soil reinforcement; (a) 2-in wide, 160-mil thick ribbed steel strips, and (b) steel grids with varying sizes of longitudinal and transverse bar sizes and spacings. The paper will provide a detailed description of the test system, test procedure and provide an overview of significant findings from over 250 pullouts tests that have been completed to date.

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Authors Details;

1. Associate Professor, Department of Civil and Environmental Engineering, Texas Tech University, Lubbock, TX 79409, USA. priyantha.jayawickrama@ttu.edu
2. Assistant Professor, Department of Civil and Environmental Engineering, Texas Tech University, Lubbock, TX 79409, USA. william.d.lawson@ttu.edu
3. Research Associate, Department of Civil and Environmental Engineering, Texas Tech University, Lubbock, TX 79409, USA. timothy.a.wood@ttu.edu