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TxDOT Research Publications

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Item 1

Evaluation of Traffic Control Devices, Year 3

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

TTI 1001-2 • 2012

"This project was established to provide a means of conducting small-scale research activities on an as-needed basis so that the results could be available within months of starting the specific research. This report summarizes the research activities that were conducted between September 2010 and August 2011. There were five primary activities and five secondary activities. The five primary activities were evaluating nighttime visibility along rural highways with bright signs, continuing the evaluation of lead-free thermoplastic pavement markings, evaluating contrast pavement marking layouts, continuing the evaluation of accelerated pavement marking test decks, and providing district support for hurricane evacuation routing. In addition, the researchers also started to evaluated criteria for setting 80 mph and 85 mph speed limits, evaluated bridge clearance signing, narrowed the focus of a rotational sign sheeting study, provided technical support for the Texas Manual on Uniform Traffic Control Devices (MUTCD), and provided technical support for the Texas Department of Transportation (TxDOT) sign sheeting specification."

This report is available for free download (5.6 MB):
http://tti.tamu.edu/documents/9-1001-2.pdf

Item 2

Statewide Implementation of PAVE-IR in the Texas Department of Transportation

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

TTI 4577-05-1 • 2012

This project conducted work to complement implementation of Pave-IR into the Texas Department of Transportation's hot-mix-asphalt quality control/quality assurance specification. Pave-IR provides real-time thermal profiling of paving operations to detect thermal segregation. To facilitate this implementation, a webinar was first conducted to introduce industry and agency personnel to the background of thermal profiling and how thermal segregation relates to mixture properties and performance. More than 80 attendees comprising both contractor and agency personnel attended the webinar. The webinar materials are available separate of this report as Product 5-4577-05-P1. Next, Pave-IR thermal profiling was demonstrated on eight construction projects. This report presents the results from these demonstrations, which were made of varying mixture types around the state. The thermal profiles collected ranged from projects with little thermal segregation to projects with frequent severe thermal segregation. In all cases, the demonstrations revealed contractor and agency staff eager to learn more about the technology and how the results can be used to place higher quality asphalt mixtures.

This report is available for free download (2.3 MB):
http://tti.tamu.edu/documents/5-4577-05-1.pdf

Item 3

UT Curved Girder Analysis Tools (UTCGAT) -- Version: 1.0.0

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT)
CTR 5574-01-P2 • 2012

This software product was developed and is maintained by the University of Texas at Austin. UTCGAT is a suite of software tools for the analysis of curved girders. The suite consists of UT Bridge and UT Lift. UT Bridge is a 3-dimensional finite element program for the analysis of curved steel I-girders. Computations include linear elastic analysis and eigenvalue buckling analysis for both girder erection and concrete deck placement. UT Lift is an easy to use, macro-programmed Excel spreadsheet for determining the safety of lifting a horizontally curved steel I-girder with one crane and two lift clamps.

This report is available for free download (Website with link to license agreement and software download):
http://www.txdot.gov/business/contractors_consultants/engineering_software.htm

Item 4

Laboratory Evaluation of Constructability Issues with Surface Treatment Binder

TEXAS TECH UNIVERSITY. CENTER FOR MULTIDISCIPLINARY RESEARCH IN TRANSPORTATION (TECHMRT)

