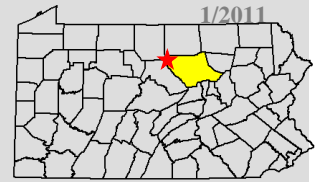


Worksite in Focus

Slate Run & Francis Roads

DCNR Bureau of Forestry



Project Overview:

The PA Bureau of Forestry completes a demonstration project every year with funding from their Dirt and Gravel Road Maintenance Program. The purpose of these demonstration projects is to showcase new and innovative ideas in Environmentally Sensitive Road Maintenance to other road maintenance professionals. The 2010 demonstration project involved the use of innovative bank stabilization techniques to address two recurring landslide issues in the northwest corner of Lycoming county. Slate Run and Francis Roads are two of the most highly traveled State Forest roads in the region due to their access to popular fishing and recreation sites, and because they link State Routes 414 and 44.

The Problem:

Two sections of roadway, one on Slate Run Road and one on Francis Road, have been continual problems for maintenance crews due to the threat of landslides. The landslide problem on Francis Road was caused by the road's proximity to a stream, while the problem on Slate Run Road was caused by steep side slopes and saturated soil conditions.



Francis Road (before): The bank instability here was caused by the proximity to the stream.



Slate Run Road (before): The bank instability here is caused by the many springs and seeps that saturate the site every year.

The Solution:

An innovative bank stabilization technique was used on the two unstable road sections to reinforce the downslope road bank. Soil Nail Launcher Inc. (SNL) was contracted to stabilize the failing slopes. SNL uses long "soil nails" that are driven into the bank to anchor it in place. These nails can either be shot into the bank with an air cannon, or cemented into a pre-drilled hole. The pattern, depth, and density of the nails depends on the nature of each slide prone area. If desired or needed, the surface of the slope can be faced in concrete. In addition to this unique slope stabilization process, a 3,000 foot section of Slate Run Road was rehabilitated using traditional ESM practices such as underdrain, crosspipes, and Driving Surface Aggregate.

Project Facts

Project: Slate Run & Francis Roads
Project Owner: Tiadaghton State Forest
Watershed: Slate Run (EV watershed)
Pine Creek Tributary
Project Length: 3,000 feet
Date Completed: June 2010

Cost Summary:

Slope Stabilization: ~\$64,500
Utilization of "Soil Nail Launcher" technology.
Driving Surface Aggregate: ~\$23,800
1,100 tons of paver-placed Driving Surface Aggregate
Drainage and Base Work: ~\$11,700
Included underdrain, crosspipes, and geotextile.
TOTAL: ~\$100,000

For More Information:

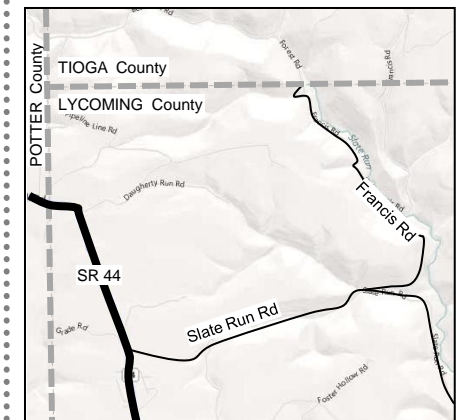
Center for Dirt and Gravel Road Studies
(814)865-5355 www.dirtandgravelroads.org

Tiadaghton State Forest District
(570)753-5721 www.dcnr.state.pa.us/forestry

Soil Nail Launcher
(970)245-7737 <http://soilnaillauncher.com/>
This does not constitute an endorsement of Soil Nail Launcher Inc. by the Center or the Program. The contact info is being provided as part of this educational resource.

Site Location:

Francis and Slate Run Roads are located in the northwest corner of Lycoming County, east off of State Route 44.



The publishers of this publication gratefully acknowledge the financial support of the Pennsylvania Bureau of Forestry. For additional information or assistance, contact: Center for Dirt & Gravel Roads Studies, Penn State University, 207 Research Unit D, University Park, PA 16802 (Toll-Free Phone: 1-866-668-6683, Fax: 814-863-6787, Email: dirtandgravel@psu.edu). Additional copies available on our website at: www.dirtandgravelroads.org



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Slope Stabilization on Slate Run and Francis Roads

The Soil Nail Launcher process involves the use of long steel rods that are either driven or drilled into the failing slope. Image 1 to the right shows a specialized excavator attachment being used to install soil nails on Slate Run Road. One of the advantages of this process is that it can usually be done almost entirely from the road surface without disturbing the bank or land below. This minimizes stream impacts and may eliminate the need for certain permits. The soil nails serve as anchor pins to tie the various layers of soil and rock underneath the road into a cohesive unit.

Sometimes the soil nails can be “shot” into the road base with a large air cannon. However, the base on these roads prevented the soil nails from being “shot” into the ground. Instead, holes were pre-drilled into the slope with a carbide bit drill mounted on the excavator. The rods were then placed into the holes, and grout was pumped through the hollow rod until it filled the entire cavity, both inside and outside the rod, cementing it in place (Image 2).

In some cases, such as Slate Run Road, the soil nails alone are enough to reinforce the slope. In such situations, the exposed soil nails are trimmed at the surface and the stabilization is complete. In other cases, such as Francis Road, additional surface reinforcement is needed. The extremely steep slope and proximity to the stream required that the slope stabilization site on Francis Road be covered in “shotcrete” (pumpable concrete). The exposed ends of the soil nails on Francis road were attached to a wire mesh to create a form on which to apply the concrete. The shotcrete is then sprayed over the mesh and nails to create a facing on the slope (Image 3). If desired, the concrete can be dyed a variety of colors to provide a more natural looking surface.

*This type of slope stabilization is **not** a practice that is suited to every situation. It may, however, be worth consideration if you have a slide prone section of roadway where other slope stabilization methods are not feasible. Please note that information on this project is provided as an educational resource. It does not constitute an endorsement of Soil Nail Launcher Inc. by the Center or the Program.*

Other ESM Practices on Slate Run Road

In addition to the slope stabilization on both roads, many other Environmentally Sensitive Maintenance Practices were implemented on Slate Run Road. Six new crosspipes were installed to reduce concentrated drainage along the roadway. Approximately 2,000 feet of underdrain was installed to drain the numerous springs and seeps that frequently saturated the road banks, ditches, and surface (Image 4). Geotextile fabric was placed on the road surface to provide support in many traditionally wet areas. Driving Surface Aggregate was then paver placed on the road at a 14 foot width and 6” compacted depth.



Slate Run Rd: Soil nail holes are drilled into the road slope.



Slate Run Rd: Grout is pumped through a hollow soil nail to fill the hole from the bottom up.



Francis Road: Wire mesh is tied into the exposed ends of the soil nails, then a “shotcrete” facing is added.



Slate Run Rd: 2,000 feet of underdrain was installed due to the many springs and seeps that kept the road area saturated for much of the year.