



**Title:** LAUNCHED SOIL NAILS: NEW METHOD FOR RAPID LOW-IMPACT SLOPE REPAIRS

**Accession Number:** 00680787

**Record Type:** Component

**Language 1:** English

**Abstract:** A variety of methods have been used during the last 20 years to reinforce soils. One of these is soil nailing. Most often, soil nails are installed by inserting steel rods in drilled holes, then grouting them in place. Sometimes the nails are inserted using percussion methods. These methods generally require excavation of a working bench in order for the construction equipment to work below the slope being nailed. These methods are not suitable for repairing small slips of road fills and embankments where access is limited. Launched soil nailing, a new technique developed in the United Kingdom by Soil Nailing, Ltd., allows nails to be inserted into the slope using a launcher attached to the end of an excavator boom. With this method the nails can be installed into slopes up to 8 to 11 m (26 to 36 ft) above or below the road surface without excavation or ground disturbance. The launcher uses high-pressure compressed air to install the nail. The depth of penetration depends both on the compressed air pressure and on the in situ material. At a reproduction rate of 15 nails per hour, this method is rapid, yielding production results not experienced using conventional methods. In July and August 1992, the USDA Forest Service sponsored a demonstration project for launched soil nails to stabilize failing road slopes. Small slope failures [no deeper than about 4.5 m (15 ft)] can be stabilized for about \$150/sq m (\$14/sq ft) of slope face. Low retaining walls and excavate-and-replace methods typically cost \$161 to \$645+/sq m (\$15 to \$60+/sq ft) of face area. Equipment mobility, rapid placement, minimum site disturbance, and low costs indicate a strong future for launched soil nails for the repair of the road infrastructure.

**TRIS Files:** HRIS

**Pagination:** p. 240-251

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**Features:** Figures (9); Photos (4); References (2)

**Monograph Title:** [SIXTH INTERNATIONAL CONFERENCE ON LOW-VOLUME ROADS, MINNEAPOLIS, MINNESOTA, JUNE 25-29, 1995. CONFERENCE PROCEEDINGS, 2 VOLUMES](#)

**Monograph Accession Number:** 00680715

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**Availability:**

- [Transportation Research Board Business Office](#)  
500 Fifth Street, NW  
Washington, DC 20001 USA
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Order URL: <http://worldcat.org/isbn/0309060745>

**ISBN:** 0309060745

**Publication Date:** 1995

**Conference:** [Sixth International Conference on Low-Volume Roads](#)  
Location: Minneapolis, Minnesota  
Date: 19950625 - 19950629  
Sponsors: [Forest Service and Agricultural Marketing Service, U.S. Department of Agriculture](#); [Federal Highway Administration, U.S. Department of Transportation](#); [Bureau of Indian Affairs, U.S. Department of the Interior](#); and [Kuwait Fund for Arab Economic Development](#).

**Serial:** [Transportation Research Board Conference Proceedings](#)  
Issue Number: 6  
Publisher: [Transportation Research Board](#)  
ISSN: 1073-1652

**Index Terms:** Conferences; Cost effectiveness; Demonstration projects; Embankments; Fills; Low volume roads; Repairing; Slope stability; Slopes; Soil nailing; Soil stabilization; Technology; United Kingdom; Repairs

**Subject Areas:** Geotechnology  
Highways  
I42: Soil Mechanics

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