On the Road in New Hampshire

Survey Says...

In the fall 2005, the UNH T² Center surveyed highway managers, town administrators, and select boards. The survey was also sent electronically to pw.net (see page 11) allowing people to respond on-line. The response was extraordinary, 44 people responded or 12% (a typical response to any survey is around 4%).

The following people responded:

• 1 Selectmen,
• 3 Town Administrators,
• 9 Town Engineers,
• 11 Directors of Public Works,
• 17 Road Agents,
• 4 Superintendents, and
• 2 Crew members
• 7 who described themselves as other.

Responses came from all over NH. The average size town has a population is 14,081 with 120 miles of road.

Overall, people value the UNH T² Center’s training efforts and would like to see courses on the following topics:
• Cost Estimating,
• Pavement Markings,
• Performance Reviews, and
• Plan Reading.

The UNH T² Center plans to respond these requests this year. Spring workshops are listed on page twelve of this issue of Road Business.

Future plans for the Road Business are to devote more space to technical articles and less space to the Master Roads Scholars, Publications, and Videos.

Thanks to all who participated!
Winter Tenting of Road Surfaces
By Doug MacGuire, Project Assistant

Plan View

Profile View

Transverse Crack
Contaminated Base: Water, Sand, and Salt
Pavement
Road Base
Subgrade

Figure 1: Tent Crack

In New Hampshire, cold temperatures play an active role in pavement deterioration. The freeze/thaw cycle may decrease the maintenance-free life of a road up to 50%. Frost heaving and decreased pavement strength cause deteriorations such as rutting and surface cracking. Tenting is a pavement deterioration which may significantly reduce the lifespan of a road.

Tenting – What is it?

Tenting is localized frost heaving within a transverse pavement crack (see figure 1). Research shows that tenting produces an upward lift in the pavement as high as four inches over a 10 foot horizontal distance. This distress produces a highly uneven riding surface and greatly accelerates pavement deterioration. All roads are prone to tenting, including roads designed for high traffic loads and the frost/thaw cycle.

What Causes It?

During the freeze/thaw cycle, frost migrates into unstable subgrade material resulting in pavement deterioration. A frost susceptible subgrade may heave creating the visible road distresses. Tenting can occur in pavements even those specifically designed to resist tenting.

Road sand/salt mix infiltrates the road base through a surface crack. As the ground thaws, water carries salt into crack and saturates the base. The freezing-point of salt-saturated material around the crack is lower than the surrounding base material. The difference in freezing temperatures produce uneven freezing. The thawed areas around the crack will continue to saturate while the surrounding base materials freeze. Ice lenses form beneath the crack and heave the pavement creating a tented appearance.

Frost susceptible fines enter during the next thaw cycle and prevent the crack from returning to normal. This exaggerates the tenting during the next freeze cycle. The fine sand deposits are illustrated in the picture on page three, where the pavement surface was removed to expose the road base.

Conclusion

Crackseal pavements before the problem occurs. Cracksealing will prevent further intrusion of water and sand/salt mix. If infiltration has already occurred, the problem is within the road base.

An overlay prevents additional intrusion but reflection cracking will occur and allow additional salt water intrusion. The more successful, yet more expensive, option is to remove the salt contaminated base material and resurface.
The best advice is to do preventative maintenance treatment (surface treatments) to stop a problem before it starts.

Source:
Winter Tenting of Highway Pavements, NHDOT Research Record, FHWA-NH-RD-12323C, 2000

Handling Incoming Communication

Good workplace habits come from working smart. Manage incoming information with the fewest possible moves: e-mail, voice mail, phone calls, and regular mail. It doesn’t take long for incoming communication to demand constant attention and rob precious time.

People who receive new e-mails and voice mails all day, should schedule time to check them. (E.G., first thing in the morning and right after lunch.) Read or listen to messages to determine their priority; particularly with regard to current schedules. If necessary or appropriate, send off a prompt answer (promising follow-up, when required).

**E-mail**

- Use the two-minute rule. When it takes less than two minutes to answer a message, do it then file or delete the message.
- Use folders to organize messages.
- Immediate delete any unneeded messages.
- Use follow-up flags or dated calendar alarms to bring forward e-mail when it needs attention.

**Voice Mail**

- Review voice mail, take notes and delete them.
- Respond to those that fit the two-minute rule.
- Schedule the others for follow-up, as appropriate.

