

Research Digest

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Research Digest

Item 1

Best Practices in Pavement Design for Design-Build Projects

MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT)

TRS 1402 • 2014

"MnDOT uses design-build on certain transportation construction projects within the project delivery guidelines of the Federal Highway Administration. Under its current practices, however, MnDOT specifies the pavement designs to be used. The agency was interested in investigating other states' practices for pavement design in design-build projects to determine if it is feasible to open the pavement design component of its projects to bidders, and if it is, to identify best practices for doing so. As part of this investigation, MnDOT is also interested in using alternate technical concepts in which the agency designs a project for bidding but bidders may submit alternatives that meet or exceed requirements for certain components with agency approval. We gathered information for this report through an online survey of state departments of transportation to assess their experience with pavement design in design-build projects and through a literature search of published findings. Using those results, we worked with MnDOT to identify five respondents to interview in further detail." --p.1

This report is available for free download (709 KB):

<http://www.lrrb.org/media/reports/TRS1402.pdf>

Item 2

Case Studies on Successful Utilization of Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Pavements

NATIONAL CENTER FOR ASPHALT TECHNOLOGY (NCAT)

NCAT Report 14-06 • 2014

Over the past decade, the rapid cost escalation of raw materials used in highway construction has affected the ability of highway and road agencies to maintain their existing pavement system. A common strategy among many highway agencies to offset rising materials costs is to utilize more recycled materials in pavements, particularly Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS). Effective utilization of these and other recycled materials in pavements is also consistent with the desire to use more sustainable construction practices in the transportation infrastructure. This report describes the development of specifications and practices of a few state highway agencies that have successfully used RAP and RAS. With regard to RAP usage, the Florida Department of Transportation's (FDOT's) and the Ohio Department of Transportation's (Ohio DOT's) programs are highlighted. In Florida, over 75% of all mixes produced for DOT projects contain RAP, with an average RAP content of 22%. The FDOT has found RAP mixes to perform very well. The Ohio DOT also has a long history of recycling asphalt. Like most states, Ohio allows higher RAP contents in lower pavement layers, but allows 5% more RAP when a contractor meets additional processing requirements. Missouri and Texas are leading states in the development of specifications and practices for asphalt mixes containing RAS. Missouri Department of Transportation's (MoDOT's) effort led to the use of finer grind RAS. Texas and Missouri were among the first states to allow post-consumer RAS in asphalt mixes. Texas has also developed stringent deleterious materials requirements for RAS.

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- Introduction
- Background on RAP Usage
- Florida DOT's Recycling Program
- Ohio DOT's RAP Program
- Summary of Successful Practices for Using RAP
- Background on RAS Usage
- Missouri DOT's RAS Program
- Texas DOT's Shingle Recycling Program
- Summary of Successful Practices for Using RAS
- Conclusions
- References

This report is available for free download:

<http://www.ncat.us/files/reports/2014/rep14-06.pdf>

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Item 3

Considerations for the Development of Work Zone Mobility Performance Measures and Thresholds for Virginia Freeways

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

VCTIR 14-R6 • 2014

The Federal Highway Administration has been encouraging states to improve their monitoring and tracking of the mobility impacts of work zones. The use of mobility performance measures will enable agencies to assess better the contribution of work zones to network congestion; to identify specific projects that are in need of remedial action; and potentially to assess penalties to contractors creating excessive, avoidable negative impacts. Although the Virginia Department of Transportation (VDOT) has defined allowable lane closure hours for the interstate system, VDOT has not defined specific performance measures and thresholds for what constitutes “unacceptable” work zone mobility impacts. Performance measures and thresholds have been developed by a number of other states, so there is a need to determine whether these could be adapted for use by VDOT.

This study explored issues related to a potential work zone mobility performance measurement program for Virginia. The issues investigated included identification of potential performance measures, definition of performance thresholds, and recommendations for data sources for performance measurement calculations. This information was synthesized from information regarding the experiences of selected states and experiences from a series of case studies that used data from Virginia work zones.

