TEXAS DEPARTMENT OF TRANSPORTATION

FY 2013

RESEARCH PROGRAM

RESEARCH AND TECHNOLOGY IMPLEMENTATION OFFICE

Table of Contents

Institutions Active in TxDOT's 2013 Research Program.....2

Fiscal Year 2013 Research Program.....3

RMC 1 Active Projects 5

RMC 2 Active Projects 39

RMC 4 Active Projects 69

RMC 5 Active Projects 91

RMC P Active Projects.....121

Index.....135

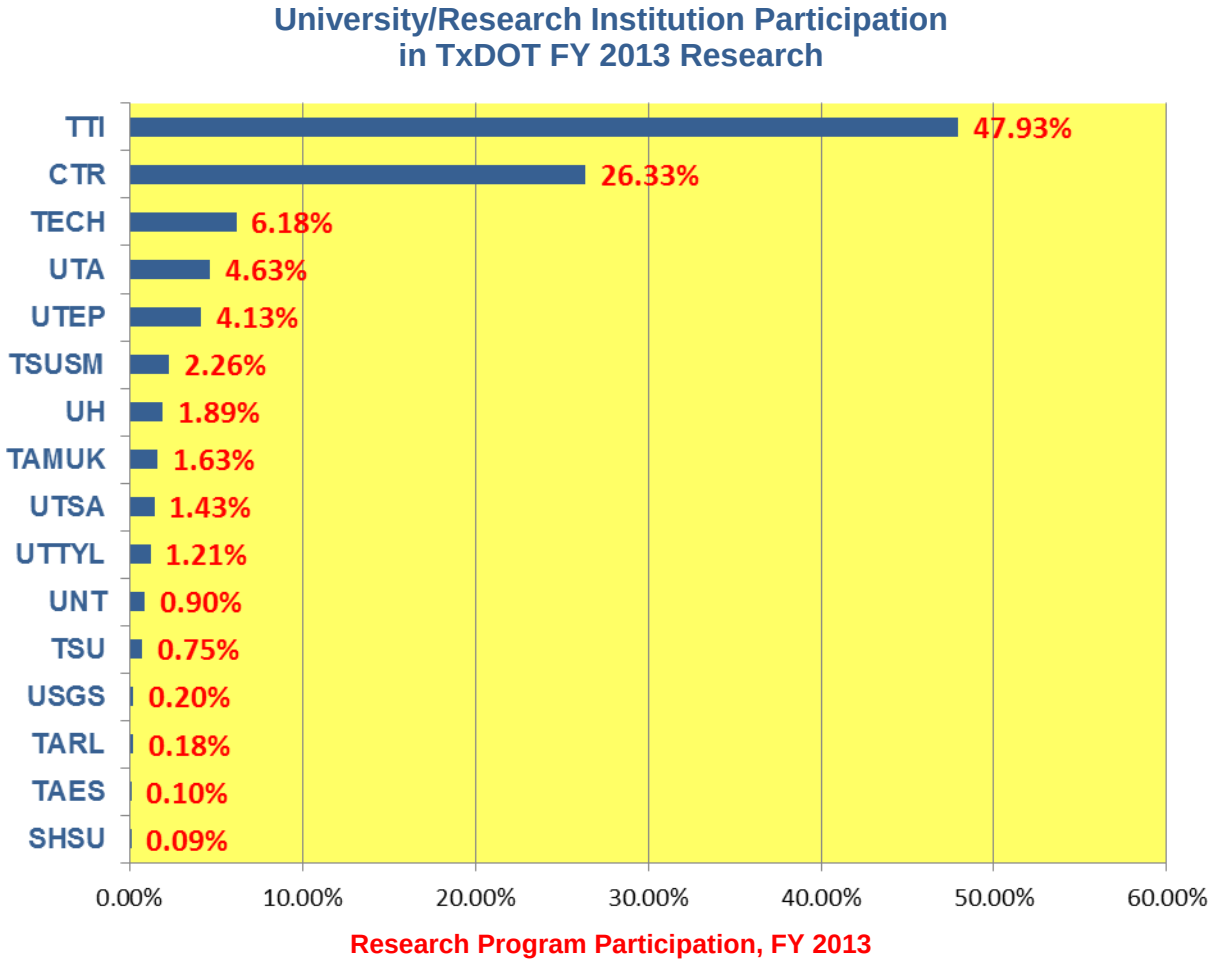
Institutions Active in TxDOT's 2013 Research Program

Acronym	University/Research Institution
CTR	Center for Transportation Research, The University of Texas at Austin
SHSU	Sam Houston State University
TAES	Texas AgriLife Research
TAMUK	Texas A&M University–Kingsville
TARL	Tarleton State University
TECH	Center for Multidisciplinary Research in Transportation, Texas Tech University
TSU	Texas Southern University
TSUSM	Texas State University–San Marcos
TTI	Texas A&M Transportation Institute
UH	University of Houston
UNT	University of North Texas
USGS	U.S. Geological Survey
UTA	The University of Texas at Arlington
UTEP	The University of Texas at El Paso
UTSA	The University of Texas at San Antonio
UTTYL	The University of Texas at Tyler

Fiscal Year 2013 Research Program

University Participation

TxDOT's fiscal year 2013 research program consists of 116 projects, with budgets totaling $18.3 million. This work is contracted to 15 Texas state-supported universities and the U.S. Geological Survey (USGS). The figure below shows project agreement percentages by university/research institution as of November 26, 2012.



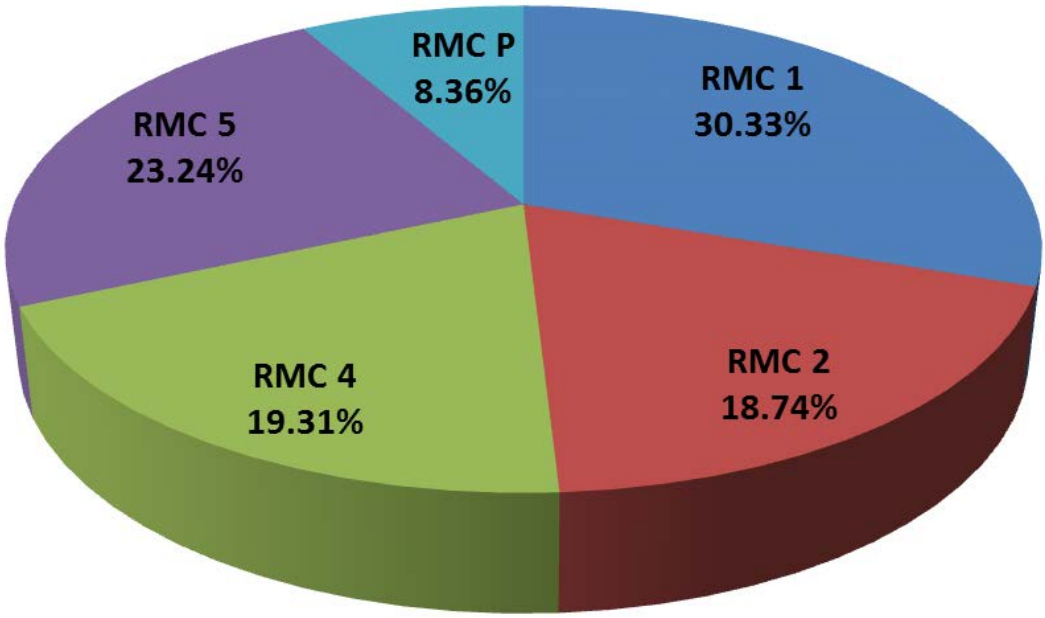
Research Management Committee (RMC) Funding