**Postal mail**

- Open mail once a day.
- Toss the junk or the unneeded paper.
- Use the two-minute rule.
- File informational mail. Delegate whenever possible. Place the rest in a follow-up system and respond to in a timely manner.

Finally, don’t get into the habit of reading every e-mail, when it arrives, or even answering the phone every time it rings. Answer returned calls. Otherwise, use voice mail. Have systems in place to ensure to manage incoming communication within a schedule, rather than letting it manage or even overwhelm schedules.

Source
Master Roads Scholars

Bruce Adler—Chesterfield

Bruce Adler is an equipment and motor grader operator. His career began in the Navy Construction Battalion, where he built bases, paved roads, and airstrips. Bruce worked for a drilling and blasting company. Twelve years ago he joined Chesterfield because he wanted more permanent career closer to home.

Bruce is a Harley Davidson man. He restored a 1968 bike and owns a couple others.

Bart Bevis--Chesterfield

Bart Bevis is a Chesterfield native and involved in several of the town’s departments. Bart joined the Highway Department eleven years ago as a backhoe operator. Seven years ago, he was promoted to Road Agent.

Bart volunteered with the Fire Department for 32 years. He began as a fire fighter and was appointed chief. He served as the town’s emergency management director. He was responsible to ensure town preparedness in the event of a nuclear release from the power plant. He stepped down from both positions but is still involved with the departments and is acting deputy fire chief.

Bart was always interested in public works. He has worked construction since high school. Bart’s hobbies are spending time outdoors and working with his hands.

Bart enjoys the UNH T² Center classes and sharing information. He likes to hear different perspectives and solutions. He says that the town, including the highway department, shares his feelings about training and realizes the value. In fact, the Selectboard have listed training as one of the requirements for promotion.

Jim Plante--Chesterfield

Jim Plante is a truck driver and equipment operator. He joined the highway department five years ago. Previously, he worked for Agway delivering grain around New England where he drove 300-400 miles per day.

Jim plans to take more UNH T² classes because he finds them interesting and gains knowledge directly applicable to work.

Jim has four children, two sons and two daughters. He is the grandfather to five grandchildren. In his spare time, he enjoys hunting and fishing.
Earl Labonte--Lebanon

Earl Labonte is the deputy director of public works and the operations and maintenance group leader. He was hired in this position nine years ago. Earl oversees many divisions including, water distribution, collection systems, and fleet maintenance.

Earl previously worked for the Air Force as a Construction Equipment Operator. He was then promoted to Project Manager. He served for 25 years.

Earl plans to continue to attend UNH T² Center classes. He values networking and exposure to different ideas and concepts.

Larry Jackson--Littleton

Jackson's the one as chamber celebrates 85 years in business

By Joshua Knox, Courier Staff

BETHLEHEM-On Jan. 20, the Littleton Chamber of Commerce awarded its Citizen of the Year honors to the former Highway Department superintendent for his decades of work in the town.

“During that time, he had 6,000 bosses,” said local lawyer Brien Ward. “Throughout his 33 years, Jackson’s forward-thinking attitude helped the town find new solutions to old problems.

Jackson began work as a laborer in 1972. He moved up to truck driver, equipment operator, foreman, and finally to department head.

Jackson was always learning on the job. He began to attend UNH T² Roads Scholar Program in 1985. Upon his retirement, he had attained the rank of “Master Roads Scholar.” Jackson also sat on the UNH T² Advisory Board.

Brien Ward said “Jackson’s zeal for learning was apparent in the way he approached his duties.” According to Ward, Jackson never tried to solve a problem by saying “this is how we did it in 1973,” he looked for the best methods and techniques available.

Ward noted that Jackson’s favorite day of the year was the town’s annual Earth Day celebration where Larry helps direct the town’s clean-up efforts. Ward joked that it was the one day of the year when Jackson could turn the tables on his 6,000 bosses.

“He got to tell everyone what to do,” said Ward.

Jackson came to the podium amid a thunderous standing ovation from the more than 150 Littleton residents and businesspeople in attendance.

“I'd like to thank the town for giving me that opportunity,” he said. “This is quite an honor, thank you.”

