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DEPARTMENT OF TRANSPORTATION

PennDOT Local Technical Assistance Program

moving FORWARD

FALL 2013

A quarterly review of news and information about Pennsylvania local roads.

From Dirt Roads to GRS Bridges

Four generations of Groves give back to their township

by Amy Bobb, PSATS

The Grove family has been a valuable part of building North Hopewell Township's road system since the 1930s. This past summer, three generations of Groves – Dusty, 59; Ben, 28; and Bruce, 85 – gather during the construction of a GRS bridge in the township.

When Ben Grove was a boy growing up in North Hopewell Township, York County, he would ride along with his grandfather and father while they plowed snow for the township.

"I thought it was the coolest thing ever," Ben says.

He can recall the large amounts of snow that had to be cleared during the blizzards of 1993 and 1996. He can also remember visiting his grandparents at the township building where his grandfather was a township supervisor and his grandmother was the township clerk.

"It was a big deal for us to go back there and visit and see all the trucks and equipment," Ben recalls. "I saw my grandfather as the mayor of the township, along with the two other supervisors."

Perhaps those memories helped to inspire him, in 2003 while still a senior in high school, to run for office to fill the unexpired term of a supervisor who had moved out of the township. He won the primary, just weeks after turning 18, and went on to win the general election in a landslide against two write-in candidates.

"My dad didn't even know I was running," says Ben, now 28, who explains he was motivated to run after hearing a news story about the youngest elected mayor. "I got all non-family members to sign my petition, and about a week before the primary, my dad found out and asked me if I was running for township supervisor."

It really should have come as no surprise since he is now the fourth generation of Groves to have served as a North Hopewell Township supervisor. His great-grandfather Daniel was a supervisor who helped to build some of the township's first roads as part of the Works Progress Administration projects of the 1930s; his grandfather Bruce was responsible for turning most of the dirt roads into macadam when he was supervisor between 1963 and 1995; and his dad, Duston, helped to build the township building in 1974.

"Before that, the township office was in my mom's kitchen," says Duston. Dusty, as he is called by everyone, went on to become a township supervisor in 2001 and has served as the chairman of the board for the last 10 years.

"I was proud of Ben for running for supervisor," says Dusty, 59, who is also a full-time farmer. "It showed his commitment to the community. Growing up with my dad and me working for the township, he knows the background on issues and understands what it takes to get something done. He sees it as his heritage to give back to his community."

Although Ben elected not to run for supervisor again once his two-year term ended, he has remained a valuable part of the township road crew over the past decade and continues to plow snow, work on the roads, and do whatever else is necessary to keep the township in tip-top shape.

"I think it's pretty neat to work here at the

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ALSO IN THIS ISSUE

Corrosion of Bridges

What You Need to Know about Corrosion of Reinforcement in Concrete Bridges

by Christina Cercone, Graduate Student, Lehigh University, and Clay Naito, Associate Professor, Lehigh University

Concrete is a widely used construction material in bridge systems throughout the United States. Typically, concrete bridge systems are designed using reinforced, prestressed concrete or post-tensioned concrete components. Prestressed and post-tensioned concrete differs from traditional non-prestressed reinforced concrete systems in that they provide precompression of the concrete before the bridge goes into service. This additional compression helps to resist the tensile demands on the component generated from traffic loads. As with all bridge systems, deterioration needs to be monitored by the owner throughout the lifespan of the structure.

Corrosion Still Persists

In general, prestressed and post-tensioned systems face similar durability issues as non-prestressed concrete systems. This includes corrosion of steel reinforcement and delamination and spalling of the concrete. To reduce the occurrence of corrosion in bridge systems, the reinforcement is required to have a minimum amount of concrete between the bar and the surface of the component. This concrete cover acts to protect the reinforcement from corrosion initiators, such as moisture and chlorides. Due to construction errors and high levels of exposure, however, corrosion still occurs.