The table below shows a summary by RMC of the number of continuing/new projects and total funding for fiscal year 2013. The total project funding below is rounded to the nearest thousand dollars.

RMC	Focus Area of RMC	Number of Continuing Projects	Number of New Projects	Total Project Funding
1	Construction and Maintenance	21	10	$5,578,000
2	Planning and Environment	16	11	$3,446,000
4	Safety and Operations	13	7	$3,551,000
5	Structures and Hydraulics	20	7	$4,274,000
P	Administration	11	0	$1,539,000
Total		81	35	$18,388,000

The figure below shows each RMC's proportion of the total fiscal year 2013 program.

Fiscal Year 2013 Program by RMC
Total = $18,388,000



RMC 1 Active Projects

Project	Title	Start Date	Page
0-6274	Project Level Performance Database for Rigid Pavement in Texas, Phase II	11/14/2008	7
0-6610	Impact of Changes in Profile Measurement Technology on QA Testing of Pavement Smoothness	9/1/2010	8
0-6613	Evaluate Binder and Mixture Aging for Warm Mix Asphalts	9/1/2010	9
0-6614	Use of Recycled Asphalt Shingles in HMA	9/1/2010	10
0-6617	Revamping Aggregate Property Requirements for Portland Cement Concrete	9/1/2010	11
0-6618	Mitigation of High Sulfate Soils in Texas	9/1/2010	12
0-6619	Evaluation of Skid Measurements Used by TXDOT	9/1/2010	13
0-6620	Dwarf Turf-Type and Early Maturing Annual Ryegrass to Establish Perennial Vegetation	9/1/2010	14
0-6622	Implementation of a Texas Mechanistic-Empirical Thickness Design System (TexME)	11/5/2010	15
0-6658	Collection of Materials and Performance Data for Texas Flexible Pavements and Overlays	11/9/2010	16
0-6663	Evaluation of Pavement Rutting and Distress Measurements	10/4/2010	17
0-6665	TxDOT Native Plant Integration Program for South, Central and West Texas	9/1/2010	18
0-6673	Evaluate the Improvement in Pavement Ride, Distress and Condition Based on Different Treatment Types	9/1/2011	19
0-6674	Improving Fracture Resistance Measurement in Asphalt Binder Specification with Verification on Asphalt Mixtures Cracking	9/1/2011	20
0-6675	Evaluation of Bonus/Penalty Pay Adjustment Systems for HMA and Ride Specifications of Concrete and Asphalt Pavements	9/1/2011	21
0-6676	Rapid Field Detection of Moisture Content for Base and Subgrade	9/1/2011	22
0-6679	Performance Life of Various HMA Mixes in Texas	9/1/2011	23
0-6682	Validation of the Maximum Allowable Amounts of Recycled Binder, RAP & RAS Using Accelerated Pavement Testing	4/11/2012	24
0-6683	Develop a Pavement Project Evaluation Index to Support the 4-Year Pavement Management Plan	9/1/2011	25
0-6686	Improving DMS 9210 Requirements for Limestone Rock Asphalt (LRA)	9/1/2011	26

Project	Title	Start Date	Page
0-6687	Minimize Premature Distresses in Continuously Reinforced Concrete Pavement	9/1/2011	27
0-6738	Performance Studies and Future Directions for Mixes Containing RAP and RAS	9/1/2012	28
0-6740	Improvement of Construction Quality Control by Using Intelligent Compaction Technology for Base and Soil	11/1/2012	29
0-6741	Longer Lasting Permeable Friction Courses (PFCs)	9/1/2012	30
0-6742	Performance Tests for Thin Asphalt Layers	9/1/2012	31
0-6744	New HMA Shear Resistance and Rutting Test for Texas Mixes	9/1/2012	32
0-6746	Validation of TxDOT Flexible Pavement Skid Prediction Model	11/9/2012	33
0-6747	Seal Coat Quality: Does Low Cost Mean Low Quality?	9/1/2012	34
0-6748	Best Practice for Flexible Pavement Structure Widening Projects	9/1/2012	35
0-6749	Feasibility Study of Two-Lift Concrete Paving	9/1/2012	36
0-6752	Study of Short Term Skid Improvements by Light Texturing with a Milling Machine	9/6/2012	37

0-6274—Project Level Performance Database for Rigid Pavement in Texas, Phase II

Start Date: 11/14/2008 ***End Date:*** 08/31/2013

Abstract

Objectives: The purpose of this project is to update the existing Rigid Pavement Database to include information that will help in the development and calibration of the TxDOT M-E Design for continuously reinforced concrete pavement (CRCP) and develop an advanced and user-friendly database to track the performance of typical and special concrete pavements in Texas. This study will concentrate on the following areas:

1. Additional project level data collection in selected test sections: The detailed CRCP behavior and performance have been investigated in the current rigid pavement database project, 0-5445. The investigations included identifying the effect of (a) crack spacing on load transfer efficiency, (b) concrete setting temperature on transverse crack spacing, and (c) slab thickness on deflections. The investigations also resulted in developing a hypothesis on punchout mechanisms. Additional project level field testing will be conducted to gather more information on CRCP behavior and performance. The findings will be used to develop and calibrate to-be-developed TxDOT M-E design procedures for CRCP.
2. Expansion of the database to include more Level 2 and Level 3 sections: This will help understand the performance of jointed concrete pavement (JCP) and CRCP sections constructed with various designs and environmental conditions. Sections that encompass wide range of condition in Texas in design, materials, and environmental condition, will be included in Level 2 and Level 3 investigations. If distresses are observed and determined to be due to cumulative fatigue damage, the sections will be included in Level 1 investigations and more detailed testing and evaluations will be conducted.
3. Inclusion of special sections in the database: Over the years, TxDOT has built a number of special test sections to investigate the effects of various factors as well as to try new concepts.
4. Further development of an advanced and user friendly database: A web-based database architecture was developed under the current database project. This database is webbased, GIS-oriented, and application-integrated, and will allow interactions with other TxDOT pavement databases. As more project level information is collected in this project, the database will be populated with the information and user friendly analysis functions will be developed.

