University of Idaho NCATT (National Center for Advanced Transportation Technology)
and Idaho Transportation Department Cooperative Transportation Research Program **Research Brief**

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Installation of Soil-Pinned Geosynthetic Reinforcement for Slope Stabilization

The primary goal is to evaluate installation methods and long-term performance of a slope surface stabilization strategy based on soil pins and geosynthetic blankets.

Shallow soil slips (less than 1 meter thick) commonly occur on highway cutslopes that are 2:1 or steeper, comprised of native clay or silt soils, and which are prone to repeated freeze-thaw cycles and associated rain events during otherwise cold weather. Such conditions typically occur in the Inland Northwest from late autumn through early spring, causing numerous slope failures that clog roadside ditches with mud and leave bare, erosion-prone scars on the slopes. Although such cutslopes often are vegetated with reasonably good stands of grass, the rooting depth and tenacity often are not sufficient enough to resist shallow slope failures. Thus, the establishment of deeper-rooted shrubs, such as woods rose, snowberry, and oregon grape, would help resist such failures. However, these shrubs require several years to become sufficiently mature and pervasive enough to provide biogeotechnical support for a given slope; thus, artificial support is necessary for slope stability during the first years after seeding/transplanting.

One method proposed to meet this need for temporary slope support relies on a geogrid-reinforced, synthetic erosion control blanket (e.c.b.) pinned to the slope using 1 to 2-meter long dowels. The soil pins consist of threaded steel or fiberglass rebar sections that are driven or pushed into the slope. They provide shear resistance and some compressional load by the tightening of threaded nuts against steel plates at the ground surface.

A field demonstration site was selected along US 95 south of Moscow where a cutslope has been prone to shallow slips (MP 338.6). Details of the installation are given below.

Materials:

1. Two rolls of specially sewn geogrid-backed, synthetic erosion control blanket (each roll was 7.5 ft wide by 90 ft long to yield a coverage area of 75 sq.yards, or 68.5 sq.meters). The geogrid was Huesker Fortrac 55/30-20, which has a rated tensile strength of 3,700 lb./ft. (5.02 kN/m) in the machine direction and 2,020 lb./ft. (2.74 kN/m) in the cross direction. The synthetic e.c.b. was Bon Terra's SFB blanket, a 10-oz./sq.yard synthetic blanket comprised of polypropylene fibers and UV-stabilized netting. Cost: $8.90/sq.yd. ($9.74/sq.m).
2. Soil pins comprised of continuous-threaded, No. 6, grade 70, steel rebar with matching steel plates and nuts. The pins were 4-ft. (1.2-m) long and the plates were 6 in. by 6 in. square (152mm by 152mm). Cost per unit (one bar, one plate, one nut) was $9.60.
3. The seed mix consisted of intermediate wheatgrass, meadow brome, creeping red fescue, Canada bluegrass, woods rose, white Dutch clover, oregon grape, snowberry. Hydroseeding was a one-pass application using the following soil amendments: 100 lb. (45 kg.) of Quattro Fertil-Fibers™ and 0.5 gal. (1.9 liter) of Quattro Kiwi Power™ mixed with approximately 150 gal. (568 liters) of water. Cost of seed and amendments was $0.25/sq.yd. ($0.27/sq.m).

Procedure:

1. The failed and rill-eroded cutslope was smoothed and dressed using a rubber-tired backhoe.
2. A regular, staggered pattern for the soil pins was laid out using a 2-m spacing; the pins then were pushed into the ground using the backhoe bucket and a reusable, protective sleeve placed over each pin (Figure 1), and leaving about 4-6 inches of the pin exposed at the ground surface. A portion of the treatment area had weathered granitic bedrock near the ground surface, where the steel pins could not be pushed into the ground without damaging them.
3. The geogrid backed e.c.b. was rolled out on the ground surface and placed over the exposed pins (bars). Plates and nuts were installed on each threaded bar and tensioned by hand. Heavy-duty, 9-gage wire staples were used to anchor the e.c.b. along the toe of the slope and in the weathered rock area that lacked the threaded steel bars.
4. The steel pin assemblies were pushed/pounded into the ground an additional 2-3 inches with the backhoe bucket to tension the geogrid (Figure 2).
5. The project required 18 manhours and 7 equipment hr., bringing the total cost to $17.55/sq.yd. ($19.20/sq.m).

Project: Integrated Erosion Control Methods for Highway Construction and Slope Maintenance
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Figure 1. Installation of soil pins (No. 6, threaded steel rebar) using a backhoe bucket and driving sleeve; test site on US 95 south of Moscow.

Figure 2. Geogrid-backed, synthetic erosion control blanket after hydroseeding treatment and post-tensioning of soil pins; test site on US 95 south of Moscow.