

Research Digest

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TxDOT Research

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Research Digest

Item 1

Implementation of Curing, Texturing, Subbase, and Compaction Measurement Alternatives for Continuously Reinforced Concrete Pavement

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6037-01-1 • 2014

This report evaluates four different subbase types, two different concrete mix designs (a standard Texas Department of Transportation gradation and an optimized gradation), three different curing compounds, and four different surface textures that researchers tested on a new section of continuously reinforced concrete pavement. In particular, researchers found: The instrumented roller package was effective in locating areas of low stiffness in subgrade soils. Falling weight deflectometer and dynamic cone penetrometer data can be used to evaluate the stiffness of stabilized subbases before concrete paving commences. The proposed curing compound evaluation protocol not only considered the moisture loss throughout the maturing process of concrete, but also introduced the relative humidity, surface abrasion strength, and water content of cured concrete samples to assess the curing compound effectiveness. It appears that the use of geotextile between Continuously Reinforced Concrete Pavement (CRCP) and the subbase is questionable and may not provide the desired pavement performance. The ConcreteWorks program was effectively calibrated using the data collected from this project.

(xii, 124 pages)

This report is available for free download (7.2 MB):

<http://tti.tamu.edu/documents/5-6037-01-1.pdf>

Item 2

Developing Guidelines for Repairing Severe Edge Failures: Technical Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6271-2-1 • 2014

This report presents various edge failures, the methods used by districts to repair them, and the results of the repair. While there was no clear consensus on the best treatment of in-situ material for pavements with edge failures, the districts agreed that an up-front investigation should be conducted, samples should be obtained and tested, and widening the pavement contributes to a reduced risk of edge failure. Special treatments may be necessary when dealing with pavements that have no shoulders, steep front slopes, and/or subgrade soils of high plasticity. Researchers found that geogrid reinforcement is beneficial to reducing longitudinal edge cracking, but will not totally eliminate edge cracking problems. Scarifying and reshaping the existing material with stabilization, combined with a flexible base overlay has shown good performance. Without a uniform cross section, simply widening the pavement can result in cracking problems at the longitudinal construction joint. This report also provides guidelines for repairing severe edge failures.

(ix, 47 pages)

This report is available for free download (14.3 MB):

<http://tti.tamu.edu/documents/0-6271-2-1.pdf>

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Item 3

Evaluation of Binder Aging and Its Influence in Aging of Hot Mix Asphalt Concrete

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6613-1 • 2014

Warm mix asphalt (WMA) technologies, through reduced mixing and placement temperatures, have reduced fuel consumption, enhanced compaction, increased haul distances and an extended paving season. Issues of concern in WMA are binder oxidation and absorption and their impact on pavement durability. Key future work should combine results from this project with other recent TxDOT projects to develop a comprehensive and fundamentals based mixture design and pavement performance prediction methodology that accounts for climate, traffic loading, pavement structural properties, life-cycle cost analysis, and that is applicable to HMA, WMA, polymer-modified binders, and mixtures that incorporate RAP and RAS. Such an effort would be a major contribution to pavement design and is a realistic goal. Some other key findings are: 1) absorption is directly related to aggregate void fraction, 2) WMA absorption is somewhat less than HMA absorption, 3) the DGC provides a reliable and relatively easy measure of absorption for an aggregate/binder pair, 4) standard (ASTM) methods for measuring absorption can be problematic, depending on the level of absorption, 5) binders modified using warm mix technologies were found to have similar oxidation kinetics to their base binders, 6) the overlay tester and VEC measurements were successfully used to characterize mixture fatigue. 7) mixture fatigue resistance declines with binder oxidation, a result that is omitted entirely from typical pavement design guides (e.g., the MEPDG), and 8) during the first summer of its service life, oxidative aging, curing, and absorption have a significant beneficial effect on the performance of warm mixes. (xxiii, 192 pages)

This report is available for free download (15.6 MB):

<http://tti.tamu.edu/documents/0-6613-1.pdf>

Item 4

Field Performance of RAS Test Sections and Laboratory Investigation of Impact of Rejuvenators on Engineering Properties of RAP/RAS Mixes