Project Manager

German Claros, RTI

Project Advisors

Amber Allardyce, ITD
David Wagner, FTW
Elizabeth (Lisa) Lukefahr, CST
Gerald (Jerry) Lankes, TCPA
Hua Chen, CST
Joe Leidy, CST
Stacey Young, LBB

Research Supervisor

Moon Won, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$917,015	Center for Multidisciplinary Research in Transportation	$133,205
	Center for Transportation Research	$90,000

0-6610—Impact of Changes in Profile Measurement Technology on QA Testing of Pavement Smoothness

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: This research will establish the impact of recent changes in profiling technology lasers on TxDOT's implementation of the Department's Item 585 ride specification.

According to the research project statement, the project should provide recommendations on whether and how the Department can accommodate new sensor technology within the existing framework of Item 585, considering that the pay adjustment schedules in this current specification are based on inertial profiles collected with the traditional single-point lasers. Of particular importance to this research is verification of the ride statistics and defect locations determined from profile measurements with the traditional single-point and newer wide-footprint lasers. This verification would require ground truth measurements to establish benchmarks that may be used to identify where changes are required in the existing ride specification and determine what these changes should be. Additionally, this research project aims to evaluate the bump criteria in the existing ride specification to establish an improved methodology that Engineers can use to objectively determine the need for corrections based on measured surface profiles to fix defects that diminish road-user perception of ride quality.

Project Manager

German Claros, RTI

Project Advisors

Cal Hays, TYL
Dale Rand, CST
Darlene Goehl, BRY
Elizabeth (Lisa) Lukefahr, CST
Glen Dvorak, YKM
Magdy Mikhail, CST
Phillip Hempel, CST
Rodney Tucker, SJT
Todd Copenhaver, CST

Research Supervisor

Emmanuel Fernando, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$593,841	Texas A&M Transportation Institute	$113,915
	University of Texas at Arlington	$75,511

0-6613—Evaluate Binder and Mixture Aging for Warm Mix Asphalts

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objectives: The purpose of this project is to evaluate binder oxidation, binder absorption by aggregates, and the impact of these issues on mixture durability for the various common warm mix technologies and to develop a new binder specification, suitable for unmodified and modified binders, that incorporates binder oxidative aging and its impact on WMA pavement durability.

Warm mix asphalt (WMA) technologies employ reduced mixing and placement temperatures thereby allowing 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. Ongoing TxDOT project 0-6009 is quantifying oxidation rates in HMA pavements and their impact on pavement durability, but does not address warm mixes or binder absorption.

To accomplish the objectives in this project, researchers will be taking measurements of laboratory and field warm mix materials: binders, aggregates, lab-compacted mixtures, and pavement cores. Studies will include measurements of fundamental absorption-related properties of binders and aggregates, absorption of warm mix and hot mix asphalts by aggregates at both warm mix and hot mix temperatures, and characterization of laboratory and field warm mixture specimens as to both mixture rheology and recovered binder oxidation and rheological hardening.

Project Manager

German Claros, RTI

Project Advisors

Alan Albus, LBB
Dar Hao Chen, CST
Gisel Carrasco, CST
Jacques Fontenot, TYL
Ronald Hatcher, CHS
Jerry Peterson, CST

Research Supervisor

Charles Glover, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$525,511	Texas A&M Transportation Institute	$199,353

0-6614—Use of Recycled Asphalt Shingles in HMA

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: This research project will conduct and in depth study of the use of recycled asphalt shingles (RAS) in hot-mix asphalt (HMA) or warm-mix asphalt (WMA) mixtures and recommend changes to Texas Department of Transportation (TxDOT) specifications to allow optimal use of these mixtures.

Use of recycled asphalt shingles (RAS) in hot-mix asphalt (HMA) or warm-mix asphalt (WMA) mixtures has the potential to significantly reduce the cost of asphalt paving mixes while conserving energy and preserving the environment. Research on this subject is relatively limited in the literature. The main objectives of this research project are defined as below:

- Define best practices relative to the use of RAS in HMA and WMA mixes,
- Develop a balanced mixture design method(s) for RAS mixes including characterizing RAS binder and developing new RAS binder blending charts,
- Construct and monitor field test sections containing RAS,
- Define the environmental benefits associated with the use of RAS, and
- Recommend changes in Texas Department of Transportation (TxDOT) specifications to allow optimal use of RAS.

To achieve these objectives, the following eight-task work plan is proposed.

- Task 1 - define current best practices by visiting shingle manufacturers and shingle processors in Texas and testing RAS materials as well as conducting literature reviews.
- Task 2 - characterize RAS binder properties and develop RAS binder blending charts through extensive laboratory binder testing. Mixture design method(s) for RAS mixes will be proposed based on laboratory evaluation of engineering properties of RAS mixes in Task 3, and will be validated through field test sections in Task 4.
- Task 5 - define the environmental benefits and cost savings.
- Task 6 - recommend changes to current specifications and mix design methods based on research results from Task 1 through 5.
- Task 7 - Conduct two workshops to effectively implement findings.
- Task 8 - Document all research activities in a research report.

Project Manager

German Claros, RTI

Project Advisors

Douglass Mack, ENV
Gisel Carrasco, CST
Mary Fletcher, TYL
Robert Lee, CST
Stephen Smith, ODA

Research Supervisor

Fujie Zhou, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$402,026	Texas A&M Transportation Institute	$85,000

0-6617—Revamping Aggregate Property Requirements for Portland Cement Concrete

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: This research will evaluate several aggregate tests and their relationship to concrete performance and determine what aggregate properties are important for concrete used in pavement.

Current TxDOT specifications for aggregates in Portland cement concrete have been in Item 421 for over 37 years. Two tests have been required to qualify aggregate for concrete. The magnesium sulfate soundness test which was developed to evaluate the effect of freezing and thawing of aggregates and is only an indirect test for durability. It has had very mixed results as a predictor of concrete performance. The Los Angeles abrasion test has been used to evaluate aggregate strength and toughness. This test has also been shown not to be a good predictor of concrete performance. This research will evaluate several tests including the micro-Deval, aggregate imaging system (AIMS), unconfined freeze-thaw, crushing strength (wet and dry), and absorption tests singly and in combination. Concrete performance will be established from subjective ratings by TxDOT personnel based on many years of service. The concrete performance will be correlated with the aggregate test results. From these correlations aggregate tests and test limits will be recommended.

