

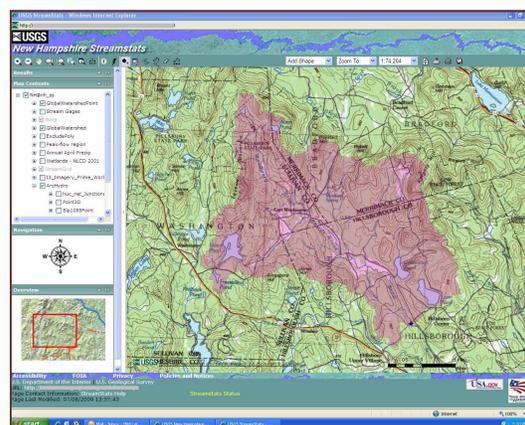
## About this Issue:

This issue of *Focus on Research* examines several recently completed NHDOT research projects of significant value to the Department. The impact of each study is expected to be felt for years to come in the design, construction and maintenance of highway and bridge projects in New Hampshire.

## Estimating Flood Discharges for New Hampshire Streams

On October 6th, the Research Section hosted back-to-back presentations of a recently completed NHDOT-funded research project that developed a new tool for estimating the flood frequency and flows of New Hampshire streams. The presentations were attended by 48 members of Highway Design, Bridge Design, Environment, and the NHDES Wetlands Bureau. Principal investigator Scott Olson, a hydrologist at the USGS NH-VT Water Science Center, made the presentation.

The USGS utilized flood-frequency and drainage-basin characteristics from 117 stream gages in and adjacent to New Hampshire during the study, and developed regression equations for estimating the flood discharges at the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence intervals at ungaged waterways. The drainage-basin characteristics included drainage area, mean April precipitation, percentage of wetland area, and main channel slope.



Noted benefits of this project include updated flood flow discharge estimates at gaged and ungaged streams in New Hampshire and development of the NH StreamStats web-based computer application. The NH StreamStats is a powerful GIS-based tool that enables the user to quickly obtain discharge statistics, drainage-basin characteristics, and other information at user-selected sites on streams. The NH StreamStats is hosted on the USGS website and is similar to programs available for several other states in the U.S. Both the NH StreamStats application and the final report for this project can be accessed at [http://water.usgs.gov/osw/streamstats/new\\_hampshire.html](http://water.usgs.gov/osw/streamstats/new_hampshire.html).

### Project Details:

Researcher:  
U.S. Geological Survey

Project Cost  
\$130,000

## Ground Vibrations Emanating from Construction Equipment

Highway construction within New Hampshire has trended toward increased reconstruction and rehabilitation projects in congested urban areas. This has resulted in a greater concern for vibrations generated by non-blasting construction activities, a greater potential for complaints or damage, and an increased need to monitor vibrations during construction.

NHDOT researchers developed a Vibration Assessment Impact Rating Procedure to gauge the impact of construction-induced vibrations at project sites. The procedure enables assessments to be conducted for each type of vibration-producing activity anticipated during a project in relation to various types of man-made structures and vibration-sensitive operations in the vicinity of the work. A variety of non-blasting construction activities were investigated including vibratory compaction, excavation and splitting of rock with a hoe-ram, sheet pile driving, pavement breaking, demolition, track mounted vehicles, and heavy construction traffic.

As a result of the research, vibration assessments can be performed comparing different construction activities at the same site, or the potential impact of an activity at one site versus the same activity at another site. Data are collected, stored and tracked in a database. The vibration assessment procedure and database allow for development of preliminary cost estimates for vibration monitoring services and provide a resource for decision-making during various phases of NHDOT projects. Proposed changes to the specifications are under review to allow for continued input of information into the database.

### Project Details:

Researcher:  
NHDOT, M&R  
Engineering Geology  
Unit

Project Cost  
\$15,000



SEE PAGE 4 to CONTACT the  
NHDOT RESEARCH  
SECTION

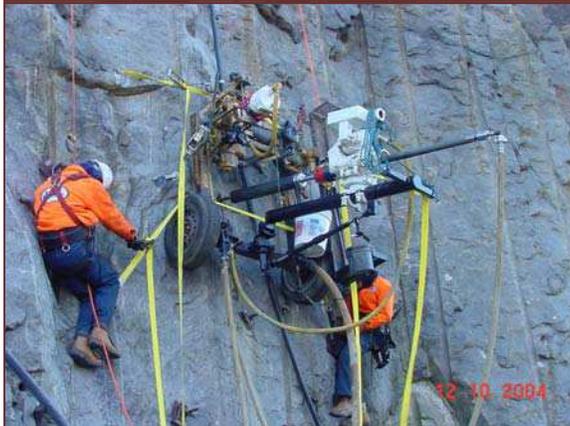


# Assessing the Condition and Estimating the Longevity of Rock Reinforcement Systems



*Editors Note: Work to replace selected rock reinforcements at the "Barron Mountain" rock cut was performed during the 2009 construction season. The scope-of-work for the project was based on the research outlined in the piece below.*