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6614-3 • 2014

In the last several years, recycled asphalt shingles (RAS), in addition to reclaimed asphalt pavement (RAP), have been widely used in Texas. The use of RAS can significantly reduce the cost of asphalt mixtures, conserve energy, and protect the environment. However, one of the major concerns is poor cracking resistance of RAS mixes due to super stiff asphalt binder in the RAS. This research focused on field performance of RAS test sections and the benefit of using rejuvenators in improving cracking resistance of RAS(RAP) mixes. In addition, a simple cost analysis was performed to investigate the cost-benefits of using rejuvenators. It was found that both increasing design density (leading to higher virgin binder content) and using soft virgin binders (e.g. PGXX-28) can improve cracking resistance. With respect to improving cracking resistance of RAS mixes, the three rejuvenators evaluated in this research are all effective. Furthermore, the incorporation of rejuvenators also improved the moisture susceptibility and rutting resistance of the mixtures containing recycled materials. Apparently, additional tests and analyses are necessary. Specifically, field test sections with different types of rejuvenators should be constructed for further evaluation. Additionally, the observed field performance indicated that cracking performance is influenced by many factors, such as traffic, climate, existing pavement conditions for asphalt overlays, and pavement structure and layer thickness. It is extremely difficult to propose a single cracking requirement for all applications. There is a need to develop a RAP/RAS mix design and performance evaluation system for project-specific service conditions, including traffic, climate, existing pavement conditions, etc. (x, 92 pages)

This report is available for free download (2.3 MB):

<http://tti.tamu.edu/documents/0-6614-3.pdf>

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Item 5

0-6614, Use of Recycled Asphalt Shingles in HMA

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT). RESEARCH AND TECHNOLOGY IMPLEMENTATION OFFICE (RTI)

TTI 6614 PSR • [2014]

"In the last several years, both reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS) have been widely used in paving Texas highways. Compared to RAP, RAS has two features: 1) much higher asphalt binder content, and 2) super stiff asphalt binder... the super high stiffness of RAS binder causes strong concern on durability (or cracking performance) of asphalt mixes containing RAS. Another concern was the variability of processed RAS due to different RAS sources varying from manufacture waste shingles to a wide variety of tear-off shingles. To address these two major concerns (variability and durability), in 2010, the Texas Department of Transportation (TxDOT) initiated this research study at the Texas A&M Transportation Institute with objectives to: Define variability of processed RAS. Develop best practices for RAS processing and stockpile management. Evaluate methods of improving cracking performance of RAS mixes in the laboratory. Construct field test sections to validate laboratory test results.

(2 pages)

This report is available for free download (130 KB):

<http://tti.tamu.edu/documents/0-6614-S.pdf>

Item 6

Turf-Type and Early Maturing Annual Ryegrass to Establish Perennial Vegetation: Technical Report

TEXAS SOUTHERN UNIVERSITY (TSU). CENTER FOR TRANSPORTATION TRAINING AND RESEARCH

TARL 6620-1 • 2014

Annual ryegrass (*Lolium multiflorum*) is not currently recommended by TxDOT as a roadside re-vegetation nurse crop because its late maturity and height are too competitive for establishing perennial or spring plant mixtures. Two available genotypes used for turf that could be seeded with perennial grasses/legumes and annual wildflowers are Panterra V and Hanamiwase. Panterra V is turf-type annual ryegrass developed for home lawns while Hanamiwase is an early maturity annual ryegrass that produces seed in February and March. Both the turf-type and early-maturing annual ryegrasses could be less competitive for nutrients, moisture, and sunlight while providing adequate cover. Appropriate warm-season perennial grasses/legumes and wildflower mixes specified by TxDOT were planted as treatments in each of four regions (Beeville, Overton, Nacogdoches, and Stephenville) to evaluate these annual ryegrass genotypes, seeding rates, and mowing influences. Additionally, similar treatments were installed at five locations in a roadway implementation trial. The turf-type and early-maturing ryegrasses proved to be both competitive and persistent when used as nurse crops for warm-season perennials with mature heights similar to the annual ryegrass varieties used in the past.

(x, 52 pages) : color illus.