Project Manager

German Claros, RTI

Project Advisors

Caroline Herrera, CST
Elizabeth (Lisa) Lukefahr, CST
Ryan Barborak, CST
Steven Swindell, BRY
Michael Dawidczik, CST

Research Supervisor

David Fowler, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$542,000	Center for Transportation Research	$150,000

0-6618—Mitigation of High Sulfate Soils in Texas

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: The main objective of this research is to determine ways to stabilize soils with sulfate concentration higher than 8000 ppm and if the soil mineralogy is a factor in this stabilization.

Despite increased knowledge and awareness of sulfate heave, the Texas Department of Transportation (TxDOT) continues to experience pavement failures during and immediately after construction on roads designed to last 20 years or more. Failures are particularly evident in sites where high sulfate soils of 8000 ppm or higher predominate. Many of these failures are attributed to sulfate-induced heave where an expansive mineral called ettringite is formed from calcium-based stabilizers reacting with water, clay, and sulfates.

The researchers have identified several tasks to address development of methods to quantify reactive alumina and silica in treated soils; establish stabilizer dosage and sulfate concentrations at which heaving occur; understand the rate of heaving or ettringite formation kinetics; address reactions between sulfates and other additives such as fly ash and develop mitigation strategies to address heaving in sulfate soils. Project deliverables will include: 1) development of methods to better understand the causes of heaving in chemically treated high sulfate soils, and 2) develop methods or strategies to limit the sulfate heaving in these high sulfate soils.

Project Manager

German Claros, RTI

Project Advisors

Clifton (Cliff) Coward, CST
Gary Mizer, CHS
Jimmy Si, CST
John Bilyeu, CST
Mary Fletcher, TYL
Michael Lee, LFK
Miguel (Mike) Arellano, AUS
Noel Paramanantham, PAR
Richard Williammee, FTW

Research Supervisor

Anand Puppala, UTA

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$381,350	Sam Houston State University	$12,009
	University of Texas at Arlington	$83,936

0-6619—Evaluation of Skid Measurements Used by TXDOT

Start Date: 09/01/2010 ***End Date:*** 02/28/2013

Abstract

Objective: This study will evaluate the skid measurement equipment used by TxDOT to ensure accuracy of measurements using one channel systems and if necessary modify the equipment to measure load.

Accurate estimates of tire-roadway friction values (SN) are critical to the safety of the traveling public. The seven skid measurement systems currently used by TxDOT do not directly measure the vertical test wheel load (W) but calculate it using the locked wheel drag force (F) and the trailer geometry. This technique has been proven at TTI to work well on flat, tangent pavement sections. When vertical wheel loads are not measured directly, external dynamic forces such as grade, curvature and roughness could contribute to errors in the reported skid number.

The first phase of this project will quantify the magnitude of any errors by means of field experiments where the two channel, Texas A&M Transportation Institute, ASTM E-274, skid trailer is compared to the one channel TxDOT, E-274 skid trailer. The comparisons will be made on selected roadways that exhibit mild, medium and sever geometric attributes.

If the errors are found significant, the second phase of the project will be the development of methods to either measure the vertical load directly by the use of strain gages or inertial methods using accelerometers or other transducers. If logistically practical, the chosen modification will then be applied to a TxDOT system for test.

Project Manager

German Claros, RTI

Project Advisors

Cal Hays, TYL
Edward Morgan, CST
Elizabeth (Lisa) Lukefahr, CST
John Wirth, CST
Michael Lee, LFK
Paul Schneider, TYL
Phillip Hempel, CST
Rodney Tucker, SJT
Tom Hunter, LFK
Magdy Mikhail, CST

Research Supervisor

Richard (Dick) Zimmer, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$272,069	Texas A&M Transportation Institute	$78,896

***0-6620*—Dwarf Turf-Type and Early Maturing Annual Ryegrass to Establish Perennial Vegetation**

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: The findings from this research will result in a procedure manual for utilizing ryegrass lines to establish permanent vegetation on roadsides.

Annual ryegrass is not currently recommended by TxDOT for roadside re-vegetation nurse crop because its late maturity and height are too competitive for establishing perennial or spring plant mixtures. Two genotypes are available which are significantly less competitive and could be seeded with fall seeded perennials and wild flowers: a short dwarf-type ryegrass developed for home lawns and an early maturity type ryegrass which produces seed heads in January or February. Both the dwarf- and early maturing-type annual ryegrasses could be less competitive for nutrients, moisture, and sunlight. We will determine if dwarf or early maturing ryegrass are less competitive nurse crops for warm season perennials and allow spring development of wildflower seed production. We will fall plant perennials and the TxDOT wild flower mix in all treatments for each of four zones to determine the ideal annual ryegrass genotype, seeding rates, fertilizer rates, and stand management. We will also determine long-term effect of treatments on establishment and persistence of warm-season perennials and wild flowers. We will then test these findings on TxDOT right-of-way construction sites in all 11 Natural Regions of Texas and write a procedure manual for utilizing ryegrass lines to establishment permanent vegetation on roadsides.

Project Manager

German Claros, RTI

Project Advisors

David Harper, LBB
David Nuckels, ENV
Jon Geiselbrecht, AUS
Marvin Hatter, SAT
Steve Orchard, CRP
Sydney Newman, PAR

Research Supervisor

Hennen Cummings, TARL

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$253,243	Tarleton State University	$33,961
	Texas AgriLife Research	$18,759

0-6622—Implementation of a Texas Mechanistic-Empirical Thickness Design System (TexME)

Start Date: 11/05/2010 ***End Date:*** 08/31/2013

Abstract

Objective: Updating performance models and testing procedures to allow a mechanistic-empirical pavement design system.

Since the mid 1990's there have been many improvements in base materials and asphalt mixes. However, TxDOT performance models have not been updated to reflect those improvements, so it is impossible to determine benefits from improved base materials or superior asphalt mixes. The development of new performance models based on fundamental material properties will enable Texas pavement designers to take full advantage of new materials. The main objectives of this project are defined as below:

1. Improve on models and testing procedures developed in 0-5798 and develop additional performance models and testing procedures that allow mechanistic-empirical prediction of pavement performance for Texas flexible pavement types and environmental conditions. Integrate performance prediction models for all flexible pavement types including surface-treated pavements, and incorporate traffic load spectra, and the enhanced integrated climatic model (EICM) into program specification documents that can be used to update and enhance the FPS 19 design system implemented in the 1990's;
2. Conduct case study in two Districts to demonstrate and document the advantage of the ME-based design process for Texas conditions;
3. Establish comprehensive material testing facilities at Cedar Park campus of the Texas Department of Transportation; and
4. Conduct workshops on the materials testing procedures and the ME design process using a prototype workstation-based application.