TechMRT 5893-1 • 2012

TxDOT depends greatly on sprayed seals for new road construction (surface treatment) and on preventive maintenance (seal coat). It is very important for TxDOT to have emulsified asphalt (EA) as a key binder type at its disposal to reduce costs. However, EA brings its own set of challenges. Compared to other binder types, EAs are more complex in composition, have a much shorter shelf life, and their behavior under different construction scenarios is difficult to predict. TxDOT field personnel can effectively use EAs if tools are available to test binder quality as received at the site and to predict their behavior. It is useful for the designers to rank the most effective binder-aggregate combinations and to predict the rate at which EA will achieve stiffness and bond strength with aggregate to be able to open the road for traffic. This research project was launched by TxDOT to address these issues and find solutions that are of benefit to field personnel. A field evaluation of selected seal coat projects was conducted to help design laboratory experiments for this study. For each field project, extensive construction-related data was collected. The same aggregate-binder combinations used in these field projects were also included in the laboratory test programs at TechMRT and CTR. The CTR team conducted additional weather-rack related tests using a wider range of binders available from the TxDOT Cedar Park lab. Laboratory test data clearly showed that some binder-aggregate combinations become ready for opening to traffic and/or brooming sooner than others. This delay also depends on the climatic conditions. The ASTM D7000 Sweep Test, used in other states to determine the effectiveness of binder-aggregate combinations for seal coats, was also conducted. A statistics-based curing model that incorporates the amount of water lost to evaporation is proposed. The experimental data was used to develop a second statistical model to predict the rate of setting of binder when in contact with different aggregates under different climatic conditions. Two field tests were developed to assess the quality of the emulsion received at the job site. The first is a simple field test that determines mass loss and calculates the dilution ratio in EA. This test showed commendable repeatability of results. The second field test used Shell cups to determine the Saybolt-Furol Viscosity (SFV) of the binder. The repeatability of the test improved drastically when a water bath was introduced to control specimen temperature. Finally, six construction projects were used for field evaluation of the new field tests and to calibrate the statistical models that were developed. For the prediction models to be ready for widespread use, additional tests are needed to increase the model reliability.

This report is available for free download (10.6 MB):
http://www.depts.ttu.edu/techmrtweb/Reports/Complete%20Reports/0-5893-1.pdf

Item 5

Subbase and Subgrade Performance Investigation and Design Guidelines for Concrete Pavement

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

TTI 6037-2 • 2012

The main issue associated with this research is if cheaper alternatives can be configured for subbase construction. Subbase layers have certain functions that need to be fulfilled in order to assure adequate pavement performance. One key aspect is resistance to erosion, and assessment of each of these functions relative to different alternatives is key to understanding the capability of different alternatives to perform adequately. In this respect, this project was poised to examine the design assumptions associated with each alternative and provide design recommendations accordingly to include test methods and material specifications. This report describes some of the work accomplished by summarizing data on subbase performance and testing relative to concrete pavement subbase and subgrade erosion but mainly addresses guidelines for concrete pavement subbase design. Findings from field investigations are discussed to identify factors associated with erosion. An approach to mechanistically consider the erosion process was introduced and review of current design procedures was conducted to reveal how they address erosion. This review was extended to include erosion models described in the literature as a means to shed light on the relationship between measurable material properties and performance. Additionally, past and current design procedures relative to erosion were reviewed in terms of test methods, erosion models, and their utility to characterize subbase materials with respect to erosion resistance. With this information, a new test configuration was devised that uses a rapid tri-axial test and a Hamburg wheel-tracking device for evaluating erodibility with respect to the subbase type and degree of stabilization (cement content). Test devices, procedures, and results are explained and summarized for application in mechanistic design processes. A proposed erosion model was validated by comparing erosion predictions to erosion results. Several computer program analyses were conducted to assess the design and performance implications of different subbases alternatives. Guidelines are provided to promote economical and sustainable design of concrete pavement subbases.

This report is available for free download (4 MB):
http://tti.tamu.edu/documents/0-6037-2.pdf