This report is available for free download (5 MB):

<http://tti.tamu.edu/documents/0-6620-1.pdf>

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Item 7

0-6622, Implementation of a Texas Mechanistic-Empirical Thickness Design System (TxME)

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT). RESEARCH AND TECHNOLOGY IMPLEMENTATION OFFICE (RTI)

TTI 6622 PSR • 2014

"Developments over the last several decades have offered an opportunity for more rational and rigorous pavement design procedures [than TxDOT's current flexible pavement design system]. Substantial work has already been completed in Texas, nationally, and internationally in all aspects of modeling, materials characterization, and structural design. These and other assets provided the technical infrastructure that made it possible to develop a new mechanistic-empirical flexible pavement design system (TxME) specifically for Texas. This new system will enable Texas pavement designers to take full advantage of new or premium materials, with a full consideration of the influential factors, including pavement structure, traffic volume, and environmental conditions. The main objectives of this project were to identify or propose performance models and implementation approaches, and develop the new TxME." --Background

(2 pages)

This report is available for free download (142 KB):

<http://tti.tamu.edu/documents/0-6622-S.pdf>

Item 8

Fleet Equipment Performance Measurement Preventive Maintenance Model: Final Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6626-1 • 2014

The concept of preventive maintenance is very important in the effective management and deployment of vehicle fleets. The Texas Department of Transportation (TxDOT) operates a large fleet of on-road and off-road equipment. Newer engines and vehicles are equipped with on-board diagnostic systems that can provide data on engine operation as indicators of engine load. There is the possibility of tracking these parameters to refine predictions for when equipment maintenance should be performed. Project 0-6626 aimed to provide a proof of concept for this idea by studying TxDOT's fleet, selecting a vehicle category for data collection, and developing an algorithm that can be used to recommend appropriate oil change intervals based on engine data collected through on-board diagnostic systems.

(x, 66 pages)

This report is available for free download (2.2 MB):

<http://tti.tamu.edu/documents/0-6626-1.pdf>

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Item 9

Texas-Specific Drive Cycles and Idle Emissions Rates for Using with EPA's MOVES Model: Final Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6629-1 • 2014

The U.S. Environmental Protection Agency's (EPA) newest emissions model, MOtor Vehicle Emission Simulator (MOVES), uses a disaggregate approach that enables the users of the model to create and use local drive schedules (drive cycles) in order to perform an accurate analysis. However, only the national average drive schedules are currently included in the default database of the model. Furthermore, the cold start and idling emissions and activity data of heavy duty diesel trucks (HDDVs) that are included in the MOVES model are based on a very limited number of data sources even though they are very important components of the total on-road mobile source emissions inventory. This report provides local drive cycles emissions rates for heavy-duty diesel trucks. The report also compares estimated emissions from MOVES for a sample of vehicles to real-world in-use emissions measurements. Furthermore, the technical and tactical issues of integrating the results of this study into MOVES for formal emissions analyses purpose are investigated and recommendations provided based on the findings.

(xiii, 191 pages)

This report is available for free download (5.2 MB):

<http://tti.tamu.edu/documents/0-6629-1.pdf>

Item 10

0-6656, ASR Testing: A New Approach to Aggregate Classification and Mix Design Verification

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT). RESEARCH AND TECHNOLOGY IMPLEMENTATION OFFICE (RTI)

TTI 6656 PSR • [2014]

"In the past 5.5 years, the Texas Department of Transportation (TxDOT) spent approximately \$2 million for recasting precast concrete products that had alkali-silica reaction (ASR). Aggregates belonging to false positive and negative categories based on the current test methods are gradually growing. Therefore, the demand for a rapid and reliable test, which can assess aggregate ASR potential at various alkali loadings, is high. This study developed a fast, reliable test method to determine aggregate alkali-silica reactivity based on the time-dependent nature of the onset and speed of reaction."