Project Manager

German Claros, RTI

Project Advisors

Brett Haggerty, CST
Catherine Wolff, TPP
David Wagner, FTW
Ernest De La Garza, CRP
Joe Leidy, CST
John Wright, PAR
Magdy Mikhail, CST
Mark McDaniel, CST

Research Supervisor

Fujie Zhou, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$728,210	Texas A&M Transportation Institute	$141,450
	University of Texas at El Paso	$69,699

0-6658—Collection of Materials and Performance Data for Texas Flexible Pavements and Overlays

Start Date: 11/09/2010 ***End Date:*** 08/31/2015

Abstract

The primary objective of this project is to collect materials and pavement performance data on a minimum of a 100 highway test sections around the State of Texas. As well as being used to calibrate and validate mechanistic-empirical (M-E) design models, the data will also serve as an ongoing reference data source and/or diagnostic tool for TxDOT engineers and other transportation professionals. The scope of work to accomplish these objectives will include the following activities:

- Selection of field test sections across the State.
- Extensive laboratory and field testing.
- Literature review of M-E models and evaluation of existing databases.
- M-E model calibration and validation.
- Demonstration workshop of the data collected.

A plan for data collection and material testing (lab and field), a plan for data analysis, and a plan for model calibration will be developed during the first months of this research project and, after TxDOT approval, will be implemented by the research team. A minimum of 100 sections (representing different pavement types, material types, climatic regions, traffic levels, and ages [new and old]) will be targeted.

Project Manager

German Claros, RTI

Project Advisors

Billy Pigg, WAC
Brett Haggerty, CST
Jaime Gandara, CST
Jerry Peterson, CST
Joe Leidy, CST
Mark McDaniel, CST
Stephen Guerra, CST
Todd Copenhaver, CST

Research Supervisor

Lubinda Walubita, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$1,853,291	Texas A&M Transportation Institute	$289,158
	University of Texas at El Paso	$146,000

0-6663—Evaluation of Pavement Rutting and Distress Measurements

Start Date: 10/04/2010 ***End Date:*** 05/31/2013

Abstract

Objective: The Texas Department of Transportation (TxDOT) has developed a state-of-the-art 3-D system for rut measurements. The objective of this project is to evaluate this system.

The development of a system to more accurately measure and quantify roadway cracking is also currently underway. These systems will allow the assessment of road performance at both the network- and project-levels and potentially eliminate the need for manual visual assessments to rate pavement distress. Furthermore, the improved accuracy of these systems, which can measure distress while traveling at highway speeds, will eliminate any subjective elements in visual rating and can lead to more consistent and reliable data.

The improved accuracy of the systems under development will significantly impact the TxDOT Pavement Management Information System (PMIS). PMIS is used to monitor statewide pavement condition and to evaluate the effectiveness of pavement maintenance and rehabilitation treatments. PMIS is also used to report progress towards the annual statewide pavement condition goal (90 percent of lane miles in "good" or better condition). Based on preliminary reports from other State agencies, adoption of the new system may indicate an "apparent" increase in overall pavement rutting. Consequently, current algorithms and utility functions used in PMIS will require revision to reflect the improved accuracy of these new systems.

To ensure the rational adoption of the new systems, TxDOT have initiated this project to allow an independent assessment of the accuracy and repeatability of the new automated distress data measurements. The TxDOT system will be compared to other similar systems from a variety of different vendors to identify the best system for automated distress that can be implemented by TxDOT. The project will have two phases. Phase I will evaluate the rut measurements and Phase 2 will evaluate automated distress data measurements including longitudinal, transverse, and alligator cracking, failures, spalled cracks and punchouts.

Project Manager

German Claros, RTI

Project Advisors

Darlene Goehl, BRY
Magdy Mikhail, CST
Robin Huang, CST
Todd Copenhaver, CST
Tracy House, AUS
Mike Arellano, AUS

Research Supervisor

Mike Murphy, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$534,299	Center for Transportation Research	$208,308

***0-6665*—TxDOT Native Plant Integration Program for South, Central and West Texas**

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: This project will collect, evaluate, and release native seed sources for use by TxDOT in Central, West, and South Texas.

Project seed collectors will obtain seeds from target native plant species throughout these regions. Evaluation plantings will be made using these seeds at numerous locations throughout the project area, and plant performance of the various species and collections will be assessed. Following evaluation and testing, the most suitable species and collections will be increased in field-scale production fields, and seeds harvested from these fields will be distributed to commercial growers to make well-tested, adapted native plants and seeds readily available for use by TxDOT for right of way vegetation management and restoration.

Project Manager

German Claros, RTI

Project Advisor

Dennis Markwardt, MNT

Research Supervisor

Forrest Smith, TAMUK

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$750,000	Texas A&M University–Kingsville	$300,000

0-6673—Evaluate the Improvement in Pavement Ride, Distress and Condition Based on Different Treatment Types

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to standardize treatment types and develop revised values for ride and distress scores.

The scope of this project involves preparing a set of guidelines to assist TxDOT districts in identifying the appropriate PMIS treatment levels to develop pavement management plans, and also to predict the improvement of pavement ride, distress, and condition due to assigned treatments. The project will also investigate the need to incorporate a network level structural index to the decision criteria, and evaluate if treatment level definitions should be expanded or sublevels added to the major categories.

An enhanced PMIS decision making process to assign treatment levels will result in better forecasting of pavement performance allowing TxDOT to have reliable information to support funding allocation decisions when developing pavement management plans.

Project Manager

German Claros, RTI

Project Advisors

Aldo Madrid, ELP
Ali Esmaili-Doki, PAR
Bryan Stampley, CST
Feng Hong, CST
Magdy Mikhail, CST
Miguel (Mike) Arellano, AUS
Pedro (Pete) Alvarez, PHR
Terry Paholek, BRY
Wade (Daniel) Blackmon, PAR
Walter Hambrick, HOU
Jenny Li, CST

Research Supervisor

Carlos Chang Albitres, UTEP

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$338,984	Texas A&M Transportation Institute	$83,597
	University of Texas at El Paso	$85,696

0-6674—Improving Fracture Resistance Measurement in Asphalt Binder Specification with Verification on Asphalt Mixtures Cracking

Start Date: 09/01/2011 ***End Date:*** 08/31/2014

Abstract

Objective: The objective of this project is to develop better laboratory tests procedures for binders that can predict rutting or cracking performance.

