

Focus on Research



NHDOT Research Advisory Council Ranks Research Problem Statements

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The NHDOT Research Advisory Council (RAC) met April 20, 2016 at the Audubon Center in Concord. The RAC members are the Bureau Administrators plus the Assistant Director of Project Development. Nineteen (19) problem statements were presented to the RAC by representatives from the Department, UNH, UVM, PSU, USGS, CRREL, and others. Following each presentation, RAC members would rate each topic on a scale from zero (no need) to five (absolute need). When the presentation session was completed, the RAC members then ranked the proposed projects with the one being the highest priority.

The rankings are used to select what topics will be funded in the next cycle of research.

The 19 problem statements had sponsorship from eight different Bureaus.

- Aeronautics
- Bridge Design
- Bridge Maintenance
- Environment
- Highway Design
- Materials and Research
- Rail and Transit
- TSMO

The seven top-ranked projects:

1. The Use of Unmanned Aircraft Systems to Increase Safety and Decrease Costs of Transportation Projects and/or Related Tasks
2. Mildly Contaminated Soil Distribution Assessment
3. Development of Data-Driven Guidance on the Selection of Deep Foundations on Projects with Hydroacoustic Limits and Mitigation Requirements
4. Gusset-less Truss Connection Physical and Structural Model to Aid Bridge Inspection and Condition Assessment
5. Layer Coefficients for NHDOT Pavement Design
6. Binder Aging
7. Reducing Cracking in New Bridge Curbs



SPR2 Manual Updated



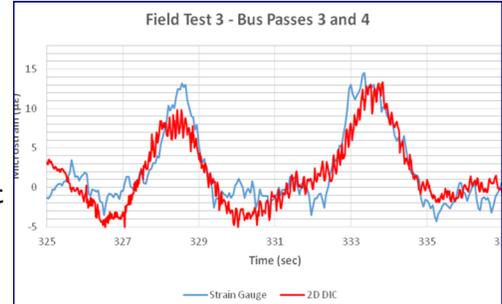
The [NHDOT SPR2 Program Manual](#) was updated to

reflect current regulations and procedures. The updated manual includes information on how research projects are selected as well as outlining the management of the SPR2 Program at NHDOT.

Instrumentation, Digital Image Correlation, and Modeling to Monitor Bridge Behavior and Condition

A recognized Recipient of the Sweet 16 High Value Research Projects

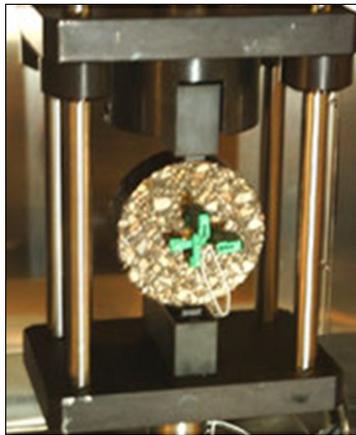
Bridge managers have historically relied on visual inspection reports, photographs, and field observations to assess bridge health. Using a structural model and strain gauges can enhance bridge condition management; however, strain gauge installation is damaging to the protective paint on the steel. Research found that using less damaging commercially available digital imaging equipment enables the collection of global deflection information to calibrate the model with field-collected structural response data.



Bridge response measured by strain gauge (blue) and camera (red)

<http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/I5680I.htm>

Performance of High RAP Pavement Sections in NH



NHDOT has allowed Recycled Asphalt Pavement (RAP) in Hot Mix Asphalt for over 20 years, but has limited use to 15-20% of the mix. This study evaluated changes in performance due to increased amounts of RAP as well as using a softer binder with higher RAP content mixes. The results of this project support the practical limitation of 1% total recycled binder which is consistent with NHDOT practice. The performance results due to changes in binder were not conclusive. <http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/I5680b.htm>

Dynamic modulus test performed in indirect tension mode on an Instron servo hydraulic machine

Fingerprinting Sources of Nitrogen in Wells Near Blasting Sites

NHDOT and USGS evaluated nitrogen levels in groundwater wells near blasting sites associated with highway construction. The goal of the study was to determine if nitrogen contamination due to blasting could be differentiated from other potential sources of contamination like septic systems or agricultural runoff. Looking at the chemistry and stable nitrogen isotopes, the study determined that different sources of nitrogen have unique characteristics. In turn, it is possible to identify the source of the contamination based on those characteristics. The results of the study were published in the January 2016 issue of the journal Environmental Science and Technology.

<http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/I5680v.htm>



Taking samples of nitrogen residue from blasted rock

Improve the Quality and Service Life of Water-Based Pavement Markings on Pavements with High-Iron Aggregate

Airports use white pavement paint marking on airport runways and yellow paint on taxiways to allow pilots to distinguish landing strips. When the white paint was discolored by rust-like staining, it made it difficult for pilots to distinguish the runways from the taxiways. The danger associated with a plane potentially landing on a taxiway is quite high. This study determined the cause of the discoloration was from the ferrous minerals found in the pavement aggregates. 50% of New Hampshire airports experience staining of the white pavement markings. The staining can be removed by pressure washing but will reoccur with six months to a year. The study evaluated different paint types (both solvent and water-based), various paint additives, and paint treatments (i.e., clear-coating) as well as pavement treatments such as sealers and grooves. The most cost-effective solution is to modify the specification for type TT-P-1952E paints to include a rust inhibitor. The matching bead type is required for proper marking visibility.