(2 pages)

This report is available for free download (110 KB):

<http://tti.tamu.edu/documents/0-6656-S.pdf>

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Item 11

Research to Develop an ITS Strategic Plan for Texas

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6672-2 v.1 • 2014

TxDOT's mission is to provide safe and reliable transportation solutions for the citizens of Texas. Intelligent transportation systems (ITS) can play a pivotal role in meeting that mission. TxDOT can take advantage of advanced and emerging technologies to enhance safety and promote reliability by ensuring that travelers see the transportation network as a seamless system that helps get them to their destinations and deliver goods and services to the citizens of Texas with as little disruption as possible. ITS is a critical component of the transportation infrastructure that helps ensure the system operates in the most efficient way possible every day, every night, and during all types of situations and weather conditions. TxDOT has four primary goals related to meeting its mission. These goals are: maintain a safe system, address congestion, connect Texas communities, and become a best-in-class state agency. The agency cannot hope to successfully meet these goals without ITS in its arsenal of strategies to advance transportation across the state. This report documents the research that was undertaken to develop the ITS Strategic Plan for Texas. This research included an assessment of current U.S. trends in ITS and related initiatives, interviews with ITS stakeholders across Texas to determine needs, and a peer state review. The plan provides a framework to guide the development and deployment of an integrated statewide program for Intelligent Transportation Systems. The Texas Transportation Commission, TxDOT, as well as the broad community of ITS providers, stakeholders, and agency partners, will use this plan to promote the development, deployment, and use of ITS statewide. If this plan is to succeed, it needs the cooperation of all affected groups involved in ITS and transportation planning, design, funding, and implementation in the state.

(xvi, 158 pages)

This report is available for free download:

<http://tti.tamu.edu/documents/0-6672-2-Vol-1.pdf>

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Item 12

TxDOT ITS Strategic Plan for Texas

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6672-2 v.2 • 2014

TxDOT's mission is to provide safe and reliable transportation solutions for the citizens of Texas. Intelligent transportation systems (ITS) can play a pivotal role in meeting that mission. TxDOT can take advantage of advanced and emerging technologies to enhance safety and promote reliability by ensuring that travelers see the transportation network as a seamless system that helps get them to their destinations and deliver goods and services to the citizens of Texas with as little disruption as possible. ITS is a critical component of the transportation infrastructure that helps ensure the system operates in the most efficient way possible every day, every night, and during all types of situations and weather conditions.

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This report is available for free download:

<http://tti.tamu.edu/documents/0-6672-2-Vol-2.pdf>

Item 13

Laboratory Evaluation of Asphalt Binder Rutting, Fracture, and Adhesion Tests

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6674-1 • 2014

The current performance grading (PG) specification for asphalt binders was developed based on the Strategic Highway Research Program (SHRP) and is based primarily on the study of unmodified asphalt binders. Over the years, experience has proven that the PG grading system, while good for ensuring overall quality, fails in some cases to predict rutting and cracking performance, particularly as it applies to softer but highly modified binders. Therefore, it is necessary to improve current asphalt binders performance parameters and associated specification limits, especially for modified binders. This report documents the laboratory evaluation of several new tests for rutting, fatigue, and adhesion property of asphalt binders, including the multiple stress creep and recovery (MSCR) test, linear amplitude sweep (LAS) test, double edged notched tension (DENT) test elastic recovery test, pull-off test, pneumatic adhesion tensile testing instrument (PATTI), dynamic mechanical analyzer (DMA) test and surface energy test. It was found that the MSCR test and associated specification works better than the current $G^*/\sin\delta$ -based PG specification, especially for those highly modified asphalt binders (such as PG64-34)... (ix, 66 pages)

This report is available for free download (4 MB):

<http://tti.tamu.edu/documents/0-6674-1.pdf>

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Item 14

0-6676, Rapid Field Detection of Moisture Content for Base and Subgrade

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT). RESEARCH AND TECHNOLOGY IMPLEMENTATION OFFICE (RTI)

TTI 6676 PSR • [2014]

"Properly applying water during compaction of roadway base and subgrade materials is important for achieving adequate compaction. Construction specifications determine the required water content, and field measurement historically takes place with a nuclear density gauge. However, with the regulatory requirements of using nuclear sources, and continued interest in stiffness or modulus-based compaction acceptance, researchers need to identify techniques to rapidly measure moisture content on base and subgrades without using a nuclear source.... Researchers surveyed potential technologies for such rapid measurement. Researchers chose three non-nuclear tests, the nuclear gauge for comparison purposes, and the oven dry gravimetric water content for the reference value."

