| To: SUPERSEDED BY EI 08-031 EFFECTIVE 1/8/09 | | New York State Department of Transportation ENGINEERING INSTRUCTION | EI 05-026 |
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Title: **SPECIAL SPECIFICATION FOR LAUNCHED SOIL NAIL SLOPE REINFORCEMENT**

Distribution:
- ☐ Manufacturers (18)
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Approved: Robert L. Sack, Deputy Chief Engineer (Research) — 4 AUG 05 Date

**ADMINISTRATIVE INFORMATION:**

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of January 12, 2006.
- Superseded issuance(s): This EI does not supersede any previous issuances.
- Disposition of issued materials: The information transmitted by this issuance will reside in the Special Specifications directory of the Toolbox Server.

**PURPOSE:** The purpose of this EI is to issue a new special specification for the installation of launched soil nail slope reinforcement.

**TECHNICAL INFORMATION:**

- PIN Approval: The launched soil nail slope reinforcement special specification is to be approved on a project-by-project basis. Designers must send their request for approval to the Design Quality Assurance Bureau (DQAB) and the Geotechnical Engineering Bureau (GEB) through their Special Specification (SS) Coordinator as per Highway Design Manual (HDM) Chapter 21. The Designer will incorporate the special specification into the PS&E submission to DQAB as outlined in HDM Chapter 21.9.3.2 Submitted Materials.

- Launched soil nailing is a technique developed in the United Kingdom for the reinforcement of locally unstable existing soil masses. Soil nails are inserted using high-pressure air approaching 17.2 MPa by a launcher that is mounted on a hydraulic excavator. As the soil nail passes into the soil, the ground around the nail is displaced by compression at the nail tip. This forms an annulus of compression which reduces the soil drag on the nail. As the nail comes to rest, the soil rebounds onto and bonds with the nail. The soil nails reinforce the locally unstable soil mass by transferring the nail's tensile and shear resistance through the failure plane of the sliding soil. The nails maintain the resisting force because they are anchored beyond the slip plane.

**TRANSMITTED MATERIALS:**

Attached is the following special specification containing several items of work:

Item 554.15----17: Launched Soil Nail Slope Reinforcement.
Item 554.16----17: Launched Soil Nail Slope Reinforcement (Galvanized).
Item 554.17----17: Shotcrete Cover for Launched Soil Nail Slope.
Item 554.18----17: Composite Reinforced Erosion Control Material Cover for Launched Soil Nail Slope.

**BACKGROUND:** The special specification was created to provide designers with another option for stabilizing earth slopes that show evidence of localized surface failures. The installation of launched soil nails will improve or reinstate the strength and stability of the soil structure.

Soil nails are long steel rods installed to reinforce or strengthen the existing ground. Recently, there has been a development in the installation process which incorporates a tool utilizing compressed air to launch a soil nail into place. Applications of the installation method include the ability to work beneath most overhead utilities, a relatively rapid installation process (approximately 25 linear meters of road per day for a two-row installation), minimum ground disturbance, single lane closure for mobilization, and installation from the top of the affected slope. The installation method is not appropriate for use in very compact soils or soils containing a significant quantity of boulders and/or cobbles. Underground utility markout is required to avoid damage by the installation process.

**REFERENCES:** The following sources of information were used in developing this EI and the attached Special Specification and are sources for further information on the subject matter:

1. Website for launched soil nails found at www.soilnaillauncher.com
2. Launched Soil Nails Stabilize Embankments, Robert Barrett, Albert Ruckman, Bernard Myles, and John Steward, July 23, 2002.
3. US Department of Transportation, Federal Highway Administration, Publication No. FHWA-FPL-93-003: Application Guide for Launched Soil Nails Volume 1 and Publication No. FHWA-FPL-93-004: Project Report for Launched Soil Nails-1992 Demonstration Project Volume 2.

**CONTACT:** Questions or comments regarding this issuance should be directed to Randy Romer of the Geotechnical Engineering Bureau at (518) 457-4714, rromer@dot.state.ny.us. Questions or comments regarding the technical aspects of the special specification should be directed to Jim Reinhold of the Geotechnical Engineering Bureau at (518) 457-4715, jreinhold@dot.state.ny.us.

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| ITEM 554.15 | 17 - | LAUNCHED SOIL NAIL SLOPE REINFORCEMENT |
| ITEM 554.16 | 17 - | LAUNCHED SOIL NAIL SLOPE REINFORCEMENT (GALVANIZED) |
| ITEM 554.17 | 17 - | SHOTCRETE COVER FOR LAUNCHED SOIL NAIL SLOPE |
| ITEM 554.18 | 17 - | COMPOSITE REINFORCED EROSION CONTROL MATERIAL COVER FOR LAUNCHED SOIL NAIL SLOPE |

## DESCRIPTION

This work shall consist of installing Launched Soil Nails and furnishing all equipment and materials for the installation. The Launched Soil Nails may be left exposed or may incorporate a cover, as described below, in accordance with the contract documents.

Launched soil nails are inserted into existing soil masses by high-pressure air. The soil nails reinforce these locally unstable soil masses by transferring the soil nail's tensile and shear resistance from the stable side of the slip plane to the unstable side.