Corrosion of the reinforcement in concrete bridges is one of the main causes of bridge deterioration. When steel reinforcement bars or prestressing strands within the concrete corrode, the steel can increase up to seven times its original diameter. This increase in size of the reinforcement places tensile forces on the surrounding concrete, causing the concrete to crack.

Cracking typically manifests as longitudinal splitting cracks, localized spalling around the reinforcement, or delamination of a section of the beam. In general, corrosion of one reinforcing bar or strand is associated with longitudinal cracking while corrosion of multiple adjacent reinforcing bars or strands can result in spalling or delamination of the concrete. The photos below illustrate examples of corrosion-induced deterioration.

It is imperative for the safety of the public to identify the presence of corrosion, repair the damage, and mitigate the source of corrosion at an early stage.

What Causes Corrosion?

Corrosion of steel in concrete is caused by two electrochemical reactions: anodic reaction, which is capable of producing electrons and oxidizing iron, and cathodic reaction, which is capable of consuming electrons (ACI 222R). Properly made concrete has a high pH level, which enables an electrochemical reaction that typically results in the formation of iron oxides or hydroxides that form a protective layer around the steel. This protective layer is fairly stable as long as the concrete maintains a high pH and is not subjected to external attack by environmental or chemical products (Naito and Warncke, 2008).

The corrosion of steel strands in concrete members can be initiated by a number of different factors, but the two most common causes are chloride attack and the carbonation of concrete. The degree of corrosion of the reinforcement can vary, with the most severe corrosion causing complete fracture of the reinforcement and resulting in strength loss in the system.

Corrosion levels

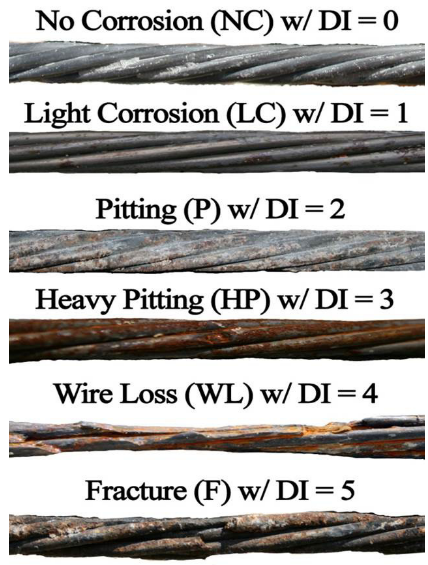
Chloride-induced corrosion is the most common cause of reinforcement corrosion due to the fact that chloride ions are found in numerous sources, including improper concrete material admixtures or

Corrosion of the steel reinforcement induces longitudinal cracking (left) and spalling and delamination (right).

contaminants, as well as external sources, such as marine environments and deicing salts. When the chloride ions come into contact with the reinforcement, the protective layer around the steel is lost, and oxidation of the steel begins to occur, resulting in the corrosion of the strand.

In areas of Pennsylvania that experience harsh winters, exposure of the concrete to deicing salts (such as calcium or magnesium chloride) is inevitable. Once the concrete is exposed, the chloride ions can then be transmitted in the concrete through concrete pores, cracks, and construction joints, resulting in corrosion of the reinforcement.

Currently, numerous methods are available to measure chloride levels in concrete. Two common methods of measuring the total chloride measurement in the United States are defined in ASTM C1152 Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete and AASHTO T-260 Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials (Naito and Warncke, 2008). For bridges where visible signs of corrosion are not present but concerns over corrosion exist, the chloride levels can be examined. The results from these tests are then commonly compared to two threshold values described in ACI 222R to determine if chloride-induced corrosion is a concern.



The second most common cause of corrosion is from carbonation of the concrete. Carbonation occurs when carbon dioxide in the atmosphere enters into the surface pores of concrete, thus decreasing the pH level of the pore solution. This front of decreased pH penetrates the concrete and results in the loss of the steel protective layer, allowing for the initiation of corrosion (Naito and Warncke, 2008).

Carbonation of concrete requires very high levels of carbon dioxide, much larger than the levels present in urban areas. However in industrial areas where the carbon dioxide levels are elevated, concrete systems are more vulnerable to carbonation.