(2 pages)

This report is available for free download (244 KB):

<http://tti.tamu.edu/documents/0-6676-S.pdf>

Item 15

Incorporating Greenhouse Gas Emissions in Long Range Transportation Planning: Final Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6696-1 • 2014

Greenhouse gas (GHG) emissions continue to be an important focus area for state, local, and federal agencies. The transportation sector is the second biggest contributor to GHG emissions in the U.S., and Texas contributes the highest emissions among states in the country. Many transportation agencies are moving toward tackling the issue of GHG emissions on a voluntary or state-level policy basis. It is also expected that in the future, federal regulations could require transportation planning. This report presents a framework to link GHG emissions mitigation strategies with long-range transportation plans. The intent of the framework was to be flexible, practical, and equip Texas transportation practitioners with tools needed to address GHG emissions in the long-range transportation planning process. Each step of the framework involves different stakeholders, processes, and challenges that can occur and need to be taken into consideration. The framework can be used to supplement federal-level guidance or policy, or serve as a starting point for TxDOT and its partner agencies in the absence of federal guidance on the subject or transportation GHG emissions reductions. The framework includes guidance on incorporating control strategies, performance measures, and evaluation tools into long-range planning process to reduce GHG emissions.

(xvi, 125 pages)

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

<http://tti.tamu.edu/documents/0-6696-1.pdf>

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Item 16

Characteristics of Texas Pedestrian Crashes and Evaluation of Driver Yielding at Pedestrian Treatments

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6702-1 • 2014

For Texas, the average number of pedestrian fatalities for 2007 to 2011 is about 400 per year. Due to the high number of pedestrian crashes, Texas is considered by the Federal Highway Administration (FHWA) to be a "focus" state. Researchers found that 2 percent of all Texas Department of Transportation (TxDOT)-reportable traffic crashes and 15 percent of all TxDOT-reportable fatal crashes were pedestrian related. Most non-fatal crashes are associated with daylight, at intersections, and on city streets, whereas most fatal crashes are associated with dark conditions, midblock locations, and high-speed roadways. Twenty-one percent of all fatal TxDOT-reportable pedestrian crashes occurred on freeways--a location where pedestrians are least expected. Additional research into how to address pedestrian crashes, especially freeway crashes is needed, perhaps using FHWA's new systematic safety project selection tool. In the past decade, the pedestrian hybrid beacon (PHB) and rectangular rapid-flashing beacon (RRFB) have shown great potential in improving driver yielding rates and conditions for crossing pedestrians. Researchers conducted a field study at 7 traffic control signal (TCS) sites, 22 RRFB sites, and 32 PHB sites in Texas with the effectiveness measure being the percent of drivers yielding to a staged pedestrian. Results showed that driver yielding rates (98 percent), followed by PHBs (89 percent) and RRFBs (86 percent). Those cities with a greater number of a particular device (i.e., Austin for the PHB and Garland for the RRFB) had higher driver yielding rates as compared to cities where the device was only used at a few crossings. Also, as drivers became more familiar with the PHB a greater proportion yielded, perhaps because they gained a better understanding of expectations or requirements over time. As part of this study, researchers conducted a before-and-after field study at four RRFB sites and one PHB site to identify the changes in driver yielding and selected pedestrian behaviors resulting from installing these treatments at previously untreated crosswalks. The installations resulted in noticeable improvement in the number of yielding vehicles. (xxi, 267 pages)

This report is available for free download (4.1 MB):

<http://tti.tamu.edu/documents/0-6702-1.pdf>

Item 17

Evaluation of Innovative Devices to Control Traffic Entering From Low-Volume Access Points within a Lane Closure

