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Introducing the New NCDOT Research and Development Newsletter

Welcome to the first issue of the NCDOT Research and Development Unit's newsletter, *Research and Development News*. Each issue will touch on local, regional and national transportation related news and projects. Readers can expect to see an in-depth report on a particularly successful NCDOT research project or series of projects, short summary of other interesting local projects and highlights of recent national research reports. The Librarian's Corner will keep you up to date on services and information from our Research Library Staff.

Research and Development's goal is to provide department team members access to quality information, connect them with top flight researchers, and to develop a practical research program with an eye towards implementation. Nearly all areas of NCDOT operations are eligible for research funding. Whether it is operations, design, maintenance, materials or fiscal matters, we can help or find someone who can. We also coordinate NCDOT's participation in the National Cooperative Highway Research Program (NCHRP) and national Pooled Funds.

Multiple new research projects were kicked off this fall and the diverse subjects range from guardrail performance, to pavement design issues, to customer service evaluations and even an investigation into the potential cost-effective use of unmanned aerial systems. For a full list of new FY2015 research beginning this fiscal year, please visit the [Research Projects Page](#).

We hope you enjoy this newsletter, and if you have ideas for articles or questions about the Research Program, please give us a call or drop us an email. Look for more information on the research program and a how to submit ideas for future research in future issues.

Neil Mastin



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Asphalt Surface Treatments for Preventive Maintenance

Mustan Kadibhai

Asphalt surface treatments (ASTs), also known as chip seals, are among the most efficient and cost-effective methods utilized by state highway agencies to preserve and rejuvenate existing pavements. A series of research projects funded by the NCDOT and conducted by NCSU has shown various ways to improve chip seal performance. These improvements include the use of: (1) lightweight aggregate with uniform gradation, (2) polymer-modified emulsions (PMEs), and (3) optimized rolling protocols. The findings from the research project # 2007-06 “*Performance-Based Analysis of Polymer-Modified Emulsions in Bituminous Surface Treatments*” clearly indicate a significant improvement in the performance of chip seals constructed with PMEs.

Projects such as those completed in past years as well as those that are currently underway have placed NCSU in the forefront of research in the field of pavement preservation and modernized NCDOT’s chip seal implementation. The national recognition of the significance of the NCSU research on asphalt surface treatments is evidenced by a total of 11 peer-reviewed journal papers and numerous conference papers and presentations. This recognition has also resulted in winning the NCHRP 09-50 project *Performance-Related Specification for Asphalt Binders Used In Preservation Treatments*.

Several test procedures were developed or refined at NCSU while conducting NCDOT research projects including:

A modified sand circle method based on *Roads and Traffic Authority Test Method T 240: Texture Depth of Coarse Textured Road Surfaces* has been developed that describes the procedure for measuring the average textural depth of a chip seal.

MMLS3 Performance Test Procedure, a third-scale unidirectional vehicle load simulator that can be used to measure several parameters including aggregate loss and rutting.

Digital Image Processing (DIP) used for evaluation of bleeding performance. National Instruments Vision Assistant (NIVA) 7.0 is used for the analysis of the digital image to generate a histogram of gray scale intensity values (GIVs)

The **Ignition Oven Test**, specified in ASTM D 6307 (ASTM), is adopted to determine the weight of residual aggregate and emulsion.

LIST OF RELATED NCDOT RESEARCH PROJECTS

NCDOT Research Project # [2004-04](#) “Optimizing Gradations for Surface Treatments”
Final Report available [Project Information Page](#).

NCDOT Research Project # [2006-06](#) “Quantifying the Benefits of Improved Rolling of Chip Seals”
Final Report available [Project Information Page](#).

NCDOT Research Project # [2007-06](#) “Performance-Based Analysis of Polymer-Modified Emulsions in Asphalt Surface Treatments.” Final Report available [Project Information Page](#).

NCDOT Research Project # [2008-04](#) “Development of a New Chip Seal Mix Design Method” Final Report available [Project Information Page](#).