This report is available for free download (866 KB):

http://www.virginia-dot.org/vtrc/main/online_reports/pdf/14-r6.pdf

Item 4

Determinants of variability in preliminary engineering funding

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

FHWA/VCTIR 14-R2 • 2014

For the Virginia Department of Transportation (VDOT), preliminary engineering (PE) is a phase in the project development process whose expenditures are differentiated from the right of way (RW) and construction (CN) phases. PE funds support tasks such as planning studies, preliminary and final design, public involvement, and environmental processes. At the program level - that is, the aggregate funds from all projects that are to be allocated to PE as opposed to RW or CN - PE expenditures must be large enough to prepare future projects for construction yet small enough to build existing projects. The initial interest in this study resulted from the fact that, assuming a fixed program amount, higher PE spending will be associated with lower CN spending, and construction spending is logically of interest to VDOT's stakeholders. At the project level - that is, the PE funds available for a specific project - forecast PE expenditures provide project managers with a guideline regarding what resources will be needed to prepare a specific project for construction. This report analyzes the extent and causes of this variability in PE expenditures at the program and project levels.

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http://www.virginia-dot.org/vtrc/main/online_reports/pdf/14-r2.pdf

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Item 5

Development of Near Real Time Performance Measurements for Closed-Loop Signal Systems (CLS) Using Historical Traffic Data from Existing Loop Detectors and Signal Timing Data

NORTH CAROLINA STATE UNIVERSITY, RALEIGH

FHWA/NC/2012-12 • 2014

The overarching goal of this research project was to investigate the potential for the NCDOT Central Office Signal Timing (COST) Section to monitor and assess the quality of field deployed closed-loop signal system plans using the data inherent in the systems. The project is complete and has produced recommendations and deliverables that should enhance the COST Section's ability to achieve its mission of developing and maintaining quality signal coordination plans across the state of North Carolina.

Key findings and conclusions include the identification of a series of monitoring and analysis elements that can be implemented using the OASIS software detector and split monitor logs. In order to analyze dynamic, cycle-by-cycle bandwidth, a tool entitled the Dynamic Bandwidth Analysis Tool (DBAT) was developed and provided as a project deliverable. The DBAT tool was enhanced to provide exhaustive search optimization that identifies offset combinations that maximize dynamic bandwidth for a given set of split monitor log cycle-by-cycle signal indications. DBAT optimization is feasible for systems up to four or five intersections in length. An LP formulation was developed and tested that overcomes the system size limitation. The LP formulation can serve as the basis for future development of an implementable dynamic bandwidth optimization tool.

This report is available for free download (29 MB):

<http://www.ncdot.gov/doh/preconstruct/tpb/research/download/2012-12finalreport.pdf>

Item 6

Development of Performance Measurement for Freight Transportation

NATIONAL CENTER FOR INTERMODAL TRANSPORTATION FOR ECONOMIC COMPETITIVENESS (NCITEC)

FHWA/LA.14/522 • 2014

In this project, the researchers built a set of performance measures that are unified, user-oriented, scalable, systematic, effective, and calculable for intermodal freight management and developed methodologies to calculate and use the measures. The following measures for freight transportation systems are suggested to address the needs of transportation users. 1. Mobility: Reducing transportation time and delay is a major concern of most transportation users. 2. Safety: The objectives related to transportation safety and security includes improving traffic safety, i.e., reducing traffic accident rates, injuries, fatalities, and risks. They also include increasing traffic security and reducing crime rates, improving accident detection and response, and increasing public and homeland security. 3. Environmental Stewardship: The objectives include reducing the amount of transportation-related pollutants, promoting the community livability near major transportation infrastructures, and decreasing energy consumption. 4. Direct Cost Efficiency: The objectives include developing cost-efficient transportation systems that have low cost/benefit ratios and high sustainability. 5. Economic Growth: The objectives include promoting local or regional economic growth and increasing local or regional employment opportunities. There are two major outcomes from this project: An intermodal performance measurement system for freight management, including metrics definition, calculation procedure, and methodologies of data collection. A case study that demonstrates how to apply the proposed performance measurement system to evaluate the Louisiana intermodal network for freight management.