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6708-1 • 2014

This report describes the methodology and results of analyses performed to identify and evaluate alternative methods to control traffic entering a lane closure on a two-lane, two-way road from low-volume access points. Researchers documented the state-of-the-practice regarding temporary traffic control at lane closures on two-lane, two-way roads in Texas, and examined existing and innovative devices and strategies that could be used to control traffic entering from low-volume access points. Researchers also compared the benefits and costs of various temporary traffic control alternatives for low-volume access points. Motorist surveys and field studies were conducted to assess motorist understanding and the operational and safety effectiveness of two innovative devices to control traffic at low-volume access points. The findings from these tasks and studies were used to develop guidelines regarding the appropriate traffic control for low-volume access points within a lane closure on a two-lane, two-way road. (x, 69 pages)

This report is available for free download (3.6 MB):

<http://tti.tamu.edu/documents/0-6708-1.pdf>

Research Digest

Item 18

Literature Review, Performance of RAP/RAS Mixes and New Direction

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6738-1 • 2014

In the last several years reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS) have been widely used in asphalt mixes in Texas. The use of RAP/RAS can significantly reduce the initial cost of asphalt mixtures, conserve energy, and protect our environment. There are always two main concerns: variability of RAP/RAS and durability (or cracking) of RAP/RAS mixes. Past studies in Texas have clearly indicated that both RAP and RAS have acceptable variability following the best practices for handling RAP/RAS. This study will focus on the durability of RAP/RAS mixes. This report presents a review of using RAP/RAS in asphalt mixes, the identified research focus, and the revised field experimental test plan. Specifically, this report discusses the field performance of RAP/RAS mixes in Texas and other states, and the observed field performance data strongly support the necessity of establishing a RAP/RAS mix design system for project-specific service conditions. The best practices for using RAP/RAS processing, mix design, production, and field construction, are also documented. Additionally, the new specification for asphalt mixes in Texas is reviewed and then a revised field experimental test plan for validating the new specification is recommended.

(x, 59 pages)

This report is available for free download (5.6 MB):

<http://tti.tamu.edu/documents/0-6738-1.pdf>

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Item 19

HMA Shear Resistance, Permanent Deformation, and Rutting Tests for Texas Mixes: Year-1 Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6744-1 • 2014

Traditionally run at one test temperature (122°F), the Hamburg Wheel Tracking Test (HWTT) has a proven history of identifying hot-mix asphalt (HMA) mixes that are moisture susceptible and/or prone to rutting failures have occurred with HMA mixes that had passed the HWTT in the laboratory; mostly in high shear locations, in particular with slow moving (accelerating/decelerating) traffic at controlled intersections, stop-go sections, in areas of elevated temperatures, heavy/high traffic loading, and/or where lower PG asphalt-binder grades have been used. As a supplement to the HWTT, this two-year study is being undertaken to develop a simpler and less time consuming shear resistance and permanent deformation (PD)/rutting test that is also cost-effective, repeatable, and produces superior results in terms of correlation with field rutting performance. In particular, such a test should have the potential to discriminate HMA mixes for application in high shear stress areas (i.e., intersections) as well as being an indicator of the critical temperatures at which a given HMA mix, with a given PG asphalt-binder grade, becomes unstable and more prone to rutting and/or shear failure. In line with these objectives, this interim report documents the research work completed in Year-1 of the study, namely: a) data search and literature review; b) computational modeling and shear stress-strain analysis; c) comparative evaluation of the Asphalt Mixture Performance Tester (AMPT) and the Universal Testing Machine (UTM); d) comparative evaluation of the Flow Number (FN), Dynamic Modulus (DM), and Repeated Load Permanent Deformation (RLPD) tests relative to the HWTT test method.
(various pagings)

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This report is available for free download (4.6 MB):