The Contractor or Subcontractor performing this work must have prior experience installing launched soil nails.

## MATERIALS

**Soil Nails:** Soil Nails to be furnished shall have a nominal outside diameter of 38 mm and a minimum length of 5.5 m. The contractor shall provide certification that the tensile strength of the nails is a minimum of 413 MPa. The soil nails may either be solid steel or perforated hollow steel bars with a smooth outer surface and a minimum wall thickness of 3.05 mm as specified by a note in the contract documents entitled "Launched Soil Nails." The contract documents will also specify whether or not the nails are to be galvanized. Remaining lengths from previously installed Soil Nails shall not be reused.

Perforations shall be two 3.175 mm holes every 150 mm on the bottom 2.4 m or as directed by the Engineer.

**Shotcrete:** Shotcrete shall conform to the requirements of Section 583- Shotcrete.

**Wire Fabric:** Provide wire fabric conforming to the requirements of § 709-02, Wire Fabric For Concrete Reinforcement.

**Composite Reinforced Erosion Control Material:** Provide a synthetic erosion control material which promotes vegetative growth that is internally reinforced by a double-twisted steel wire mesh with a wire diameter of at least 2.20 mm and a nominal mesh opening between the angles of twist of 83 mm. Acceptance will be based on the submission to the Engineer of a sample and copy of the manufacturer's specifications. Submit sample one week prior to application.

## CONSTRUCTION DETAILS

Within 15 days of when work is to begin, submit proof to the Engineer for review and approval, of two projects in which the Contractor or Subcontractor performing the work has successfully installed launched soil nails within the past five years.

**ITEM 554.15 17 - LAUNCHED SOIL NAIL SLOPE REINFORCEMENT**
**ITEM 554.16 17 - LAUNCHED SOIL NAIL SLOPE REINFORCEMENT (GALVANIZED)**
**ITEM 554.17 17 - SHOTCRETE COVER FOR LAUNCHED SOIL NAIL SLOPE**
**ITEM 554.18 17 - COMPOSITE REINFORCED EROSION CONTROL MATERIAL COVER FOR LAUNCHED SOIL NAIL SLOPE**

Furnish soil nails, launching equipment, and incidentals necessary to complete the work. Install soil nails using a launcher with a single stroke at initial velocities in excess of 322 km/h or at a launcher chamber pressure of 17.2 MPa. The limits of the launched soil nail application(s) will be shown in the contract documents.

Launched Soil Nails may be two or more rows as shown in the contract documents. Each row of nails shall be offset from the previous row. Cut off the exposed portion of installed soil nails flush with ground level or as shown in the contract documents or as directed by the Engineer. The method of cutting the nails shall not leave an exposed sharp, pointed end. If a shotcrete or other surface erosion control application is noted in the contract plans, a nominal exposed portion of the soil nail will be required for attachment of the wire fabric.

Payment shall not be made for soil nails that do not penetrate a minimum of 3.0 m from the slope surface. Nails which do not meet the minimum penetration embedment shall not be removed. An additional nail will be installed within the area encompassed by the adjacent nail pattern.

If noted in the contract documents, the limits of the installed soil nail area shall be shotcreted. The shotcrete will be reinforced with wire fabric. The wire fabric will be anchored to the installed soil nails by connector plates positively attached to the soil nail heads. The wire fabric shall be contoured to the surface profiles. After the wire fabric is in place, a 100 mm application of shotcrete shall be placed, encapsulating the connector plates and wire fabric. Hollow soil nail heads shall be free of debris to facilitate drainage.

Provide shotcrete equipment capable of delivering the premixed material accurately, uniformly and continuously through the delivery hose. Control shotcrete application thickness, nozzle technique, air pressure, and rate of shotcrete placement to prevent sagging or sloughing of freshly applied shotcrete.

If noted in the contract plans, provide composite reinforced erosion control material internally reinforced with double-twisted steel wire mesh in lieu of shotcrete. Fasten the composite reinforced erosion control material onto the extruding soil nails using connector plates or other method to the satisfaction of the Engineer. Further secure the composite reinforced erosion material onto the slope face in accordance with the manufacturer's recommendations.

Seeding of slope after placement of erosion control material shall be done under a separate specification.

## METHOD OF MEASUREMENT

The launched soil nail slope reinforcement work measured for payment will be the nearest whole number of square meters of treated slope face between the payment lines shown in the contract documents.

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The shotcrete and wire fabric reinforcement work measured for payment will be the nearest whole number of square meters of slope face covered by the shotcrete.

The unit of measurement for the composite reinforced erosion control material will be the nearest whole number of square meters satisfactorily placed.

## BASIS OF PAYMENT

The unit price bid per square meter of slope treated with launched soil nails shall include the cost of furnishing all labor, materials, and equipment required to install the launched soil nails to the minimum embedment.

The unit price bid per square meter of shotcrete, wire fabric reinforcement, and connector plates shall include the cost of furnishing all labor, materials, and equipment required for the installation.

The unit price bid per square meter of composite reinforced erosion control material shall include the cost of furnishing all labor, materials, and equipment required for the installation.