NCDOT Research Project # 2009-01 “Development of a Field Testing System for Asphalt Surface Treatments” (ongoing)

NCDOT Research Project # 2010-02 “Fog Seal Effectiveness for Bituminous Surface Treatments” (ongoing)

NCDOT Research Project # 2011-03 “Extending the Use of Chip Seals to Higher Volume Roads by Using Polymer-Modified Emulsions and Optimized Construction Procedures” (ongoing)

NCDOT Research Project # 2013-03 “Field Calibration and Implementation of the Performance- Based Chip Seal Mix Design Method” (ongoing)

Environmental Projects

John Kirby

[Precipitation Alert: Ongoing Maintenance of Precipitation Alert and Visualization Tool in Support of NC DOT's Storm Water Quality Monitoring](#)

The State Climatic Office (SCO) of North Carolina has developed a Multi-sensor Precipitation Estimate (MPE) website for the North Carolina Department of Transportation (NCDOT) - Highway Stormwater Program. This website enables engineers to closely monitor estimated precipitation amounts at NCDOT construction and other related sites across the State. The user can identify their own latitude/longitude monitoring sites and receive an email alert when precipitation at that location has exceeded a particular threshold such as 0.5 inches within 24 hours. Also, there is a map interface that allows for spatial visualization of precipitation estimates throughout the State for various time frames such as 6 hours, 15 day, and 90 day periods. This interface allows rainfall data to be overlaid with other data layers such as county lines, cities, NCDOT primary and secondary roads, and water features. There are several benefits of the MPE website compared to the standard rain gage device that include: 1) Provides rainfall email notification; 2) Provides the ability to create multiple stations; 3) Provides record keeping; 4) Provides rainfall data for remote locations; 5) Provides a broader regional perspective of rainfall amounts; and 6) Provides compatible data with independent daily precipitation gage network.

[Reducing stormwater flows and pollution from ocean outfalls at Kure Beach NC using Dune Infiltration Systems](#)

Urban development in coastal areas bolstered the need for stormwater treatment practices due to increases in impervious area that increased runoff and bacteria export. Prior to current stormwater regulations, some stormwater systems were constructed to discharge directly onto the beach, placing ocean swimmers at risk of contracting illnesses. In order to combat this issue, the Town of Kure Beach, NCDOT, and NCSU-BAE developed a new stormwater BMP, the Kure Beach Dune Infiltration System (DIS). The DIS was designed to capture the runoff from a 12.7 mm/hr (0.5 in/hr) storm event by diverting stormwater into subsurface StormChambers™, located beneath the dunes, and allow for infiltration of stormwater within the dunes. Two DISs were constructed and monitored for several years. A control site, with no stormwater inputs, was also monitored. Thus far, monitoring results of the untreated stormwater revealed bacteria concentrations reaching as high as 53 times the state maximum, while post-treatment groundwater concentrations remained mostly below the state maximum. Overall, there was a 97% difference between the stormwater and groundwater bacteria median concentrations. Furthermore, 99% of all storm flows at the sites were captured and treated, with one system capturing all associated flows. Short term mounding of groundwater beneath the DISs occurred following infiltration events, but subsided within a few hours to days, to levels similar to those in a nearby control dune.

Other Environmental Projects* being managed by John W. Kirby include:

FHWA/NC/[2009-24](#) *Evaluating Potential Effects of Widening US Highway 64 on the Black Bear Population of Alligator River National Refuge, Dare County, NC.* Final report available. [Project Information Page](#).

FHWA/NC/[2009-25](#) *Evaluating Potential Effects of Widening US Highway 64 on Red Wolves, Washington, Tyrell and Dare Counties, NC.* Final report available. [Project Information Page](#).

FHWA/NC/[2009-26](#) *Cost Effective Wildlife Crossing Structures which Minimize the Highway Barrier Effects on Wildlife & Improve Highway Safety along US Highway 64, Tyrell County, NC.* Final report available. [Project Information Page](#).

*This series of projects is ongoing and deals with ways to assist wildlife in safely navigating across highways, specifically US Highway 64 in Eastern North Carolina.