<http://tti.tamu.edu/documents/0-6744-1.pdf>

Research Digest

Item 20

Feasibility Study of Two-Lift Concrete Paving: Technical Report

TEXAS STATE UNIVERSITY, SAN MARCOS

TSUSM 6749-1 • 2014

Two-lift concrete paving (2LCP) involves placing two layers of concrete (wet-on-wet) instead of a single homogeneous layer, as typically done in the United States. 2LCP offers the opportunity to optimize the use of local aggregates, recycled materials to produce an economical, durable, and sustainable pavement system with the most desirable surface characteristics (improved skid resistance and reduced noise). Districts including Houston, Fort Worth, and Dallas have the potential to receive great benefit from the concept by being able to use more local materials that is not considered appropriate for traditional (single-lift) concrete pavement used. Despite above mentioned benefits, challenges of 2LCP are to have the proper paving equipment, pavement construction management, the right mixture proportions to use the local materials in the bottom lift, which results in an economical pavement placement, and the proper proportions and materials to ensure adequate surface friction and abrasion resistance in the top lift. A comprehensive literature review was conducted to gather previous experiences and past performance of 2LCP, particularly to justify the cost and efficiently execute the process of 2LCP. Surveys and interviews were conducted on contractors and agencies with experience with 2LCP. A one-day workshop regarding 2LCP was organized to obtain information from a wide range of agency, construction, equipment manufacturer, and Texas Department of Transportation (TxDOT) personnel with experience and interest in 2LCP. The workshop also served as a solicitation of ideas of best practice, most cost effective approach, concerns, and requirements associated with materials and construction of 2LCP... This report discusses additional requirements in materials, equipment and construction, project scheduling, and jobsite management that will be beneficial in the implementation of 2LCP construction. This study also evaluated feasibility and cost effectiveness of 2LCP, particularly in Texas. (x, 115 pages)

This report is available for free download (3.2 MB):

<http://tti.tamu.edu/documents/0-6749-1.pdf>

Item 21

Maximizing Mitigation Benefits: Making a Difference with Strategic Inter-Resource Agency Planning. Year One Technical Report

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6762-1 • 2014

The objective of this research project is to assess current mitigation policies and practices in comparison to resource agency objectives, and identify mitigation strategies and priorities that provide greater cost-benefit potential and implementation speed through strategic inter-resource agency planning. Mitigation for various actions associated with transportation development has been part of the process for decades. Although the science, practice, and technology may have advanced during this time, many of the processes and practices are rooted in traditional rules and regulations that require mitigation. The objective for this project is to assess mitigation policies and practices as a whole—looking at both the current and future of mitigation efforts in the transportation development process. This report summarizes activities conducted in the first year of the project. (ix, 102 pages)

This report is available for free download (3.8 MB):

<http://tti.tamu.edu/documents/0-6762-1.pdf>

Research Digest

Item 22

Temporary Large Guide Signs

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 6782-1 • 2014

A common issue during phased highway construction projects is the need to temporarily relocate large guide signs on the roadside or install new guide signs for temporary use. The conventional concrete foundations used for these signs are costly and time consuming to install and remove after construction is completed. Direct embed wood and steel post support systems for temporary large guide signs were developed and successfully crash tested in accordance with MASH guidelines. The designs considered wind loads, foundation requirements, and impact performance. The direct embedded support posts eliminate the need for reinforced concrete foundations. The results of the research can be used to establish acceptance of other less critical design configurations for other sizes of temporary guide signs. Variations include different post size, grade, and spacing.

(xiii, 144 pages)

This report is available for free download (14.6 MB):

<http://tti.tamu.edu/documents/0-6782-1.pdf>

Item 23

Construction of New Profiler Certification Tracks

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

TTI 9047-01-1 • 2014

The existing smoothness specifications of the Texas Department of Transportation (TxDOT) require certification of inertial profilers for ride quality assurance testing. Currently, inertial profilers are certified based on profile measurements collected on dense-graded hot-mix asphalt concrete, and flexible base sections with distinctly different textures when the dense-graded asphalt surfaces on which these profilers were certified. TxDOT also uses inertial profilers to measure the smoothness of the state highway network as part of the department's annual pavement condition surveys to support pavement management applications. A significant percentage of this network consists of roads with seal coat surfaces and surface treatments. Since texture affects the international roughness index, there is a need to build additional sections to certify profilers over the range of textured surfaces on which they will be used. This project aims to enhance TxDOT's profiler certification program by building additional test sections at the Texas A&M Riverside Campus to include surfaces with different textures and smoothness levels. These new sections are expected to improve the validity and applicability of TxDOT's certification program, and also the accuracy of ride quality measurements.

(xi, 95 pages)

This report is available for free download (5.5 MB):

<http://tti.tamu.edu/documents/5-9047-01-1.pdf>