This paint should be white.

<http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/15680j.htm>

Design and Maintenance of Subsurface Gravel Wetlands

The UNH Stormwater Center reviewed the design standards and specifications for Subsurface Gravel Wetlands used by the NHDOT. This stormwater management system reduces nutrient content in runoff by allowing water to flow through a buried horizontal layer of gravel which allows anaerobic microbial treatment of runoff. Recommended changes to the design standards and specifications are expected to provide savings of more than \$5,000 per acre of contributing impervious area.



Stormwater gravel wetland near Durham

<http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/15680w.htm>

Validating Pollutant Loading

Rain and snowmelt that runs off of roadways carries pollutants. Runoff is treated in retention ponds, gravel wetlands, swales, and other methods to improve stormwater quality before that water enters rivers, lakes, and wetlands. NHDOT uses the Simple Method for estimating pollution load in this runoff. The Simple Method assumes pollutant loads from historic data rather than more complicated and time-consuming physical models. This study found the



Typical New Hampshire Road Inlet

NHDES Simple Method is acceptable although it does tend to generate slightly higher estimates than actual measured pollutant loads. In addition, the pollutant load generated from a roadway does not vary based on the traffic volume. This study confirmed that using one modeling approach is effective for all New Hampshire roadways.

<http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/15680y.htm>

RECENTLY PUBLISHED

CONTACT US:

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

Ann Scholz
Phone: 603-271-1659
Fax: 603-271-8700
E-mail: ascholz@dot.state.nh.us

Beth Klemann
Phone: 603-271-8995
Fax: 603-271-8700
Email: eklemann@dot.state.wi.us

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

*“Research is to see
what everybody else
has seen, and to
think what nobody
else has thought.”*

**Albert Szent-
Gyorgyi**

*Discovered Vitamin C
Won Nobel Prize in
Medicine 1937*

New Hampshire
DOT
Department of Transportation

More Final Reports

Structural Condition Assessment of Reinforced Base Course (completed by CRREL) examined the economic viability of using reinforced pavement in New Hampshire. Potential benefits include the ability to construct thinner pavements with lower subgrade

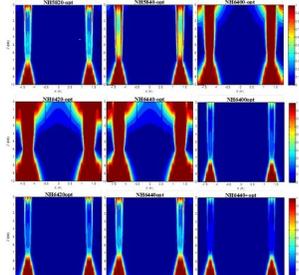
Assessment of Asphalt Concrete Reinforcement Grid in Flexible Pavement (completed by CRREL) evaluated the performance of pavement reinforcement on Route 101. Performance has been good with less cracking, but data from the Falling Weight Deflectometer was not conclusive enough to change the thickness of pavement design.

Spring Thaw Prediction completed by the Bureau of Materials and Research looked at how the frost leaves the ground in the spring to develop a prediction model could. The study found the process is not easily predicted; strength may take months to return.

Completion of Pooled Fund Project

Correlation Between Lab- and Plant-Produced High-RAP/RAS Mixtures

NHDOT is the lead state on this recently completed Pooled Fund Study which was conducted by researchers at four universities: UNH, Rutgers, NC State, and UMass Dartmouth. The study sought to evaluate the performance of asphalt that includes a high percentage of recycled asphalt pavement (RAP) especially in lower temperatures when asphalt is more prone to cracking. In addition, the study evaluated how these types of mixes reacted to moisture and cracked under fatigue. The study found that high fatigue resistance deteriorated rutting resistance but it is possible to balance these performance measures. It also found that high percentages of RAP appear to be tolerated more easily with higher layer thicknesses. <http://www.pooledfund.org/Details/Study/458>



Fatigue damage factor contours for all study mixtures after 5 years

Research Project Results go to Construction

Accelerated Bridge Construction

NHDOT has used pre-cast bridge decks on three previous projects including the I-93 bridges over Center Street/Loudon Road in Concord. Deck panels are lifted by a crane onto the beams which allows paving to occur almost immediately. Traditional bridge construction places concrete in forms and must include time for the concrete to cure. Pre-cast panels shorten the time a bridge must be closed to traffic.



Lifting a deck panel for I-93 bridge over Center Street / Loudon Road in Concord

UNH evaluated whether precast could be used to rebuild the bridge of US Route 3 over NH Route 11A in Gilford as it is more complex than previous projects with both a skew and a cross-crowned section. Construction is underway and the panels will be installed in June 2016.

<http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/I5680x.htm>

WHAT'S YOUR PROBLEM?