Item 6

Performance Monitoring Pavements with Thermal Segregation in Texas

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

TTI 6080-1 • 2012

This project conducted work to investigate the performance of asphalt surface mixtures that exhibited thermal segregation during construction. From 2004 to 2009, a total of 14 construction projects were identified for monitoring. Five of these projects did not exhibit thermal segregation, while the remaining projects did exhibit thermal segregation. In all cases, a Pave-IR thermal profiling system collected data during construction. Follow-up surveys using visual examination, ground-penetrating radar, and in some cases focused coring, were used to evaluate whether the locations of thermal segregation showed significant distress. The projects constructed free of thermal segregation have not shown any distress due to segregation. Results from projects constructed with thermal segregation present were mixed. In some cases, traffic action seems to have homogenized the pavement surface. On other projects, evidence of thermal segregation still exists shown by different surface appearance and localized changes in radar data. One project showed evidence of cracking due to segregation. Core results from field projects suggested the segregated locations will be more prone to cracking. This research project's results certainly do not show that thermally segregated locations will definitely fail within three to seven years of service; however, the results do show that instances of thermal segregation may continue to be anomalous locations in the layer, even after subsequent overlays, and exhibit properties that could lead to failures in the pavement structure.

This report is available for free download (18.5 MB):
http://tti.tamu.edu/documents/0-6080-1.pdf

Item 7

Evaluation, Presentation and Repair of Microbial Acid-Produced Attack of Concrete

TEXAS STATE UNIVERSITY, SAN MARCOS

TSUSM 6137-1 • 2011

The Texas Department of Transportation (TxDOT) has approximately 50,000 bridges in its inventory and the deterioration of concrete under these bridges, most of which are reinforced, has been a critical issue affecting the service condition. Recent research on deteriorated concrete columns on bridges in Texas indicated that microbial colonization might be a factor promoting the surface deterioration of bridge columns continuously exposed to water. Although microbial activities may be involved in the surface deterioration, it is however not clear how severe the deterioration is and whether it is a significant contributor to the deterioration. Field and laboratory investigations are needed to identify the impact of microbial induced deterioration (MID) on TxDOT bridges.

To evaluate the severity of the deterioration and determine whether MID is a significant contributor to the deterioration, visual inspection and a number of in situ tests were performed on columns of twelve selected TxDOT bridges. Laboratory tests including microbial, chemical composition, mineralogy and petrographic analyses were performed to investigate the potential cause and extent of the deterioration. Results from this comprehensive study were used to provide evidence of concrete degradation and ascertain the degree of deterioration caused by microbial attack. The study also evaluated the effectiveness and consistency of various measurements used in this study and provided a suggested test procedure to identify microbial attack on concrete and evaluate the integrity of deteriorated concrete due to the attack. In addition, a preliminary evaluation of the microbial attack resistance of commonly used TxDOT mixes was performed through evaluation of resistance of a series of mixes subjected to field and/or sulfuric acid solution exposure.

This report is available for free download (8.4 MB):
http://tti.tamu.edu/documents/0-6137-1.pdf

Item 8

Full Depth Reclamation Workshop Materials

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

TTI 6271-P2 • 2012

This CD-ROM contains two PDFs of materials used for a Project 0-6271 Full Depth Reclamation workshop. A PDF of the workshop workbook (48 pages) and a PDF of the slides from the presentation (102 pages) are provided. The workshop covered the following topics: (1) an introduction and overview of Full Depth Reclamation; (2) evaluation of soils conditions; (3) conducting a condition survey and nondestructive testing to determine a good FDR candidate; (4) verification through coring and sampling; (5) laboratory mix design procedures; (6) pavement thickness design; (7) construction specifications; (8) example of design report; (9) troubleshooting of FDR projects.

This report is available for free download (9.1 MB ZIP):
http://tti.tamu.edu/documents/0-6271-P2.zip

Item 9

Surface Treatment Bond

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

TTI 6271-P3 • 2012

This test procedure is used to determine the bond strength characteristics of the interfaces between the surface of a stabilized base layer, prime coat, and surface treatment.