The current performance grading (PG) specification for asphalt binders was developed during the Strategic Highway Research Program (SHRP), it 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 guarantee good rutting and cracking performance, particularly as it applies to modified binders. Specifically, recent studies on mixes with highly modified binders from out of state (Minnesota) found that the MnRoad mixes have substantially improved cold weather cracking properties than mixes currently used in Texas, while still passing TxDOT's Hamburg rutting requirements.

To eliminate this type of apparent discrepancy AASHTO has adopted a new PG grading system based on the Multiple Stress Creep and Recovery (MSCR) test which is claimed to encourage the adoption of binders which are softer but still retain the required rut resistant. The benefits of the new grading system have not been verified for Texas asphalt binders and mixes.

The major objectives of Project 0-6674 are:

1. Determine if the new AASHTO MSCR-based binder grading system is superior to the current TxDOT binder grading system;
2. Identify/develop a simple test method or methods to characterize fracture and adhesive properties of asphalt binders and associated tentative specification limits;
3. Determine if the asphalt binders not currently used in Texas would potentially improve overlay performance, if so conduct an associated cost-benefit analysis;
4. Identify optimal asphalt binder/aggregate combinations for different environmental zones in Texas;
5. Develop and initially populate a catalogue of all these measured (binder, binder/fine aggregate mastic, and asphalt mix) properties with relevant information that can be used to track the field performance of pavements constructed using these asphalt binders.

Project Manager

German Claros, RTI

Project Advisors

Dar Hao Chen, CST
Gisel Carrasco, CST
Jerry Peterson, CST
Rhonda Roundy, CST
Stacey Young, LBB

Research Supervisor

Fujie Zhou, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$503,940	Texas A&M Transportation Institute	$168,660

0-6675—Evaluation of Bonus/Penalty Pay Adjustment Systems for HMA and Ride Specifications of Concrete and Asphalt Pavements

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to evaluate if the current pay adjustment factors (PAFs) have improved the quality of HMAC in TxDOT and if revisions are necessary.

TxDOT currently uses a pay adjustment factor (PAF) system for production and placement of HMA and ride quality of HMAC and concrete pavements that has been in existence for almost a decade. Current PAFs is not based on expected pavement performance but rather on historical data reflecting contractors' capabilities. A meaningful PAF system should be based on expected pavement performance such that the bonuses/penalties can be economically justified. Current PAFs may be skewed resulting in PAFs that mostly greater than 1.0.

The goal of this research is to address the following objectives: 1) evaluate the validity of PAFs for ride quality, 2) evaluate the validity of PAFs for HMA production, 3) evaluate the validity of PAFs for placement, and 4) modify existing PAFs based on performance considerations.

PAFs proposed under the revised framework will incorporate the economic implications associated with superior (or inferior) pavement performance as they translate to extended (or reduced) pavement service life. A rational system should reflect that the bonuses awarded to the contractors neither exceed the benefits to the highway agency, nor the penalties levied from the contractors fall short of the potential losses incurred by the agency due to a reduced service life.

Project Manager

German Claros, RTI

Project Advisors

Bryan Esmaili-Doki, PAR
Feng Hong, CST
Tom Hunter, LFK
Tomas Saenz, ELP

Research Supervisor

Wei Fan, UTTYL

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$319,822	Center for Transportation Research	$79,892
	University of Texas at Tyler	$80,100

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

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to determine if there is a device that can measure moisture content of soils and granular bases in the field to implement the measurement of modulus of these materials.

Water content in pavement materials plays a critical role both in construction and performance. During the construction phase, the water content influences compaction; in performance, water content significantly influences strength, modulus, and permanent deformation characteristics. While efforts exist to link design and construction by accepting compacted materials based on modulus, these efforts historically have been hindered due to the dependence of modulus on water content. For modulus-based acceptance to be implementable, companion water content measurements are necessary at the time of acceptance testing. Although the nuclear gauge can provide water content measurements in the field, restrictions and licensing requirements make the use of that gauge somewhat burdensome to agencies; test procedures are needed using rapid, accurate, non-nuclear moisture-measurement methods.

To make the possibility of modulus-based acceptance an implementable reality by including nonnuclear moisture measurement, this project will:

- Evaluate and rank non-nuclear techniques for measuring water content in soils and bases used in pavement construction.
- Develop test procedures in TxDOT format for measuring water content with non-nuclear methods.
- Produce a training workshop and training materials.
- Produce a training DVD.

Project Manager

German Claros, RTI

Project Advisors

Caroline Herrera, CST
Daniel Taylor, PAR
Jimmy Si, CST
John Bilyeu, CST
Stephen Kasberg, BRY
Tony Moran, WAC

Research Supervisor

Stephen Sebesta, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$314,465	Texas A&M Transportation Institute	$189,850

0-6679—Performance Life of Various HMA Mixes in Texas

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to define the service life of various HMA mixtures so that numbers can be used by planners designers, and maintenance personnel.

A number of hot mix asphalt (HMA)1 types, such as permeable friction course (PFC), stone mastic asphalt (SMA), performance design mixes and conventional dense graded mixes are currently used to construct or overlay Texas roads. One of the important inputs into current pavement design programs used by the Texas Department of Transportation (TxDOT) is the performance lives of HMA mixes since they significantly impact the life cycle cost analyses of the pavement structures and the ultimate selection of the HMA type. Knowing performance lives is also key information when developing pavement maintenance programs. Currently, the estimated performance life of different HMA mixes (including the frequency of overlay) by the designers in Texas is highly subjective. We propose to address this problem not only in terms of the properties of the asphalt mix type but also in the context of the actual pavement design process (e.g., staged construction vs. perpetual pavement), quality of construction, maintenance needs, traffic volume, and environmental conditions.

Project Manager

German Claros, RTI

Project Advisors

Billy Pigg, WAC
Bryan Esmaili-Doki, PAR
Gisel Carrasco, CST
Miguel (Mike) Arellano, AUS
Brett Haggerty, CST

Research Supervisor

Soheil Nazarian, UTEP

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$306,000	University of Texas at El Paso	$171,000

0-6682—Validation of the Maximum Allowable Amounts of Recycled Binder, RAP & RAS Using Accelerated Pavement Testing

Start Date: 04/11/2012 ***End Date:*** 04/30/2014

Abstract

TxDOT's current special provisions have permitted the use of both RAP and RAS, but there is little evidence that these mixes give comparable performance to those mixes that do not incorporate any recycled materials. Concerns have been raised about mixes which are now "drier," more difficult to compact and more susceptible to both reflection and fatigue cracking. There is an urgent need to conduct a rapid evaluation of these materials and this can readily be performed using accelerated pavement testing (APT) technology.