New Publications from TRB

[Analytical Travel Forecasting Approaches for Project-Level Planning and Design: National Cooperative Highway Research Program \(NCHP\) Report 765](#)

This report describes methods, data sources, and procedures for producing travel forecasts for highway project-level analyses. It is an update to NCHRP Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design.

[Applying GPS Data to Understand Travel Behavior, Volume I: Background, Methods, and Tests and Volume II: Guidelines: National Cooperative Highway Research Program \(NCHRP\) Report 775](#)

Volume I describes the research process that was used to develop guidelines on the use of multiple sources of Global Positioning System (GPS) data to understand travel behavior and activity. Volume II includes guidelines which are intended to provide a jump-start for processing GPS data for travel behavior purposes and provide key information elements that practitioners should consider when using GPS data.

[Bridge System Safety and Redundancy: National Cooperative Highway Research Program \(NCHP\) Report 776](#)

This report provides proposed revisions to the design philosophy section of the American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications.

[Evaluating Impacts of Sustainability Practices on Airport Operations and Maintenance: Airport Cooperative Research Program \(ACRP\) Report 110](#)

This report provides guidance on using an evaluation process and cost-benefit tool to evaluate lifecycle costs of sustainability practices being considered by airport operators.

[Framework for Performance Specifications: Guide for Specifications Writers \(SHRP 2\) Report S2-R07-RR-3](#)

This guide from TRB's second Strategic Highway Research Program presents a flexible framework that specifiers may use to assess whether performance specifying represents a viable option for a particular project or project element.

Many more publication links can be found on [NCDOT's TRB News Feed](#)

Calendar of Events 2014-2015

December 2014

- Full Proposal Selections
- NC DOT Board of Transportation Meeting, December 3-4, 2014

January 2015

- NC DOT Board of Transportation Meeting, January 7-8, 2015
- TRB Annual Meeting (Washington, D.C.) January 11-15, 2015
- ALA Midwinter Conference (Chicago, IL), January 30-February 3, 2015

February 2015

- NC DOT Board of Transportation Meeting, February 4-5, 2015
- Research Executive Committee Meeting (TBD)

Librarian's Corner

Get to know us: The NCDOT library was originally created to house meeting agendas and minutes for the State Highway Commission, now the NC Board of Transportation. Over time, the library expanded to become a repository of many transportation related documents.

The Collection Includes:

- Books on many transportation and engineering related topics
- Research and Government Reports (NCDOT Research Reports, TRB publications, and AASHTO publications)
- Transportation related periodicals and pamphlets
- Engineering and construction manuals
- Maps
- Historical newsletters and documents dating to the 1920s (Currently available only in print)
- Board of Transportation Minutes

This growing collection is searchable through the State Library of North Carolina's Government and Heritage Library [Online Catalog](#), and currently consists of approximately 1500 items and resources available to researchers and engineers.

Contact the NCDOT Librarian, Lamara Williams-Jones, for assistance: 919-508-1820, Monday through Friday from 8:30 to 4:30. Since there is only one Librarian, customers should call before visiting the Library. Watch this space for future articles about the Library's services and helpful topics. We look forward to serving you!

Did You Know?

*Lamara Williams-Jones,
Research Librarian*

- ◇ The nation's oldest comprehensive state bicycle program was created in North Carolina in 1974 with the passage of the Bicycle and Bikeway Act by the State General Assembly.
- ◇ More than 56 million passengers fly to and from North Carolina each year and more than 800 million pounds of air freight originate annually in the state.



NCDOT Research and Development Unit General Information

How to find us:

We are located at 104 Fayetteville Street, Raleigh, in the Raney Building.

The Research & Development [web page](#) contains more information about the Unit and what we do.

The Research Library's [catalog](#) is also available on the web.

NCDOT RESEARCH AND DEVELOPMENT

The Research & Development Unit oversees transportation-related research that investigates materials, operations, planning, traffic and safety, structures, human environments, natural environments, and more. Please contact one of our engineers listed on this page if you have questions.

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RESEARCH & DEVELOPMENT