This report is available for free download (227 KB):
http://tti.tamu.edu/documents/0-6271-P3.pdf

Item 10

Monitoring of Experimental Sections Using a Web-based Database

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)

CTR 6357-1 • 2012

In recent years, a number of databases have been developed as part of TxDOT's Research Program for a diversity of goals and objectives. However, there is no one database that collects and stores lessons learned from long-term field application of different technologies or methods—in particular, after the original research project has concluded. Establishing a database that can hold information from research and construction projects provides TxDOT personnel, practitioners, and researchers with a tool to reference information from past studies to supplement data and avoid duplication of efforts. A database of this type is useful not only for tracking the performance of different types of materials or construction techniques, but also as a warehouse to archive case studies and observations about different projects that can be accessed by TxDOT engineers and others. This access is fundamental for ensuring that the experience and knowledge gained by the TxDOT personnel through the years by developing and implementing research technologies is preserved and the mistakes from the past are not repeated. Besides, the long-term monitoring and documenting of the performance of the various projects could provide valuable information in terms of the effectiveness and the efficiency of the various technologies and products developed during the original study.

Based on the analysis of the advantages and limitations of existing database systems developed previously under TxDOT's Research Program, this project created a wiki-type online database system to house all of the required information and meet the project's requirements and goals. The availability of wiki tools allowed for the development of an online database system that can store all of the required information and be easily accessed and modified by users to accommodate changing requirements and needs. A wiki consists of a collection of web pages designed to enable anyone with access to contribute or modify content, using a simplified markup language. The project's website address is http://pavements2.ce.utexas.edu:8080/txdot. This study was a "low-cost, high-payoff" project because most of the research and expensive testing had already been done but several valuable lessons were missing. This database is a useful tool that can help communicate the experiences and lessons learned not only from different projects, but from engineers themselves.

This report is available for free download (3.7 MB):
http://www.utexas.edu/research/ctr/pdf_reports/0_6357_1.pdf

Item 11

Development of a New Mix Design Method and Specification Requirements for Asphalt Treated Bases

UNIVERSITY OF TEXAS AT EL PASO. CENTER FOR TRANSPORTATION INFRASTRUCTURE SYSTEMS

UTEP 6361-1 • 2012

Asphalt treated bases (ATBs) in Texas are usually designed as per Tex-126-E, "Molding, Testing, and Evaluating Bituminous Black Base Materials," and constructed as per Item 292, "Asphalt Treatment (Plant-Mixed)," of the 2004 Standard Specification book. This specification is a hybrid of base and hot mix asphalt concrete procedures and requirements, which are sometimes incompatible. In addition, this Item uses a specific Texas Gyratory Base Compactor (TGBC) that is not readily available to all districts. Some districts use test method Tex-204-F, Part III, 'Mix Design for Large Stone Mixtures Using the Superpave Gyratory Compactor." However, this procedure was originally developed to design Type A and Type B hot mix on 6 in. by 4.5 in. specimens. Under Item 292, the unconfined compressive strength of the mix (as per Tex-126-E) is used to assess the quality of the mix. Specimens prepared under Tex-204-F are not the appropriate size for this type of testing. As such, the quality of the mix is assessed with the indirect tensile strength. The objective of this project was to propose a new mix design procedure for asphalt treated bases that can use standard equipment such as the Superpave Gyratory Compactor (SGC) to mold the specimens for mix design.

To achieve the objective of this project, current TxDOT procedures such as Tex-126-E and Tex-204-F were evaluated and modified to propose new generically-named Tex-126-H and Tex-204-H specifications. A comprehensive parametric study comparing the results of the two proposed specifications with the existing specification was performed. The impact of the number of gyrations, curing temperature, binder grade, and asphalt content variation were evaluated using prepared laboratory specimens. Parameters including density, unconfined compressive strength, indirect tensile strength, and modulus using the existing and proposed specifications were compared. Based on these studies, a new method for determining the optimum asphalt content (OAC) for ATBs was developed. The recommendations were then evaluated at six actual construction projects for reasonableness.