APT is not currently available in Texas and in this proposal the University of Texas at Arlington proposes to establish an APT center, which can be used for a range of rapid pavement evaluations. Funds have been obtained from the UTA system and ground has been acquired to house and operate the APT device. The manufacture of the APT device and establishing the facility is currently underway and this will be developed at NO COST to TxDOT.

In this study it is proposed to construct a series of flexible pavement test sections using Texas mixes in typical TxDOT pavement structures. These mixes will have different levels of RAP and RAS; the goal is to validate the cracking and rutting potential of both control and RAP/RAS modified mixes within a controlled APT program.

The key issues to be evaluated in this project include:

- Validation that poor results on lab prepared RAP/RAS samples translates to poor field performance under load. (Industry groups claim the lab studies do not simulate plant produced mixes);
- Validation of overlay design tools that have recently been developed by TTI to predict mix cracking and rutting of new overlays; these models need to be validated and calibrated for RAP and RAS mixes. Having a validated design system will then permit TxDOT designers to predict the performance of mixes containing different RAP/RAS levels for a range of existing pavement types with different pavement structures and different pre-existing cracking levels; and
- To determine if the proposed balanced mix design procedures which incorporate both a cracking and rutting evaluation in the lab design phase can be used to design RAP/RAS mixes with performances comparable to virgin mixes.

Project Manager

German Claros, RTI

Project Advisors

Billy Pigg, WAC
Dale Rand, CST
Emmanuel Isonguyo, HOU
Ernest De La Garza, CRP
Jesse Herrera, PAR
John Bilyeu, CST
Richard Izzo, CST
Richard Williammee, FTW
Robert Lee, CST

Research Supervisor

Stefan Romanoschi, UTA

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$1,119,312	Texas A&M Transportation Institute	$139,795
	University of Texas at Arlington	$458,942

0-6683—Develop a Pavement Project Evaluation Index to Support the 4-Year Pavement Management Plan

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to develop an objective ranking index that provides information for the selection and priority of pavements projects.

Each district of the Texas Department of Transportation (TxDOT) is required to develop a 4-year pavement management plan. These plans are reviewed by the 4-Year Pavement Management Task Force and the department's administration. Currently, varying forms of ranking indices and weights are used to develop these plans. These indices consider factors such as traffic volume, Skid Number, treatment history, and pavement surface conditions. The objective of this study is to develop a consistent and sound decision-support methodology that can be used by TxDOT to prioritize and rank pavement projects for the 4-Year Pavement Management Plan. This methodology is essential for developing a cost-effective and defensible multi-year pavement management plan for TxDOT. This objective will be accomplished through a practical work plan that consists of five tasks: 1) review and summarize current and best practices, 2) identify and evaluate key decision factors for pavement project prioritization, 3) develop project prioritization and ranking methodology, 4) validate methodology based on comparisons of actual vs. planned vs. recommended projects, and 5) close out the research project.

Project Manager

German Claros, RTI

Project Advisors

Charles Gurganus, TYL
Mykol Woodruff, PAR
Shaun Barnes, WFS
Stacey Young, LBB
Tammy Sims, PAR
Zheng (Jenny) Li, CST
Darlene Goehl, BRY

Research Supervisor

Nasir Gharaibeh, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$283,127	Texas A&M Transportation Institute	$126,511
	University of Texas at San Antonio	$20,000

0-6686—Improving DMS 9210 Requirements for Limestone Rock Asphalt (LRA)

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to evaluate the specification for LRA (item 330) to see if revisions are required to improve the quality of this material.

Limestone Rock Asphalt (LRA) mixtures have been produced and placed for several decades using specification requirements currently listed under DMS 9210. Several Districts have had placement issues and premature failures at the beginning of 2010. These issues and failures have been attributed to material properties. Requirements for DMS 9210 have not changed for several years and need to be evaluated to possibly produce a higher quality material to reduce the occurrence of premature failures and to minimize placement issues. The objectives of the study are to (1) Evaluate specification requirements of Item 330 and DMS 9210, (2) Conduct field evaluations and lab testing to determine workability and acceptability as stockpile material for use as needed in pavement maintenance, and (3) Consider improvements to the specification requirements to ensure an acceptable and workable stockpile material for up to 6 months.

Project Manager

German Claros, RTI

Project Advisors

Darlene Goehl, BRY
Jerry Peterson, CST
John Bohuslav, SAT
Michael Dawidczik, CST
Richard Izzo, CST

Research Supervisor

Cindy Estakhri, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$247,105	Texas A&M Transportation Institute	$125,000

0-6687—Minimize Premature Distresses in Continuously Reinforced Concrete Pavement

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to evaluate premature distresses on CRCP and develop new specifications that can prevent these types of distresses.

Field evaluations of the performance of continuously reinforced concrete pavement (CRCP) in Texas reveal that a substantial portion of distresses is not necessarily due to structural deficiencies of CRCP. Rather, many distresses appear to be due to construction and material related issues and to a lesser extent, imperfections in design details. Since these distresses occur long before structural distresses develop, they are considered premature distresses. The repair of CRCP distresses is expensive and is not always effective in restoring the pavement condition. Prevention of premature distresses in CRCP is the best course of action.

The most effective way to prevent or minimize premature distresses is to identify the mechanisms of distresses, develop appropriate special provisions to existing specifications or special specifications, and/or modify existing design standards. In this study, focus will be placed on identifying mechanisms of selected premature distress types primarily through field testing and data analysis. Once the mechanisms are identified, modifications will be suggested to the existing design standards and specifications. The products in the form of revised design standards or special provisions/special specifications could be implemented in a pilot project. The findings from field trials could be used to further enhance the revisions to design standards and specifications.