This report is available for free download (1.8 MB):

http://www.ltrc.lsu.edu/pdf/2014/fr_522.pdf

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Item 7

Development of safety performance functions for multilane highway and freeway segments maintained by the Virginia Department of Transportation

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

FHWA/VCTIR 14-R14 • 2014

The Virginia Department of Transportation (VDOT) adopted the software Safety Analyst as its highway safety management tool in 2009. One of the requirements for implementation of Safety Analyst is to have appropriate safety performance functions (SPFs) reflecting Virginia conditions. The purpose of this study was to develop such SPFs for multilane highway and freeway segments that could replace Safety Analyst's default SPFs. Five years (2004-2008) of data collected from 20,235 multilane highway segments and 2,905 directional freeway segments in Virginia were used in the development of the SPFs. Statewide SPFs were developed for 4 subtypes of multilane highway segments and 10 subtypes of freeway segments. VDOT district-group SPFs were developed for 4 subtypes of multilane highway segments. The default SPFs in Safety Analyst were found to be different than the developed Virginia SPFs with respect to their curve shapes, and, as a result, adjusting the default SPFs to Virginia conditions by calibration factors resulted in inaccurate crash predictions at low and high volumes of annual average daily traffic. Thus, the Virginia-specific statewide SPFs developed in this study should be used when implementing Safety Analyst in Virginia. Although the shapes of the multilane highway segment SPFs were found to vary across VDOT districts, incorporating variations through the creation of new subtypes was found to be inappropriate for the current version of Safety Analyst. As a consequence, district-group SPFs for the multilane highway segments cannot be implemented in Safety Analyst. However, all SPFs developed in this study, including district group SPFs, can be implemented without the use of Safety Analyst. Therefore, use of the statewide SPFs developed in this study is recommended when Safety Analyst can be used and use of the statewide or district-group SPFs developed in this study is recommended when implementation of Safety Analyst is not feasible.

This report is available for free download (1.6 MB):

http://www.virginiaodt.org/vtrc/main/online_reports/pdf/14-r14.pdf

Item 8

Effects of Natural Gas Vehicles and Fuel Prices on Key Transportation Economic Metrics

UTAH STATE UNIVERSITY

WA-RD 829.1 • 2014

The Washington State Department of Transportation (WSDOT) is responsible for planning, operating, and maintaining a highway network consisting of over 18,500 lane-miles of highway. Planning and building highways is, by nature, a long-range enterprise. It requires making many assumptions about future travel demand as well as estimating future fuel tax revenue. In recent years the growing uncertainty about oil prices and availability has made long-range transportation planning even more challenging. Rather than relying on trend extrapolation, this study uses market mechanisms to shed light on key long-range transportation planning assumptions. Although WSDOT is pursuing a variety of alternative fuels and energy sources including Electric Vehicles (EV), biofuels, propane, natural gas, etc. and their respective infrastructures, this study focuses primarily on natural gas. In particular, this study will help WSDOT assess the likelihood natural gas will substitute for petroleum fuels and estimate the impacts changes in fuel prices will have on travel demand, fuel consumption, Greenhouse Gas emissions, and fuel tax revenues.

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<http://www.wsdot.wa.gov/research/reports/fullreports/829.1.pdf>

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Item 9

Evaluation of Recycled Concrete as Aggregate in New Concrete Pavements

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT)

WA-RD 826.1 • 2014

This study evaluated the use of recycled concrete as coarse aggregate in new concrete pavements. Recycled concrete aggregate (RCA) produced from demolished pavements in three geographically-dispersed locations in Washington state were used to perform tests on aggregate characteristics, fresh concrete properties, and hardened concrete properties. Variables included the source of the RCA, percent replacement of coarse natural aggregate with RCA (0% to 45%), and percent replacement of portland cement with type F fly ash (0% or 20%). RCA from all three sources met WSDOT requirements for aggregates, and all fresh and hardened concrete properties met WSDOT requirements. Replacement of RCA for natural coarse aggregate by up to 45% by volume had no significant effects on any of the properties. These results indicate that high-quality RCA can be used as a replacement for a portion of the coarse natural aggregates in new portland cement concrete pavements in Washington State.

