Updates from the States: Virginia (January 2011)

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The Virginia Department of Transportation (VDOT) research is managed by the Virginia Center for Transportation Innovation and Research (VCTIR). VCTIR (previously known as the Virginia Transportation Research Council or VTRC) performs in-house research as well as engages in partnerships with universities and other DOT's to accomplish VDOT research goals. One of these partnerships includes the Virginia Tech Transportation Institute (VTTI).

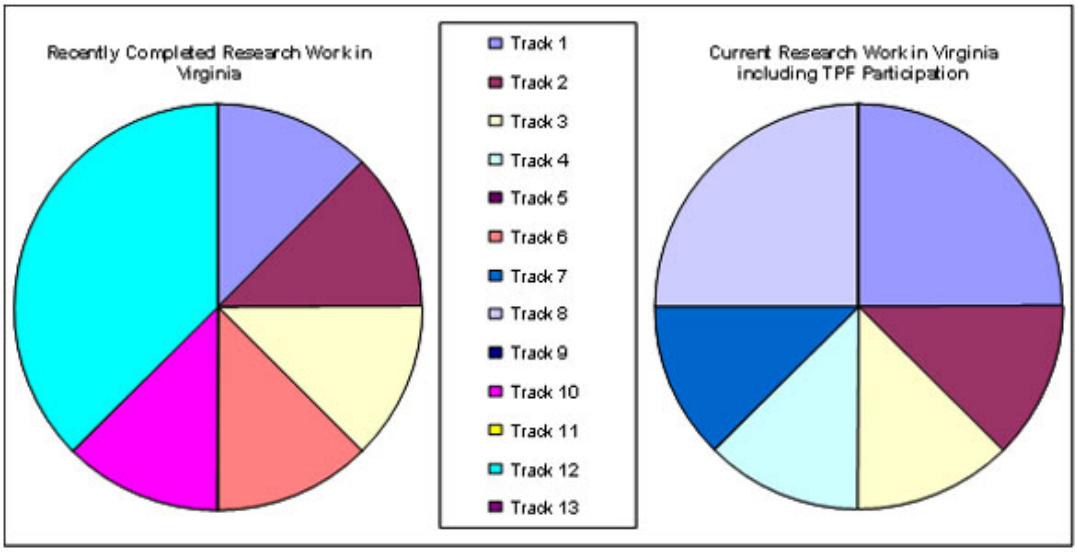
VTTI is one of the original FHWA/Federal Transit Administration Intelligent Transportation Systems Research Centers of Excellence and is home to VDOT's Smart Road. The Smart Road is described as a test-bed research facility where projects such as the Pavement Surface Properties Consortium are currently being conducted. The Pavement Surface Properties Consortium project is a transportation pooled fund (TPF) project that includes support from three other states and the Federal Highway Administration (FHWA); it is an example of how VDOT works with other states to meet research needs.

To learn more about each of these research facilities, follow the links below.

- VCTIR
- VTTI
- TPF

The following identifies research in Virginia that is ongoing (including TPF activities), and was recently completed. The research involves VDOT and/or its partners. How each of the research activities align with the CP Road Map is identified. The chart below depicts the number of research projects for each of the CP Road Map Tracks that have been recently completed or are currently ongoing in Virginia. For more details on each of the tracks follow the link below. More details on individual projects not highlighted can be found by clicking the research projects link below.

- CP Road Map Tracks
- VCTIR Research Projects:
    - Pavements
    - Materials



Current Research

Track 1: Performance-Based Concrete Pavement Mix Design System

- Characteristics of Hydraulic Cements, Supplementary Cementitious Materials, and Other Mineral Admixtures Used in Concrete
- End-Result Specifications for Hydraulic Cement Concrete: Phase II

Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems

- Sonic Measurements in VDOT Concrete Mix Designs

Track 7: High-Speed Concrete Pavement Rehabilitation and Construction

- Use of Precast Slabs for Pavement Rehabilitation and Field Trial on Interstate 66

Transportation Pooled Fund (TPF) Studies

Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements

- TPF-5(229): Characterization of Drainage Layer Properties for M-EPDG

Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements

- TPF-5(141): Pavement Surface Properties Consortium: A Research Program

Track 8: Long-Life Concrete Pavements

- TPF-5(123): Pavement Preservation Technology Transfer Among Southeast States

Recently Completed Research

Track 1: Performance-Based Concrete Pavement Mix Design System

- Measurement of Early Age Shrinkage of Virginia Concrete Mixtures (this can also be categorized under Track 11: Concrete Pavement Business Systems and Economics)

Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements

- Unbound Pavement Layer Resilient Modulus for MEPDG
- Evaluation of the Lightweight Deflectometer for In-Situ Determination of Pavement Layer Moduli

Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems

- Use of Pocket Computer with Built-in Camera for Characterizing Aggregate Shape, Angularity and Texture for QC/QA

Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction

- Evaluation of Jointed Reinforced Concrete Pavement Rehabilitation on I-64 in the Richmond and Hampton Roads Districts of Virginia

Track 10: Concrete Pavement Performance

- Investigation of the Effect of Wet Curing on Durability Parameters of Hydraulic Cement Concretes (this work can also be categorized under Track 8)

Track 12: Advanced Concrete Pavement Materials

- Composite Pavement Systems: Synthesis of Design and Construction Practices
- Strength, Elastic Modulus, Permeability and Conductance of Lightweight Concrete (this work can also be categorized under Track 1)
- High-Performance Continuously Reinforced Concrete Pavements in Richmond and Lynchburg, Virginia (this work can also be categorized under Track 1)

Highlights

The following highlights some of the recently completed research projects by providing additional details and direct links for more information.

High-Performance Continuously Reinforced Concrete Pavements in Richmond and Lynchburg Virginia

In September of 2007, VCTIR Principal Research Scientist Celik Ozyildirim completed a report that evaluates the performance of two sections of Continuously Reinforced Concrete Pavement (CRCP) in Virginia. The purpose of the report was to develop recommendations for future use of high performance concrete (HPC) in CRCP. This report suggests that HPC in CRCP has the potential for increasing service life of the pavement that may result in substantial cost savings for VDOT.

The report documents mixture design and pavement design details, the construction process, and testing results for sections along State Route 288 and on U.S. 29 Madison Heights Bypass. The report recommends strength and aggregate specifications, the use of maturity testing, and compressive strength acceptance testing. Trial batching and the construction of a test section are also included as recommendations. This report and the research it documents characterizes the performance of concrete mixtures and as such is an example of work conducted under CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System. Implementing HPC in CRCP is an example of work under Track 12: Advanced Concrete Pavement Materials.

Click here to read the report.

Effect of Wet Curing Duration on Durability Parameters of Hydraulic Cement Concretes

A 2010 report by VCTIR Associate Principal Research Scientist Stephen Lane documents research performed for the purpose of evaluating current VDOT specifications for a seven-day wet cure and the application of a liquid membrane-forming cure (LMFC). VDOT requires concrete for bridge decks to be wet cured for a minimum of seven days followed by the application of a LMFC. Lane's work suggests that wet cure beyond three days does not result in much added benefit with regard to durability and that a LMFC is not necessary when relative humidity values are high. The use of lightweight fine aggregates (LWFA), however, was shown to have a potential benefit in concrete mixtures with low water-to-cementitious materials ratios (w/cm).

This research is an effort to develop guidelines for improved concrete performance and, therefore, is an example of work categorized under Track 10: Concrete Pavement Performance. This work can also be categorized under Track 8: Long-Life Concrete Pavements because the effect on durability parameters, which will affect long-term pavement performance, is evaluated.

Click here for more information about this project.

Measurement of Early Age Shrinkage of Virginia Concrete Mixtures

Research work by VCTIR Research Scientist David Mokarem, Associate Principal Research Scientists D. Stephen Lane and Celik Ozyildirim, and Associate Director Michael Sprinkel resulted in a new testing method for evaluating volumetric changes caused by shrinkage within the first 24 hours. The report *Measurement of Early Age Shrinkage of Virginia Concrete Mixtures* documents the development of a modified American Society for Testing and Materials International (ASTM) C 157 method for measuring length change of concrete specimens during the first 24 hours after casting. The report discusses laboratory testing of various concrete mixtures. Specimens were subjected to both the modified and standard ASTM C 157 test methods.

Results suggest that mixtures with greater early-age shrinkage (i.e., first 24 hours) exhibit less shrinkage at 28, 35, 56, 84, and 118 days when compared to specimens that have less early-age shrinkage. The ability to measure shrinkage within the first 24 hours will help VDOT engineers better predict total shrinkage which will allow them to optimize concrete structural designs and to generate improved job specifications. The work highlighted here is an example of work categorized under Track 1: Performance-Based Concrete Pavement Mix Design System because it presents an innovation in testing methodologies for concrete mixtures. This work is also an example of Track 11: Concrete Pavement Business Systems and Economics because it is anticipated that future specifications will be improved based on this research.

About the CP Road Map E-News

The ***CP Road Map E-News*** is the newsletter of the Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map), a national research plan developed and jointly implemented by the concrete pavement stakeholder community. To find out more about the CP Road Map, or to get involved, contact Dale Harrington, dharrington@snyder-associates.com, 515-964-2020.

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