Benefits to Training

By Kathryn Claytor, Program Assistant

Public works is constantly changing with new methods to design, construct, and maintain roads and bridges. Public works departments must continuously update practices and procedures to ensure beneficial, cost-effective, and appropriate repairs are used. Old practices may lose money, time, resources, and manpower, and create unsafe roads.

Residents demand that tax money is spent wisely. Education and training are crucial to satisfy departmental and public needs for secure, safe, and reliable roadways. Attend training regularly to meet these goals:

- Stay informed of current trends, ideas, and resources.
- Improve customer relations.
- Increase competency and dedication of the department and community.
- Improve employee effectiveness.
- Regard training as a continuous process to improve performance and not something to be achieved and then dismissed.

This article presents benefits of attending training and maximizing the learning process.

A Solid Investment

To an accountant, training is an expense. However, training is an investment as the return outweighs the cost. Trained employees are more effective, spend less time researching problems, feel competent, and regard constructive criticism as an opportunity for change. These characteristics increase productivity and save money.

Benefits

One benefit of training is networking. Professional contacts make work easier and more meaningful. A professional network encourages the sharing information and ideas, plus an opportunity for collaboration.

Training increases an employee’s confidence as they can explain tasks and projects to others. They become a resource to others. Problem solving is crucial to job success therefore when an employee is capable of handling problems there is less stress.

Safety should be the first priority in the workplace. Safety training saves money by reducing accidents, which results in lower workers compensation fees. A safe work environment increases productivity by relieving employee safety concern.

Learning creates new connections between the neurons in the brain. New connections help the brain to process recent and recall old information. New brain connections result in less brain deterioration. Deterioration leads to age-related illnesses such as Alzheimer’s.

Make Training Count

Set personal and professional goals before attending training. Make goals realistic and honestly try to reach them. Be an active learner. Ask questions if something is unclear. Start a discussion to learn different points of view. This helps everyone.

Participate in the evaluation process. Most instructors wish to improve the presentations effectiveness and quality. Provide constructive criticism: state areas of concern and ideas for improvement. Stress the effective parts of the presentation as well.
Proper compaction is critical in road construction. An unstable road base can cause pavement deterioration. Improperly compacted base materials leads to distresses resulting in pavement failure. Surface treatments cannot rectify a problem caused by an inadequately compacted base. The only solution is to replace the base with properly compacted material.

Compaction increases soil density, simply the volume of air within the soil is decreased. Compaction increases the load bearing capacity of the soil and prevents roadway settlement.

**Factors Affecting Compaction**

- Soil Type,
- Water Content,
- Compaction Method, and
- Thickness of Compaction Layer.

**Soil type**

AASHTO (American Association of State Highway and Transportation Officials) has an extensive classification system for soils. Soil types are classified by grain size. This is determined by a sieve analysis as seen in figure 1. Soils are categorized into 15 groups, which can be generalized into two major groups, cohesive and granular.

Cohesive soils include clays and silts. They are dense and bound by molecular attraction. Particle size is very small. Average particle size is .00004” to .002” for clay. Silt ranges from .0002” to .003”. Cohesive soils do not have good drainage properties.

Granular soils consist of sands and gravels. They contain larger particles than cohesive soils with a fewer percentage of fines. Average particle size for sand is .003” to .08” and .08” to 1.0” for fine to medium gravel. Clean granular soils typically have excellent water-draining properties.

The type of soil used controls how the other compaction factors are applied.

**Water Content**

To achieve maximum compaction, the moisture content must be at the correct level for the specific soil type. There is an optimum moisture point for the best compaction. Adding water to the dry soil lubricates the particles allowing more of them to be packed into a given space.
Figure 2 shows the relationship between relative density and percent moisture added. The graph illustrates that too little or too much moisture directly effects the density of the soil. A soil with too much moisture contains water filled voids which weakens the load-bearing capacity. Water fills spaces that would be otherwise occupied by solid particles and decreases the soil density.

Cohesive soils are especially dependant on optimum water content. Cohesive soils have a high testing curve similar to the one shown in figure 2. Clean granular soils are much less dependant on water content. Their test curves are relatively flat so maximum density is obtained with less emphasis on water content.

**Compaction Method**

Compaction uses force to compress soil particles to the desired density. Different soil types respond better to certain compaction methods.