This report is available for free download (1.1 MB):

<http://www.wsdot.wa.gov/research/reports/fullreports/826.1.pdf>

Item 10

Evaluation of the MMLS3 for Accelerated Wearing of Asphalt Pavement Mixtures Containing Carbonate Aggregates

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

FHWA/VCTIR 14-R17 • 2014

The purpose of this study was to develop an accelerated wearing protocol for assessing the susceptibility of asphalt surface mixtures to polishing. This was the second phase of the study. The first phase focused on assessing the characteristics of selected carbonate aggregates available in Virginia that are normally classified as polishing and thus not considered suitable for use in pavements except for those roads with an average daily traffic of less than 750 vehicles per day. The selection of aggregates used in pavements is critical in producing surfaces that will continue to provide good skid resistance through a lengthy service life. The specifications of the Virginia Department of Transportation (VDOT) call for non-polishing aggregate for use in most surface layers. The study was aimed at making use of locally available polishing aggregates that can reduce the cost of asphalt mixtures while maintaining satisfactory wearing and skid characteristics of the pavements. The objectives of the research were (1) to evaluate the polishing/wear features of mixtures containing limestone aggregate in the laboratory using an accelerated method; (2) to compare friction properties of the laboratory-polished specimens with actual pavement friction measurements; and (3) to compare friction properties of mixtures containing carbonate rock or blends with those of mixtures with non-carbonate rocks. The study included three types of aggregates, i.e., limestone, quartzite, and granite, and blends of these aggregates. The surface mixtures studied were conventional SM-9.5 and SM-12.5 mixtures containing various percentages of limestone, limestone recycled asphalt pavement, and limestone-granite/quartzite blends. The suggested test protocol to evaluate the polishing of asphalt concrete specimens prepared in the laboratory was developed using the third-scale model mobile load simulator (MMLS3). The MMLS3 is capable of applying realistic rolling wheel contact stresses similar to those on highways from the moving traffic. The skid resistance, friction, and texture of actual pavement surfaces and laboratory-fabricated specimens were measured after different polishing intervals. Skid resistance and frictional characteristics were measured by the British pendulum tester, dynamic friction tester, and locked-wheel skid tester; the circular texture meter was used to measure surface macrotexture. Results showed that the MMLS3 can be used to simulate traffic wearing of asphalt concrete specimens of different shapes and sizes in the laboratory including core specimens removed from existing pavements and that the BPT is effective in characterizing changes in friction on specimens that are subjected to simulated trafficking via the MMLS3. Further, test specimens should have a high initial macrotexture and mixtures should have good stability so that the wearing effects are focused on the aggregates. The study recommends that the Virginia Center for Transportation Innovation and Research (VCTIR) work with Virginia Tech and VDOT's western districts to design and conduct an experiment to explore a series of carbonate / non-carbonate aggregate blends for asphalt mixtures and that the mixture gradations be designed to prevent the absence of macrotexture from impacting the ability to measure the polish of the coarse aggregate structure of the experimental mixtures. VCTIR should purchase tires with different tread patterns and try them on the MMLS3 to evaluate the polishing rate of specimens in more detail.

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http://www.virginia.gov/vtrc/main/online_reports/pdf/14-r17.pdf

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Item 11

Identifying and prototyping integrated corridor management (ICM) strategies for application in Virginia

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)
VCTIR 14-R10 • 2014

"In order to explore and demonstrate the potential for ICM application in Virginia, an investigation into the factors that are critical to its successful implementation and operation was conducted. Critical success factors were identified from the eight ICM "pioneer" sites sponsored by a U.S. Department of Transportation ICM initiative. The three most critical factors identified include (1) a robust Intelligent Transportation Systems (ITS) infrastructure; (2) the need for stakeholder partnerships and development of institutional frameworks within which ICM will be implemented and operated; and (3) the need to adopt standards and protocols through which information will be disseminated. Additionally, the potential effectiveness of ICM as a congestion mitigation measure in Virginia was explored by prototyping the application of a set of ICM strategies in a simulation environment using a segment of the I-95/I-395 corridor (between mile marker 152 and mile marker 163) as a test bed. The strategies implemented include variable speed limits; ramp metering; transit signal priority; financial incentives (reduction in transit and parking fees); high occupancy toll (HOT)/high occupancy vehicle (HOV) lanes and HOV bypass; and increased transit and parking capacity."