This report is available for free download (1.9 MB):
http://ctis.utep.edu/publications/Reports/13RR-0-6361-1.pdf

Item 12

Development Guidance for Sign Design Standards

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

TTI 6363-1 • 2012

Many of the design practices that Texas Department of Transportation (TxDOT) uses for large and small sign mounting were established many years ago. These mounting details may no longer be appropriate, given changes in sign materials, fabrication methods, and installation practices. Further, the vehicle fleet and operating conditions on our highways have changed considerably, and there is a need to assess the compliance of some existing sign support systems with current vehicle testing criteria, and to evaluate new technologies that offer to enhance performance and maintenance. This two-year research project was designed to provide TxDOT with comprehensive review and update of mounting details and standards for large and small sign supports, and to provide a mechanism for TxDOT to quickly and effectively evaluate and address high priority needs related to sign support systems. The information provided through the project will be used to update standard Sign Mounting Detail (SMD) sheets, revise or set policies and standards, and evaluate new products and technologies. The issues researched under this are formulated on an annual basis, with the ability to modify priorities as needed.

This report is available for free download (47 MB):
http://tti.tamu.edu/documents/0-6363-1.pdf

Item 13

Research and Recommendations for a Statewide Sign Retroreflectivity Maintenance Program

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

TTI 6408-1 • 2012

This study evaluated TxDOT's current sign retroreflectivity maintenance practices, assessed their effectiveness, and recommended statewide sign retroreflectivity maintenance practices that could be easily and effectively implemented to ensure that TxDOT would be in compliance with the new MUTCD language related to minimum sign retroreflectivity. The researchers measured the retroreflectivity of almost 1400 signs across the state to assess the effectiveness of TxDOT's current practices, evaluated a mobile sign retroreflectivity measurement technology, visited district and maintenance offices across the state, studied the effectiveness of using the calibrated sign and comparison panel procedures of the visual nighttime sign inspection maintenance method, developed a standardized form for making and documenting nighttime inspection, and made recommendations for changes in TxDOT's current sign retroreflectivity maintenance practices. Researchers concluded that TxDOT's current practices are quite effective compared to the minimum retroreflectivity levels in the 2011 Texas MUTCD. Three specific recommendations are provided that will bring TxDOT's current practices into compliance with the 2011 Texas MUTCD. First, TxDOT should provide calibration signs to the maintenance sections. Second, a standardized form should be used to conduct inspections and document inspections. Finally, a training program should be implemented to educate the inspectors on how to conduct the inspections and the importance of sign retroreflectivity.

This report is available for free download (1.9 MB):
http://tti.tamu.edu/documents/0-6408-1.pdf

Item 14

Energy Developments and the Transportation Infrastructure in Texas: Impacts and Strategies

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

TTI 6498-1 • 2012

In recent years, Texas has experienced a boom in energy-related activities, particularly in wind power generation and extraction of oil and natural gas. While energy developments contribute to enhance the state's ability to produce energy reliably, many short-term and long-term impacts on the state's transportation infrastructure are not properly documented. Examples include the impact of frequent truckloads on state highway infrastructure such as pavement structures and shoulders, as well as impacts on roadside infrastructure such as driveways and drainage facilities. There is also a lack of documentation on the impact on TxDOT's ability to manage the state highway right-of-way effectively, e.g., with respect to driveway access and utility crossings. This report describes the work completed to measure the impact of increased level of energy related activities on the TxDOT right-of-way and infrastructure, as well as develop recommendations to reduce and manage TxDOT's exposure and risk resulting from those activities. The report addresses a number of topics, including the process to develop a geodatabase of energy developments in the state, field visits, pavement impacts, roadside impacts, operational and safety impacts, and economic impacts. The geodatabase includes non-renewable energy datasets, renewable energy datasets, energy use datasets, and geology-related datasets. The recommendations for implementation were grouped into the following categories: early notification and coordination (five recommendations), road maintenance and repair (four recommendations), roadside management (two recommendations), and funding (five recommendations).