The New Hampshire DOT has utilized metal reinforcements to stabilize highway rock slopes for more than 35 years. Annual inspections of 10 rock reinforcement sites are conducted; however, inspectors have lacked a consistent method of determining the actual condition of these systems.



In 2003, the Department initiated a two-phase research study to assess the condition of rock reinforcements along I-93 in Woodstock. The first phase involved measuring the corrosiveness of the surrounding environment and performing nondestructive testing (NDT) on selected elements. In Phase II, anomalies identified by the NDT were investigated through destructive testing and exhumation to calibrate and validate the results of the initial investigation. The research provided an effective method for identifying areas of possible corrosion, assessing the overall condition of the reinforcements, and estimating remaining service life. As a result, it was determined that only a portion of the existing reinforcements required replacement or rehabilitation, leading to an estimated savings of \$1.1 million for the site.



Benefits can be realized by applying this technology at other sites in New Hampshire and in other states. The approach used in this study provides a sound technical basis for planning future maintenance and rehabilitation activities on reinforced rock slopes.

## Project Details:

Researcher:  
McMahon & Mann  
Consulting Engineers

Project Cost:  
Phase I - \$66,000  
Phase II - \$186,000  
*(Pooled-Fund Study - NH, NY & CT)*

***"This problem, too, will look simple after it is solved."***

***- Charles Franklin Kettering***

## Alternative Pavements for Snowmobile Crossings

### CONTACT US:

NHDOT  
Bureau of Materials & Research  
PO Box 483  
5 Hazen Drive  
Concord, NH 03302-0483

Phone: 603-271-3151  
Fax: 603-271-8700

E-mail: [groberts@dot.state.nh.us](mailto:groberts@dot.state.nh.us)

[www.nh.gov/  
dot/research](http://www.nh.gov/dot/research)

Snowmobiling is one of many winter activities available to New Hampshire residents and visitors. Numerous clubs maintain 6,800-miles of trail through partnerships with landowners, the NH Snowmobile Association, the NH Department of Resources and Economic Development (DRED), and the NH Department of Fish and Game. The trails cross many state and local roadways; in fact, a North Country highway may be crossed by as many as 10,000 snowmobiles during a snowy February.



Excessive highway pavement wear from snowmobile traffic is a maintenance issue for the NHDOT. The snowmobiles and trail grooming equipment scar and erode the pavement surfaces, eventually creating wide ruts across the highway that cause potential safety issues for vehicular traffic. Damage often includes breaking of the pavement's edge until the travel lanes are threatened.

After reviewing studies completed in other states, NHDOT field-tested two alternative surface treatment materials at snowmobile highway crossings subject to excessive pavement wear. Cost, ease of installation, durability and replacement strategies were compared with conventional hot mix asphalt over three winters. Cleanosol, a surface-applied thermoplastic material successfully used to armor snowmobile crossings in Michigan and Wisconsin, was the easiest and fastest product to install. Although the wear characteristics of this and the other tested product were not significantly better than conventional pavement, the project's Technical Advisory Group (TAG) believes that the convenience and lower cost of installing Cleanosol makes it a better choice for repairing pavement damage at snowmobile trail crossings in New Hampshire.

While the research began as a search for a more durable pavement surface, the focus on snowmobile damage to highways revealed that New Hampshire's trail crossing permit program is inadequately enforced, and that substandard trail approach aprons have contributed to the deterioration of roadway shoulder pavements. A number of important recommendations and proposed implementation activities resulted from this study:

- A revised Motorized Recreational Vehicle Trail Crossing detail for use in permitting new trail crossings;
- An enhanced cooperative effort with the recreational vehicle community to implement a



program to construct and maintain trail approaches, utilizing the Cleanosol thermoplastic surface treatment where appropriate;

- Improvement of existing trail crossings to bring them into reasonable compliance with the proposed Motorized Recreational Vehicle Trail Crossing detail.

The project's technical team, including personnel from the NHDOT and DRED, will continue to meet to review future design and implementation criteria for crossings, as well as other pertinent issues.

WHAT'S YOUR PROBLEM?