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Item 12

Influence of Changes in Water-to-Cement Ratio, Alkalinity, Concrete Fluidity, Voids, and Type of Reinforcing Steel on the Corrosion Potential of Steel in Concrete

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)
VCTIR 14-R11 • 2014

Research on steel corrosion has demonstrated that the concentrations of chloride and hydroxide ion at the concrete/steel interface influence the susceptibility of the steel to corrosive attack. This study used electrochemical means and changes in mix design to increase the alkalinity and improve consolidation of the concrete against the steel to determine if this would increase the corrosion resistance of the reinforcing steel without compromising the properties of the concrete. To understand these effects better, the following concrete properties were evaluated: compressive strength, splitting tensile strength, modulus of elasticity, and length change (shrinkage).

The evaluation involved the casting of different types of concrete samples, all of which contained artificial voids, for corrosion testing. These samples were composed of one of two concrete mixtures: (1) the Virginia Department of Transportation's (VDOT) Class A4 General Bridge Deck Concrete with Straight Portland Cement (A4), or (2) a self-consolidating concrete (SCC). Selected A4 and SCC mixtures were electrochemically treated 135 days after samples were cast. Some samples were left untreated and functioned as control samples.

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Item 13

Investigation of Performance Requirements of Full Depth Reclamation Stabilization

MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT)
TRS 1310 • 2014

"In contrast to conventional recycling is the commercial recycling of pavement and aggregate materials used in the construction of roadways. It is estimated that over 100 million tons of pavement are recycled each year in the USA. One such pavement recycling process is referred to as stabilized full depth reclamation (SFDR). SFDR recycling is achieved through the pulverization of a distressed roadway's asphalt surface and a predetermined portion of its underlying subgrade to create a rehabilitated and stabilized base course, which is overlain with an asphalt layer... The Minnesota Department of Transportation (MnDOT) recognizes the value of SFDR practices and wishes to promote further use of SFDR in its state. Before widespread application of SFDR is attainable, it is imperative that the performance requirements for SFDR be determined. Since there is an absence of such a specification in Minnesota, the structural capacity of SFDR may not be fully attained. The objective of this research project is to determine optimal properties that SFDR material should attain to be used as a base layer for hot-mix asphalt (HMA) roadways. Optimum SFDR material properties are achieved when rutting and low temperature cracking is minimized. The stabilizing materials used to achieve these parameters are to be determined by the agency that is investigating a specific SFDR project. --p.1

This report is available for free download (2.2 MB):
<http://www.lrrb.org/media/reports/TRS1310.pdf>

Item 14

Lightweight High-Performance Concrete Bulb-T Beams With Self-Consolidating Concrete in a Bridge Structure

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)
VCTIR 14-R15 • 2014

Lightweight high-performance concrete (LWHPC) with a pozzolan (fly ash or silica fume) or slag cement is expected to provide high strength and high durability with reduced dead load. Reduced dead load may provide savings in the substructure elements. Self-consolidating concrete (SCC) is a new technology with a very high level of workability as it easily fills formwork under the influence of its own mass, typically without any additional consolidation energy. In this study, self-consolidating LWHPC with slag cement was used in the prestressed bulb-T beams for the bridge on Route 17 over Route 15/29 in Fauquier County, Virginia. The deck has LWHPC with slag cement. The bridge has two spans, each 128 ft long. Test beams 65 ft long with the same cross section as the actual beams were cast and tested prior to the fabrication of the bridge beams. The LWHPC provided satisfactory strength and permeability in the test beams and bridge beams that were also SCC. The bridge deck concrete had satisfactory strength and durability with no cracks after two winters. The study recommends that lightweight SCCs with pozzolans or slag cement be considered in beams when there are long spans, poor soil conditions, and congested reinforcement. It is also recommended that lightweight concretes be considered for reducing deck cracking.