For cases where there are high levels of exposure, the likelihood of carbonation is greater when the system is exposed to wet-dry cycles, is cracked, and has high amounts of porosity. The depth of carbonation in concrete can be measured by taking pH measurements.

The pH is readily measured through the use of a phenolphthalein solution, which turns red when carbonation is not present (Naito and Warncke, 2008). Based on the results of this test, the threat of carbonation-induced corrosion to the reinforcement can be assessed.

Assessing and Reducing Damage

In most cases, damage to the concrete component can be readily assessed through visual examination. Obvious signs of distress include cracking, rust stains, delamination, and spalling of the concrete. In some cases, corrosion can occur without any visible sign of distress. For these cases, it is necessary to employ nondestructive evaluation (NDE) methods, which essentially allow the inspector to look through the concrete cover and examine the condition of the concrete and reinforcement without physically damaging the surface.

Some examples of NDE methods that have been applied to concrete bridge systems for the detection of corrosion are impact echo, magnetic flux leakage, half-cell potential method, ground penetrating radar, and remnant magnetism. Each method provides a different view of the internal condition of the component.

For example, ground-penetrating radar can identify locations of reinforcement and thickness of the concrete; remnant magnetism can identify the amount of corrosion on a reinforcement bar; and the half-cell potential method can identify the level of active corrosion in a region. Combining the information from a variety of NDE methods allows inspectors to get an overall view of the internal condition of the bridge member.

Prestressed beams and girders are commonly used components in Pennsylvania bridges. The use of the prestressing contributes significantly to the tensile strength and reduces concrete cracking in the member. It also allows for longer beam spans and more economical sections that make this type of system advantageous in bridge design. The reinforcement plays a vital role in the integrity of the bridge

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The result of strand corrosion and damage when left unchecked can be seen in these bridge girder failures in Pennsylvania and Ohio.

Control Vegetation to Reduce Safety Hazards

by Patrick Wright, Pennoni Associates

Vegetation along roads can grow rapidly, and that growth may result in safety hazards along our roadways. Employees of public agencies are responsible for observing their roads and identifying any hazards that may affect road safety. There are many maintenance and other reasons for controlling vegetation along roadways, but preventing traffic safety hazards ranks as one of the most important.

Municipalities should be able to identify different areas of concern for vegetation related to traffic safety hazards and know the steps to take to remove the vegetation and improve roadway safety.

There are many maintenance and other reasons for controlling vegetation along roadways, but preventing traffic safety hazards ranks as one of the most important.

What are Common Vegetation-Related Safety Hazards?

In the Pennsylvania Code, Title 67, Chapter 212 (also known as PennDOT Publication 212), PennDOT defines examples of vegetation-related traffic hazards as:

(b) Trees, plants, shrubs or other obstructions. The department on state-designated highways, and local authorities on any highway within their boundaries, may require a property owner to remove or trim a tree, plant, shrub or other obstruction or part thereof which constitutes a traffic hazard. The following are examples of traffic hazards:

1. The obstruction restricts the stopping sight distance for drivers of through vehicles or the available corner sight distance for drivers entering from side roads or driveways to distances less than the appropriate minimum stopping sight distance or minimum corner sight distance values.
2. The obstruction critically restricts the sight distance to a traffic-control device.
3. Vehicle crash records indicate that a crash has involved the obstruction or that the obstruction contributed to one or more of the vehicle crashes.

Based on the information in Pub 212, there are three basic roadway safety hazards related to vegetation:

- Restricted sight distance
- Restricted visibility of traffic-control devices
- Fixed object hazards along the roadside

Restricted sight distance can occur along the road or at intersections. Vegetation blocking the sight distance as drivers are traveling down a road typically occurs on the inside of curves and other locations where the road alignment changes.

Make sure vegetation doesn't restrict sight distance along a roadway.