**Cohesive soils**

The particles in cohesive soils stick together with the proper moisture content. To compact, use an impact or kneading force. A rammer or sheepsfoot roller is recommended to provide the shearing force to arrange the particles into a tight format.

A rammer is a hand operated machine with a high impact force through a gas powered piston. The sheepsfoot roller is a large drum with many protruding studs. The studs provide high point loads to the soil surface. Several passes are necessary to fully compact.

**Granular soils**

Use vibration to compact granular soils. A vibratory plate is a hand operated machine that uses one or two eccentric weights. The spinning weights propel the machine forward.

A vibratory plate with two eccentric weights moves directionally forward and reverse. The effectiveness of the machine is directly related to the weight of the plate. Use the vibratory plate in tight areas, such as a trench.

A vibratory roller consists of a large weighted drum and two drive wheels. The pressure force of the drum is further assisted by vibration.

**Thickness of Compaction Layer**

Compaction equipment is only effective to a certain depth--called a lift. Therefore, compact in lifts. For example, vibratory and rammer-type equipment compact soil in two directions. The force travels through the layer under compaction to the hard surface below and returns upward. The particles are forced tightly together and compaction occurs. If the lift exceeds the effective depth of the compaction equipment, it will not fully compact. Figure 3 shows correct and incorrect lifts.
Ensuring Proper Compaction

New Hampshire Department of Transportation (NHDOT) requires at least 95% maximum density on all road surfaces. All soils have a differing maximum density value. This is determined through a standard proctor test as specified in AASHTO T-99. Once the maximum density value is known for the specific soil, the in-place density of the material is tested.

A standard proctor test uses a sample of material to test compaction. The material is placed in a mold and then a weight is dropped onto it. The amount of weight, height of the drop, and number of blows, etc. are specified in the procedure. This test was performed several times with different moisture contents to produce the Moisture-Density curve as seen in figure 2.

The modified proctor test (AASHTO T-180) is used to determine maximum density. The procedure is similar to the standard proctor but designed to correspond with current compaction equipment and methods.

The in-place density of the material can be tested by several methods:
- Nuclear density, and
- Sand-cone.

The nuclear density test (AASHTO T-238 and T-239) is a quick and fairly accurate way to test the density and moisture content of the soil.

The nuclear unit emits radiation into the soil. In figure 4, the emission from a probe is inserted into the ground (direct) or from the surface (backscatter). The source emits photons which radiate back to detectors under the unit. A dense soil absorbs more radiation than loose soil. The unit also calculates the percent water content of the soil.

Sand-Cone Test (AASHTO T-191) is an in-place density test. A soil sample is taken of the compacted material. The sample is weighed and then dried in an oven to remove all moisture. The sample is weighed again and the difference provide the moisture content. Then a device is set up over the hole as seen in figure 5.

Using the device and the calibrated dry sand, the volume of the hole is calculated. The dry weight of the soil removed is divided by this volume to provide the density of the soil. This is an accurate method to determine density and moisture content. It becomes time consuming when several samples are taken to ensure uniform compaction.

What to use for Roads

Use free draining granular material to prevent water from being trapped in the base. Trapped water creates a weak base and frost heaves, which deteriorates the road surface. NHDOT requires a specific
gradation of the gravels used for the road construction. The NHDOT’s Standard Specifications for Road and Bridge Construction (table 1) shows sieve analysis requirements for each type of material. For a typical road with an average daily traffic (ADT) of 750-1500 the specifications for the base are 12 inches gravel and 6 inches of crushed gravel (304.2 and 304.3, respectfully). Perform a sieve analysis of materials to insure that they meet all percentage passing requirements before using.

Section 304 of Standard Specifications for Road and Bridge Construction requires the compaction depth of gravel or crushed gravel layer not to exceed eight inches. Correct water content, calculated by the proctor test, and vibratory compaction are required to achieve the 95% maximum density.

A road designed and built with proper gravels and correct compaction will insure that it performs to its fullest potential and will reduce maintenance costs.

Sources:
NHDOT: Standard Specifications for Road and Bridge Construction
When completing the evaluation form, include comments pertinent to the training session such as:

- Appropriateness, value, and helpfulness of the materials.
- Areas that are unclear.
- Speaker’s speed and voice projection.
- Environmental aspects that helped or hindered the presentation: seating arrangements, room lighting, and temperature.