This report is available for free download (350 KB):
http://www.virginiadot.org/vtrc/main/online_reports/pdf/14-r15.pdf

Research Digest

Item 15

Local Government Funding and Financing of Roads: Virginia Case Studies and Examples From Other States

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

FHWA/VCTIR 15-R2 • 2014

Several Virginia localities have used local funding and financing sources to build new roads or complete major street improvement projects when state and/or federal funding was not available. Many others have combined local funding sources with state and/or federal funds to accelerate a project of importance to the locality. The purpose of this study was twofold: (1) to determine the extent to which local governments have completed road projects under Virginia statutes that enable various types of funding and financing tools and to document lessons some localities learned in the process; and (2) to identify examples of locally generated funding sources from other states not currently used in Virginia that could be promising for road projects. To achieve the first purpose, case studies and a survey were used to gather the necessary information. To achieve the second purpose, a literature review was conducted.

Different localities had different enabling factors that led to their decisions to apply local funds to road projects. Enabling factors that were evident from the case studies included the following: high growth rates and the resultant increases in tax receipts; regional medical centers associated with substantial ancillary land development; local government staff with experience managing road construction projects; a combination of future-focused transportation plans and negotiation during the land development process; a record of success with similar projects; collaboration with universities and other local governments; careful budgeting and saving.

Examples of locally generated funding sources from other states that are not widely used in Virginia include transportation utility fees, local motor fuel taxes, mileage-based user fees, special property taxes on non-residential parking spaces, a tax per employee, concurrency, availability payment public-private partnerships, and various types of special districts.

This report is available for free download (2 MB):

http://www.virginia.gov/vtrc/main/online_reports/pdf/15-r2.pdf

Item 16

Nondestructive Measurements Using Mechanical Waves in Reinforced Concrete Structures

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

VCTIR 14-R8 • 2014

This study evaluated various techniques that use mechanical waves for the evaluation of critical concrete properties, such as proper consolidation of the concrete during placement and strength development; changes in modulus; and the detection of cracks, voids, and delaminated regions. The methods evaluated were ultrasonic shear-wave tomography, ultrasonic pulse velocity, crosshole sonic logging, sonic echo-impulse response, spectral analysis of surface waves, and the use of an impact echo scanner on pavements and bridge structures.

This report is available for free download (5.3 MB):

http://www.virginia.gov/vtrc/main/online_reports/pdf/14-r8.pdf

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Item 17

Performance Evaluation of Thin Wearing Courses Through Scaled Accelerated Trafficking

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

VCTIR 14-R17 • 2014

The primary objective of this study was to evaluate the permanent deformation (rutting) and fatigue performance of several thin asphalt concrete wearing courses using a scaled-down accelerated pavement testing device. The accelerated testing was conducted using a model mobile load simulator (MMLS3). Field testing with the MMLS3 was conducted on a 4.75-mm nominal maximum aggregate size dense-graded mixture installed at the Turner-Fairbank Highway Research Center. This mixture (designated SM-4.75), two other conventional dense-graded mixtures, and a thin gap-graded mixture were also used to prepare specimens for laboratory rutting tests using the MMLS3.

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http://www.viriniadot.org/vtrc/main/online_reports/pdf/14-r7.pdf

Item 18

Recalibration Procedures for the Structural Asphalt Layer Coefficient in the 1992 AASHTO Pavement Design Guide

NATIONAL CENTER FOR ASPHALT TECHNOLOGY (NCAT)

NCAT Report 14-08 • 2014

"Although many highway agencies are exploring the use of new mechanistic-empirical pavement design methods, many currently still use the pavement design guide based on the AASHTO Road Test in Ottawa, Illinois, from 1958 to 1960. This test established an empirical relationship between traffic loading and pavement thickness. One of the key inputs to this method is the layer coefficient for the hot mix asphalt (HMA) layers. This HMA layer coefficient has not been updated in more than 50 years despite numerous improvements in mix design methods, quality control and construction of HMA. The primary objective of this study was to recalibrate the asphalt layer coefficient based on current paving materials and construction using data collected at the NCAT Test Track accelerated pavement testing facility." --Project Synopsis

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- Introduction
- Overview of the AASHTO Empirical Design Procedure
- Recalibration Procedures
- Conclusions and Recommendations
- References

This report is available for free download (1.4 MB):