This report is available for free download (27.9 MB):
http://tti.tamu.edu/documents/0-6498-1.pdf

Item 15

The Overlay Tester: A Sensitivity Study to Improve Repeatability and Minimize Variability in the Test Results

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

TTI 6607-1 • 2012

Hot mix asphalt (HMA) overlay is one of the most commonly used methods for rehabilitating deteriorated pavements. One major type of distress influencing the life of an overlay is reflective cracking. Many departments of transportation have implemented design-level tests to measure the rutting potential of HMA; these are typically wheel-tracking tests. However, currently, there is no national design-level test for measuring resistance to cracking. Currently, the Texas Department of Transportation uses the Overlay Tester (OT) to evaluate the cracking susceptibility of HMA mixes in the laboratory. While, the OT effectively simulates the reflective cracking mechanism of opening and closing of joints and/or cracks, repeatability and variability in the test results have been major areas of concern. In particular, variability in the OT test results poses a problem with most of the conventional dense-graded HMA mixes, such as Type C and D, which is approximately 75 percent of all the HMA used on Texas highways. This laboratory study presents a comprehensive sensitivity evaluation of the critical steps of the OT test procedure in an attempt to optimize the OT repeatability and minimize variability in the test results. In general, the study indicated that the sample drying method, glue quantity, number of sample replicates, air voids, sample age at the time of testing, and temperature variations are some of the key aspects that have a significant impact on the OT test repeatability and variability. Overall, findings from this study indicate that variability in the OT test results can be minimized if these aspects are improved and/or more clearly specified in the OT test procedure (Tex-248-F).

This report is available for free download (4 MB):
http://tti.tamu.edu/documents/0-6607-1.pdf

Item 16

Texas M-E Flexible Pavement Design System: Literature Review and Proposed Framework

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

TTI 6622-1 • 2012

Recent developments over last several decades have offered an opportunity for more rational and rigorous pavement design procedures. 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 the Texas Mechanistic-Empirical (TxME) pavement design system. In the first year of this project, a comprehensive literature review was made to identify and recommend available performance models in terms of rutting, fatigue cracking, low temperature cracking, endurance limit, top-down cracking, and crushing of lightly stabilized base materials. Additionally, the researchers reviewed different reliability approaches used in existing pavement design systems, and the most practical, promising reliability approach was recommended for TxME. Finally, this report discusses the framework proposed for the TxME flexible pavement design system, including pavement structure, material properties, traffic, climate, design reliability, and user interfaces.

This report is available for free download (4.1 MB):
http://tti.tamu.edu/documents/0-6622-1.pdf

Item 17

Megaregion Freight Planning: A Synopsis

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)

CTR 6627-1 • 2012

Megaregion interest has grown strongly in the last decade and is now seen by a growing number of planners as offering effective contributions to problems such as modal congestion, development disparity, and air pollution that individual metropolitan areas or cities cannot resolve individually. Megaregion planning presents an alternative way of mitigating metropolitan problems of large-scale transportation systems, green infrastructure, and economic development and has attracted a number of transportation advocates since 2000. Central questions addressed in this report include how this approach might change freight planning in Texas, what benefits and costs are associated with its adoption, and what characteristics might be of specific interest to TxDOT. The work was structured to give the Department a comprehensive literature review, take directions of interest from the Project Monitoring Committee, undertake preliminary analysis, and present these to a workshop audience comprising TxDOT planners, Metropolitan Planning Organization staff, transportation providers, public transit agencies, and federal officials. A major recommendation is a program of future work that complements TxDOT freight planning, especially at the state transportation planning level.