**Choosing the Right Workshop**

Most workshops provide something for everyone. If the topic doesn’t seem relevant, pass the information onto someone else.

Education and awareness are powerful tools. Both Chesterfield and Claremont’s Selectboards realize the value in training. Both towns list employee training as one of the requirements for upward job mobility. Trained employees are crucial to a knowledgeable, capable, and competitive department. Only then will the organization effectively maintain roads and satisfy the public.

**Sources:**
- *Training can be a valuable investment that produces high returns for counties.* Oklahoma LTAP News, October 2005.

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**Events:**

**New Hampshire Public Works Association Annual Meeting**

May 4, 2006 at the Local Government Center

**Agenda Items:**
- Mutual Aid
- Historical Resources
- NH Retirement System
- Invasive Species

**Luncheon speakers:**
- Ed Smith, NHDOT, will discuss NHDOT outreach projects.
- Dave Danielson, SEA, will discuss Public Works Accreditation

**NHRAA Mountain of Demonstrations**

May 25, 2006 at Gunstock

**Other Events**

- Workzone Awareness Week April 3-9, 2006
- National Transportation Week, May 14-20, 2006
- National Public Works Week, May 21-27, 2006
When to Pave a Gravel Road?

Paving a gravel road isn’t cheap but as traffic counts increase maintaining one becomes expensive. The report *Economics of Upgrading an Aggregate Road* helps towns make policy decisions for maintaining and upgrading gravel roads. It was published by the Minnesota Department of Transportation (MNDOT) and the Minnesota Local Road Research Board. The report presents a method for comparing the cost of maintaining a gravel road with the cost of upgrading and maintaining an asphalt road.

**Cumulative Cost Trends**

Using annual MNDOT State Aid reports, cost estimates, and interviews, researchers found that bituminous roads have a high initial cost but gravel roads cost more for ongoing, routine annual.

Research identified the relationship between traffic level and maintenance cost. Cost analysis showed an increased spending to maintain gravel roads as the average annual daily traffic (AADT) increased. The costs of bituminous and gravel maintenance are similar when the AADT reaches 150 to 199.

**Gravel to Hot Mix**

An upgrade to a lightly surfaced road (seal coat) may be justified by maintenance savings alone.

Lightly surfaced roads require a smaller investment than an hot mix asphalt surface.

Other factors that cannot easily be assigned monetary value may indicate that it is time to pave a gravel road. Benefits include

- reducing dust,
- providing a smoother and safer surface, and
- improving vehicle and driver efficiency.

Researchers note that after an aggregate road is paved, maintenance activities shift to those required for maintaining a higher level of service such as:

- Increased brush and weed control,
- Traffic control devices required for a heightened level of service
- pavement marking, and
- snow and ice removal, anecdotal evidence suggests that snow and ice removal costs for paved roads are higher.

The report advises local officials to consider developing their own cost estimates for gravel road maintenance operations and to check the cost against their own historical data. When confident of their cost calculations, they may use the estimate in place of the historical costs. Jurisdictions lacking sufficient historical data may estimate future maintenance costs, and then compare them to historical data provided in the report. Analysis must be modified to reflect individual maintenance or construction costs as well as project timing.


Source:
Technology Exchange, University of Minnesota, vol. 13, no. 3. Summer 2005
Road Business Four Year Index

To request articles call, fax, or email the UNH T² Center or visit the web at www.t2.unh.edu/rdbus_index.

- **Bridges.** Fast Track Bridge, Fall 2004.
Publications

UNH Technology Transfer Center

These publications are available from the UNH T² Center. See www.t2.unh.edu/video_pub/publist.html for a complete list and to access some publications online. To request publications, complete form and mail or fax to 603-862-2364.

___Covered Bridge Manual. Provides historic information on covered bridge preservation and technical information on bridge components and engineering issues. USDOT & FHWA.

___Driveway Permits. Provides information on the application procedures, issuance of permits, right-of-way, drainage, construction and costs, maintenance responsibility, permit renewal, and revocation of permit suspension. NHDOT.

___Improving Highway Safety at Bridges on Local Roads and Streets. Discusses cost effective methods of improving safety at road and bridge intersections. USDOT & FHWA.


___Road Drainage and West Nile Virus. A collection of information from Stormwater, the Journal for Surface Water Quality Professionals.