<http://www.ncat.us/files/reports/2014/rep14-08.pdf>

Item 19

Regional Implementation of Warm Mix Asphalt

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT (LA DOTD)
FHWA/LA.14/534 • 2014

Asphalt is used in over 94 percent of all paved roadways in the United States. The ability to reduce its cost and emissions while improving its performance has benefits that could potentially change the direction the asphalt industry moves toward in the future. Warm-mix asphalt (WMA) technology is becoming more prevalent in routine roadway construction across the country. It provides many benefits over conventional hot-mix asphalt (HMA). There are three groups of technologies currently being used to achieve these lower temperatures. They are chemical additive, organic additive (wax), and water additive (foamed). Each of these technologies is different, yet they all function on the same basic concept. They each decrease the viscosity of the liquid binder, thus allowing the binder to more easily coat the aggregate at a cooler temperature. In the last decade, WMA has increasingly been used across the country. Many states have developed special provisions or have modified their standard specifications to accommodate the use of WMA. In an attempt to quantify the use of WMA technology in the southeastern region of the United States, this study was initiated with the following objectives. 1. To inform research agencies of the work that is ongoing, as well as the work that has already been done. 2. To provide a document that can be used to educate and inform contractors from an unbiased perspective of the costs and benefits associated with the different types of warm mix asphalt. 3. To assist government agencies in establishing acceptance criteria for warm mix asphalt, thus allowing it as a suitable replacement for hot mix asphalt. A survey was sent to 12 southeastern states to attempt to answer the questions listed above. Also, internet searches were conducted to determine specification and policy changes that were made in the subject states to accommodate WMA technology. Results of the research indicated that WMA technology is being used in all of the southeastern states and that all of the states have made changes in standard specification and special provisions to permit the use of WMA. The most significant change made in specifications is the permission to allow the mixing and placing of WMA at cooler temperatures. Although more long-term performance data is needed, it appears that at this time the performance of WMA technology is comparable to that of conventional HMA. The cost between HMA and WMA does not currently appear to be significant. WMA appears to be a viable technology, and its use is expected to increase in the immediate future.

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http://www.ltrc.lsu.edu/pdf/2012/capsule_12_4PF.pdf

Research Digest

Item 20

Structural design guidelines for concrete bridge decks reinforced with corrosion-resistant reinforcing bars

VIRGINIA CENTER FOR TRANSPORTATION INNOVATION AND RESEARCH (VCTIR)

FHWA/VCTIR 15-R10 • 2014

This research program develops and validates structural design guidelines and details for concrete bridge decks with corrosion-resistant reinforcing (CRR) bars. A two-phase experimental program was conducted where a control test set consistent with a typical Virginia Department of Transportation bridge deck design using Grade 60 steel (ASTM A615, $f_y = 60$ ksi) and epoxy-coated reinforcing steel was compared to deck slab specimens where Grade 60 is replaced with CRR bars. The experimental program was designed to evaluate how flexural performance at service and ultimate limit states are affected by a one-to-one replacement of Grade 60 with CRR bars, a reduction of concrete clear cover, and a reduction in rebar size. Structural analysis models were developed using Response 2000 in order to predict the CRR bridge deck moment-curvature and the moment-crack width relationships. Experimental trends proved to be consistent with the analytical results demonstrating the viability of Response 2000 as a design tool for reinforced concrete with high-strength and nonmetallic rebar without a defined yield plateau. For reduced bar size and clear cover (2.00 in instead 2.50 in), ASTM A1035 and UNS S32304 specimens proved to have similar deformability ratios and crack widths that comply with current AASHTO requirements, with as much as 36% less steel.

This report is available for free download (943 KB):

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Item 21

Writing Literature Reviews for Transportation Research Projects

MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT)

TRS 1405 • 2014

"This document, drawing from the literature surrounding the topic, aims to summarize the characteristics of effective literature reviews and approaches for writing them. The intended audience is principal investigators and their teams who conduct research for transportation agencies and who are expected to deliver a literature review as part of each research project. The literature search or preparatory work of identifying and collecting the appropriate writings to be analyzed in the review (such as books, peer-reviewed journal articles, conference proceedings, sponsored research and online information) is treated in a separate document." --p.1

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