This report is available for free download (4.1 MB):
http://www.utexas.edu/research/ctr/pdf_reports/0_6627_1.pdf

Item 18

Positive Feedback: Exploring Current Approaches in Iterative Travel Demand Model Implementation -- REVISED 3/9/2012

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

TTI 6632-1 • 2012

Currently, the models that TxDOT's Transportation Planning and Programming Division (TPP) developed are traditional three-step models (i.e., trip generation, trip distribution, and traffic assignment) that are sequentially applied. A limitation of this sequential approach is an inconsistency between the travel time data used in the different stages of the process that may result in: (1) TDMs, which do not accurately reflect system-wide or corridor-level travel patterns, (2) travel times in alternative analyses that may not reflect accurate results, and (3) inaccurate results being used for the air quality determination process. To resolve these differences in the model sequence, researchers proposed an iterative feedback mechanism as an approach. This project researched current trends, practices, and tools in implementing a feedback approach for potential implementation in the TxDOT TDMs. In general, past research and practice underscores the importance of incorporating feedback loops in the travel demand process, especially in regions with moderate to high levels of traffic congestion during certain times of the day. Since the current TxDOT TDM model does not include any impedance or accessibility measures in the trip generation step, the best current approach is to feed back the output from the traffic assignment step to the trip distribution step. Overall, critical consideration should be given to the relative impact that implementing feedback might have on existing TxDOT-TPP practices. A feedback mechanism necessarily includes additional training and increases the calibration time associated with delivering base year travel models; and possibly could include additional data processing (and collection) related to time-of-day implementation.

This report is available for free download (2.6 MB):
http://tti.tamu.edu/documents/0-6632-1.pdf

Item 19

Fatigue Failure and Cracking in High Mast Poles

UNIVERSITY OF HOUSTON (UH). DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UH 6650-1 • 2012

This report presents the findings of a comprehensive research project to investigate the fatigue cracking and failure of galvanized high mast illumination poles (HMIP). Ultrasonic inspection of poles throughout the state has revealed the presence of weld toe cracks at the shaft-to-base-plate connections of some galvanized poles that the Texas Department of Transportation (TxDOT) owns. However, the effect of these galvanization-induced cracks on the fatigue life of the poles has not been clearly defined. The first phase of this research involved extensive review of published and unpublished data, to identify key factors that contribute to galvanization-induced cracking. Best fabrication practices to minimize such cracking are recommended. In the second phase, a comprehensive reliability analysis of several TxDOT pole configurations was conducted for different regions in Texas to predict the fatigue lives of the cracked poles. Critical pole configurations and locations are identified to facilitate cost-effective decisions related to inspection, repair, and replacement of poles.

This report is available for free download (2.7 MB):
http://tti.tamu.edu/documents/0-6650-1.pdf

Item 20

Comprehensive Evaluation of Compaction of Asphalt Pavements and Development of Compaction Monitoring System

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6692-2 • 2012

This study aimed to conduct a comprehensive evaluation of compaction of asphalt pavements and develop software for monitoring field compaction in real time. In the first phase of this study, the researchers built several test sections that were constructed using different asphalt mixtures and various compaction methods. The results of these experiments were used to determine the effects of compaction temperature, compaction method, mixture design, and base type on the compactability of asphalt mixtures. The researchers found that the efficiency of the compactive effort across the steel rollers was non-uniform. A point on the mat closer to the center of the roller was subjected to more compaction than a point closer to the edge of the roller. The compaction temperature was found to have a great effect on compaction irrespective of mixture type. The researchers presented a method for predicting the density of asphalt pavements in real time. This method utilizes the location of the roller on the mat and the compaction curves for each roller to predict the density. The predicted density was close to the measured one. In the second phase of this study, the researchers developed a system for monitoring and documenting the compaction process of asphalt mixtures. This system is called the compaction monitoring system (CMS). The CMS uses the latest global positioning system technologies and various sensors to provide full coverage of the newly constructed mat. The CMS shows maps of coverage, compaction index, and temperature of the first roller pass in real time. The CMS was found to be simple and easy to install and use. The CMS was able to show some inconsistencies in the compaction process, for example, unequal converge across the mat, non-uniform temperature, and significant delay in compaction after placement of the mixtures. The CMS documents the compaction process for the whole project, and the data are saved on the computer. The data can be opened using the same software for reviewing the whole compaction process.

This report is available for free download (8 MB):
http://tti.tamu.edu/documents/0-6992-2.pdf