Vegetation can also block the driver's line of sight to see approaching vehicles when departing an intersection. This can be a critical safety hazard, as vehicles crossing or turning onto a road may not have enough sight distance to make safe decisions to pull out. Although this can occur on any streets, it is most severe at the intersections of higher speed roads.

Be sure vegetation doesn't get in the way at an intersection so a motorist has enough sight distance to make a safe decision about pulling out onto the road.

In addition to roadway safety hazards, vegetation can create safety hazards for pedestrians.

The second basic roadway safety hazard related to vegetation occurs where vegetation blocks signs, signals, and other official traffic-control devices.

Here, vegetation restricts the sight distance to a stop sign.

The third roadway safety hazard identified in Pub 212 is where vegetation has either caused crashes or is a potential hazard for vehicles to hit. It may have been identified as the cause of a crash in vehicle crash records.

In addition to roadway safety hazards, vegetation can create safety hazards for pedestrians. It can restrict the ability of people to walk along the sidewalk, as well as limit sight distance for pedestrians to cross streets.

Roadside Safety and Vegetation Management

As part of their vegetation management program, municipalities are encouraged to look for and identify areas where vegetation may create a safety hazard.

The keys areas are:

- along the roadway (especially near hills/curves),
- at intersections,
- at sight lines to traffic-control devices,
- along sidewalks, and
- where evidence shows trees are a hazard.

These areas can be identified as part of a systematic, cyclical review of roadways or by any employee driving on the roads. Employees should be aware of Pennsylvania's laws and regulations related to vegetation control, as well as their local ordinances. LTAP offers a Roadside Vegetation Control class and a Roadside Safety Features class that provides more information about controlling vegetation and improving roadside safety.

In most cases, vegetation within the right-of-way can be removed (one exception is for trees larger than 6 inches in diameter). Vegetation outside of the right-of-way can also be removed if it is defined as a safety hazard as described in PennDOT Pub 212.

How to Determine if Vegetation is a Hazard

To clearly define vegetation as a safety hazard in accordance with PennDOT Pub 212, a traffic and engineering study may be necessary. Pennsylvania also has a law, Title 75, Section 6112, which requires property owners to remove vegetation that is a safety hazard.

The first step for removing such vegetation is for the municipality to provide a notice to the property owner to remove the vegetation. If the property owner complies, then no further action is required. But, if the property owner resists, the municipality should document the traffic safety hazard by conducting the appropriate studies. In most cases, municipal staff can perform the studies. PennDOT form TE-119, Removal of Traffic Hazards, should be used to document the study. The studies typically involve the following steps:

1. Collect crash data
2. Conduct field investigations
3. Conduct field studies
4. Document the results using PennDOT forms

Although the law and supporting regulations for the removal of vegetation on private property is clear, it can be a sensitive issue. It may require some public relations effort and even incentives (e.g., remove a tree, plant a tree in another location). The end result should be the removal of the hazard and the improvement of safety.

Vegetation Resources

PA Vehicle Code, Title 75
PennDOT Publication 212
PennDOT TE Forms
Vegetation Control for Safety, FHWA, 2008

GEOSYNTHETIC REINFORCED SOIL-INTEGRATED BRIDGE SYSTEM

Townships Employ Alternative Bridge Technology

This past summer, North Hopewell Township, York County, (see cover article) and Sandy Township, Clearfield County, (top photo) rebuilt bridges using the Geosynthetic Reinforced Soil-Integrated Bridge System (GRS-IBS). These are only the second and third such bridges in the state. The first GRS bridge was constructed in Huston Township, Clearfield County, in 2011. The Sandy Township crew recently held a ribbon-cutting ceremony (bottom left) for the newly completed Old Bliss Bridge (bottom right). GRS-IBS is a fast, cost effective method of bridge support that blends the roadway into the superstructure.

From Dirt Roads to GRS Bridges

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township where my father and grandfather worked," he says. "There is such a variety of things to get accomplished, and every day is different."