___Stormwater Runoff, There is no Away: $15. VHS provides municipalities with ways to educate the public on helping to reduce stormwater run-off pollution. Seacoast Stormwater Coalition, 2003.


___Standard Specifications for Road and Bridge Construction. Provides road and bridge construction information, including general provisions, earthwork, pavements, and incidental construction. NHDOT.

___Tort Liability. Explains liability and insurance for organizations who are concerned with local road maintenance and discusses elements of a lawsuit. NACE, 1992.

___Traffic Sign Handbook: $15. Includes MUTCD and NHDOT standards and rules on traffic control devices typically used on rural and residential roadways. UNH T² Center, June 2005.

___US Pavement Markings. Poster illustrates pavement markings for creation of a safe roadway for drivers and highway employees doing repairs. USDOT & FHWA.

___Work Zone Safety. CD contains training materials for workzone safety; simulations on roadside work on urban streets, multiple roadway lane closings, intersections, and walkways. Rutgers University & Advanced Technology Concepts, Inc.

Material Request Form

Name: ____________________________________________
Affiliation: ______________________________________
Town/City: _______________________________________
Phone: _______________ Fax: _______________
Title: __________________________________________
Mailing address: ___________________________________
State: ____________________ Zip: ____________
Email: _________________________________________
Milestones:

Ernie Allain has been promoted to public works director in Berlin.

Rodney Bartlett has joined Peterborough as the director of public works.

Marty Bilafer, Public Works Director in Wolfeboro is retiring in March 2006.

George Chartier, is the new road agent in Littleton.

Robert Forrest has joined Rindge as their public works director.

Kyle Fox, has left the NHDOT and joined the town of Merrimack as the operations manager.

Dick Giehl has become the road agent in Campton.

Jean Marie Kennamer has left Derry and is working in Nashua.

Arthur Leblanc, director of public works in Hollis, has joined the New Hampshire Good Roads Association Board of Directors.

Richard Lemieux, Federal Highway Administrator has retired. Dick was the UNH T² Center FHWA advisor for the past 18 years.

Gus Lerandeau is the new President of the New Hampshire Good Roads Association.

Joel Moulton has joined Farmington as the public works director.

Eddie Nason is the new road agent in Brookfield.

Mack Tebbetts, is the new road agent in Barnstead.

Bruce Temple, is the public works director in Claremont.

Ken Ward, formerly of the LGC, passed away.

Web sites:


ASP (Thanks to Dave Haskell, Tamworth)

Safety Tip sheets: www.mnltap.umn.edu/publications/safety-tips

Time and date makes it possible to know what time day it is anywhere www.timeanddate.com

Listservs

A listserv is a free way to use email to exchange information. To subscribe send an email to ListProc@lists.unh.edu. Leave the subject line blank, in the body of your message type:

Subscribe listname your name

For instance:

Subscribe pw.net John Doe

PW.NET

Want to know what is happening in other towns? Or, learn the very latest in regulations? Need a place to ask questions of other public works officials? Want to be the first to receive notifications of UNH T² Center workshops? Sign up for pw.net

RunOff.Talk

Want to discuss NPDES II issues and concerns? This list enables a dialog to clarify federal permits, and determine the best technical management for compliance. Use it to announce meetings and conferences. ✤
### Spring Workshop Calendar

<table>
<thead>
<tr>
<th>Date</th>
<th>Workshop</th>
<th>Location</th>
<th>Cost</th>
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<tbody>
<tr>
<td><strong>Supervisory or Personal Development</strong></td>
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<tr>
<td>April 4</td>
<td>Performance Evaluations</td>
<td>Manchester</td>
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<tr>
<td>April 27</td>
<td>Performance Evaluations</td>
<td>Plymouth</td>
<td>$45</td>
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<td><strong>Technical Aspect of Road Maintenance or Repair</strong></td>
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<td>April 6</td>
<td>Geotextiles</td>
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<td>Reconstruction Project Planning</td>
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<td>May 2</td>
<td>Municipal Permits</td>
<td>Rochester</td>
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<td>May 9</td>
<td>A Hard Road to Travel</td>
<td>Somersworth</td>
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<tr>
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<td>Plan Reading</td>
<td>Lebanon</td>
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<td>Incident Command System</td>
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<td><strong>Tort Liability or Safety</strong></td>
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