Recently, the three generations of Groves gathered together – in the name of township business – to work (in the case of Ben and Dusty) and observe (in the case of 85-year-old Bruce) as the township constructed a bridge using a Geosynthetic Reinforced Soil-Integrated Bridge System (GRS-IBS), only the third such structure to be built in the state. (*See photos above.*) The bridge construction relies on municipal manpower and equipment to install the footers and abutments and prepare the site for the bridge to be laid.

"I have to admit I was skeptical at first about the construction, especially because I have built several houses," says Ben, who also works as a carpenter. "It didn't seem like it would work to place such a heavy structure on a stone footer. But after building it and seeing how solid and sturdy it is, I am 100 percent for this type of bridge construction now."

Ben's construction background has been invaluable during the bridge construction, according to Dusty. "I rely on my son since he has the construction experience of building houses," he says. "And, he relies on me for my life experience. Fathers and sons always have disagreements, but we get along pretty well most of the time, and we're united in the same cause: seeing our community run correctly."

With four generations of Groves entwined in North Hopewell Township's history, might there one day be a fifth generation ready to go to work for the township? Perhaps. Ben's son Landen is only 18 months old — too young to know what the future holds for him — but his dad says, "He's all about the trucks and tractors already."

Dusty says he wouldn't be surprised if his grandson also became involved in the township one day. "If he grows up in the neighborhood and stays in the neighborhood, just like we did, I wouldn't put it past him," he says. "After all, it's part of his heritage."

Upcoming Classes

To Register:
PHONE: 1-800-FOR-LTAP (367-5827)
WEBSITE: www.ltap.state.pa.us
This represents some of our scheduled courses. Look for updates on the website.

Liquid Bituminous Seal Coat
Oct. 1, Adams County
Oct. 16, Allegheny County
Oct. 18, Clearfield County
Oct. 24, Columbia County
Oct. 31, Jefferson County
Nov. 1, Clinton County
April 1, Chester County
April 3, Venango County
April 4, Mercer County

Winter Maintenance
Oct. 2, Schuylkill County
Oct. 2, Washington County
Oct. 3, Westmoreland County
Oct. 7, Schuylkill County
Oct. 8, Wyoming County
Oct. 9, Crawford County
Oct. 9, Tioga County
Oct. 18, Adams County
Nov. 19, Bucks County

Stormwater Facility Operation & Maintenance
Oct. 2, York County

Warm Mix Asphalt
Oct. 3, Lackawanna County
Oct. 17, Allegheny County
Oct. 25, Montgomery County
March 5, York County
March 11, Chester County

Roadside Vegetation Control
Oct. 4, Clinton County
Feb. 11, York County

Bridge Maintenance & Inspection
Oct. 4, Indiana County
Oct. 8, Chester County
Oct. 22, Erie County

Intersections
Oct. 7, Crawford County
Oct. 15, Allegheny County

Traffic Signs
Oct. 8, Allegheny County
Oct. 8, Erie County
Nov. 13, Lehigh County
May 13, Bucks County

Posting & Bonding of Local Roads
Oct. 10, Fayette County
Oct. 24, Cameron County
Nov. 8, Blair County
April 22, Clearfield County

Safe Driver
Oct. 10, Lehigh County
Oct. 15, Bucks County
Nov. 12, Carbon County

Full-Depth Reclamation
Oct. 11, York County
Oct. 15, Mercer County
Nov. 6, Northumberland County
Nov. 13, Allegheny County
Nov. 14, Potter County
Nov. 20, Lehigh County
Nov. 21, McKean County
April 22, Chester County

Road Surface Management
Oct. 15, Somerset County
Nov. 7, Lycoming County
Nov. 14, Adams County
Nov. 25, Warren County

Geosynthetics
Oct. 16, Allegheny County

Roadside Safety Features
Oct. 16, Armstrong County

Principles of Paving
Oct. 23, Wayne County

Work Zone (Temporary) Traffic Control
Oct. 24, Lehigh County
Aug. 19, Bucks County

Equipment and Worker Safety
Oct. 28, Bedford County

Drainage: the Key to Roads that Last
Oct. 28, Warren County
April 8, Bucks County

Americans with Disabilities Act
Oct. 30, Lehigh County

Managing Utility Cuts
Nov. 1, Adams County

Project Estimating Using Mathematical Principles
Nov. 4, Mercer County

Unpaved & Gravel Roads: Common Maintenance Practices
Nov. 5, Mercer County
Nov. 19, Lycoming County
April 1, Clearfield County

Asphalt Roads: Common Maintenance Practices
June 10, Bucks County

Congratulations to the following Roads Scholar recipients:

- Malcolm Brown – East Penn Township, Carbon County
- Lance Carter – Elizabethtown, Lancaster County
- Chris Chapman – Keating Township, McKean County
- Thomas Welker – PennDOT
- John Sickonic – Bethlehem, Northampton County

Corrosion of Bridges

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component since corrosion or damage to the reinforcement can lead to catastrophic failure of the system.

Visual inspection of corrosion damage of reinforced concrete members is the primary tool for improving the longevity of bridge systems. For areas where corrosion is present, the extent of corrosion can be identified through chloride and carbonation testing as well as the NDE techniques previously outlined.

Since corrosion when left unchecked can result in complete failure of a system, it is imperative for the safety of the public to identify the presence of corrosion, repair the damage, and mitigate the source of corrosion at an early stage. It is recommended that local agencies be proactive in identifying corrosion-induced damage and involve a licensed bridge inspector whenever concerns arise.

Did you know...

you can use your CPR training for a class credit toward Roads Scholar designation?

Details: Successful completion of an approved CPR training course accepted by your employer or the Pennsylvania Department of Health earns you one workshop credit toward Roads Scholar certification. A copy of a completion certificate must be forwarded to the LTAP office in Harrisburg within the three-year training window.

Visit www.ltap.state.pa.us for more information.

Meet the LTAP Advisory Committee

The PennDOT LTAP Advisory Committee is comprised of an appointed group of municipal government (elected and/or appointed) officials who serve a critical role as program advocates and assist PennDOT by attending training courses, reviewing course materials and content, and functioning in an advisory role on a variety of LTAP issues. The following officials currently serve as members of the Advisory Committee:

- **Donald G. Sirianni Jr.**, Chair; Springfield Township, Montgomery County, dsirianni@springfieldmontco.org
- **Paul O. Wentzler,** Co-Chair; Muncy Township, Lycoming County, muncytwp@comcast.net
- **Glenn A. Coakley**; Patton Township, Centre County, gcoakley@twp.patton.pa.us
- **Mark T. Hoke**; East Stroudburg Borough, Monroe County, esbmaint@frontier.com
- **Jeffrey K. Kinsey**; Elizabethtown Borough, Lancaster County, publicworks@etownonline.com
- **James J. McGowan**; Wilson Borough Public Works, Northampton County, loulourules11@verizon.net
- **Marlin D. Moore**; Coudersport Borough, Potter County, coudyboro@zitomedia.net
- **Douglas A. Roth**; Penn Township, Butler County, droth@penntownship.org
- **Ann Simonetti**; Marysville Borough, Perry County, asimonetti@comcast.net

WANTED

LTAP Advisory Committee Members

PennDOT is seeking candidates to fill four spots on the LTAP Advisory Committee. Township supervisors and borough council persons from PennDOT Engineering Districts 1, 4, 9, and 12 are welcome to apply. Knowledge of the LTAP Program or certification as an LTAP Road Scholar is desirable. This position is strictly as a volunteer, although expenses are reimbursed for all LTAP-related travel, including mileage, food, and lodging. The LTAP Advisory Committee, which meets twice annually, serves a critical role as program advocates and assists PennDOT by attending training courses, reviewing course materials and content, and functioning in an advisory role on a variety of LTAP issues. For more information, please contact LTAP Program Director Lou Ferretti at (717) 787-2598 or lferretti@pa.gov.

Want Off the Mailing List?

If you do not want to receive a copy of this newsletter, please send an email to ckilko@psats.org. The newsletter is available electronically on the LTAP website under Public Resources and Documents.

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