Project Manager

German Claros, RTI

Project Advisors

Andy Naranjo, CST
Dar Hao Chen, CST
Hua Chen, CST
John Cordary, FTW
Julie Rodgers, PAR
Paul (Siong Z) Wong, ATL
Quincy Allen, HOU
Lisa Lukefahr, CST

Research Supervisor

Moon Won, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$272,945	Center for Multidisciplinary Research in Transportation	$104,775
	Center for Transportation Research	$30,000

0-6738—Performance Studies and Future Directions for Mixes Containing RAP and RAS

Start Date: 09/01/2012 ***End Date:*** 08/31/2015

Abstract

Hot-Mix Asphalt (HMA) produced with RAP and RAS can significantly reduce the cost of asphalt mixtures, conserve energy, and protect our environment. However, there is substantial speculation that the recent introduction of higher RAP and RAS contents to Specification Item 341 mixes has had a negative impact on the life of HMA overlays. But, no hard data is available to substantiate the speculation and some claims. The other aspect of RAP/RAS is compactability during construction. These stiffer mixes will be more difficult to construct and therefore could be expected to have poorer overlay density and worse longitudinal joints than regular virgin HMA. The use of Warm Mix Asphalt (WMA) technologies will help on compaction issues but these mixes will not be homogeneously blended between the virgin binder and the recycled binders from RAP/RAS due to the low mixing temperatures. As the Texas Department of Transportation (TxDOT) moves into more and more RAP/RAS usage with different mix types it is necessary to learn from the experiences of the past 3 to 4 years, to determine what is working and what is not, and to study how variations in mix design options, plant production and construction process have impacted the performance life. Specifically, the major objectives of Project 0-6738 are to:

1. Evaluate the impact of RAP/RAS used in HMA and WMA on durability/performance problems of the mixes through field survey:
    a. Do we have durability problems? If so, how significant are they?
    b. Where the RAP/RAS is working; where not; where to best use?
2. Evaluate the impacts of RAP/RAS mixes' performance and identify approaches to improving the durability problems in terms of mix design (increasing target densities, using softer binders, reducing recycled binder content, etc.);
3. Develop the best practices for industry in terms of materials handling (including RAP/RAS processing and stockpiles management), plant production, and construction process;
4. Investigate the cost-benefit of pre-treatments of the RAP/RAS stockpile with rejuvenators in terms of binder blending and overall mix quality;
5. Verify maximum allowable recycled binder content in the specification in terms of binder blending and rheology of the total combined binder including WMA technologies.

Project Manager

German Claros, RTI

Project Advisors

Chad Ingram, TYL
Jason Duncan, WAC
Lawrence (Larry) Coyle, SAT
Robert Lee, CST
Scot Reaves, WFS
Tom Hunter, LFK

Research Supervisor

Fujie Zhou, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$472,432	Texas A&M Transportation Institute	$155,732

0-6740— Improvement of Construction Quality Control by Using Intelligent Compaction Technology for Base and Soil

Start Date: 11/1/2012 ***End Date:*** 11/30/2013

Abstract

TxDOT current practice for field compaction quality control and acceptance for base and soil layers is to determine the compacted density and moisture content by nuclear density gauge (NDG). TxDOT has considered several stiffness-based devices to replace density measurement because stiffness parameters are more relevant to pavement design. Since both density and stiffness measurements are truly spot tests, they cannot represent the quality and uniformity of compaction in a continuous manner. Proof rolling is currently specified in TxDOT as a crude way of evaluating the uniformity of the compacted materials.

Intelligent compaction (IC) technique is a fast-developing technology for base and soil compaction quality control and acceptance. Proof rolling subgrade and base using the intelligent compaction rollers after completing compaction can effectively identify the weak spots and significantly improve the uniformity of the compacted layers. Even though TxDOT has participated in a FHWA-led pooled fund study and funded several studies to implement the IC technology, there are still many obstacles and gaps that need to be explored and overcome in order to fully employ this technology in their day-to-day operations.

Project Manager

German Claros, RTI

Project Advisors

Wade Blackmon, PAR
Victor Goebel, WAC
Charles Gurganus, TYL
Carlos Peralez, PHR
Jimmy Si, CST
Richard Williammee, FTW

Research Supervisor

Soheil Nazarian, UTEP

The primary objective of this project is to improve the process of accepting compacted materials to ensure quality, performance and durability using IC technology. We will develop innovative and practical test protocols and specifications to improve the general quality and acceptance of compaction for subgrade, embankment, and base construction with available IC rollers or instrumented rollers.

Total Project Budget	Research Universities	FY 2013 Budget
$248,064	University of Texas at El Paso	$160,167
	University of Texas at Arlington	$20,955

0-6741—Longer Lasting Permeable Friction Courses (PFCs)

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Permeable Friction Courses (PFC) mixes have proven to be excellent mixes that exhibit a number of desirable characteristics: rut resistance, reduced wet-weather splash/spray, reduced tire noise, and increased visibility of pavement markers during heavy rain. TxDOT pays premium prices for these benefits which are sometimes short-lived as documented in project 0-5836, "Permeable Friction Course Pavements over Time." Recently several projects around Texas have had performance problems with surface fusion, loss of permeability and raveling, and three districts (Pharr, Corpus and Lubbock) do not plan to use any more PFCs. An investigation is needed to explore the potential for better optimizing the design of PFCs to minimize the risk of these problems re-occurring. A study is needed to:

1. Evaluate the feasibility of requiring current HMA laboratory performance test criteria (such as Hamburg and Overlay tests) on future PFC designs;
2. Developing new tests to minimize the risk of premature raveling and stripping; and
3. Developing guidelines on the conditions of where and when blended aggregates should be permitted.

Project Manager

German Claros, RTI

Project Advisors

Allan Moore, WFS
Christopher (Chris) Mashek, WAC
Dan Stacks, SAT
Richard Izzo, CST

Research Supervisor

Tom Scullion, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$311,165	Texas A&M Transportation Institute	$156,870

0-6742—Performance Tests for Thin Asphalt Layers

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

The increasing popularity of thin overlays (asphalt mixes laid 1-inch or thinner) in maintenance and rehabilitation projects due to budgetary constraints (among other reasons) warrants the need for improved testing and construction methods to ensure optimal performance. Selection of an inadequate mix design due to poor laboratory screening or applying poor construction practices to a good mix design can lead to costly premature pavement failures. This has been noted in a few thin overlay projects to date. The work plan in this research involves evaluation of new and modified laboratory tests to improve mix acceptance/screening for rutting, cracking, and skid problems. It also involves evaluating construction practices for surface preparation (tack coat application and micro-milling) and mat compaction. From these evaluations, the current thin overlay specifications can be updated to better assist TxDOT's pavement program.

Project Manager

German Claros, RTI

Project Advisors

Dale Rand, CST
Paul Montgomery, LFK
Paul Norman, ABL
Ronald Baker, LBB

Research Supervisor

Tom Scullion, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$311,900	Texas A&M Transportation Institute	$159,240

0-6744—New HMA Shear Resistance and Rutting Test for Texas Mixes

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

In general, 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. However, with the record summer temperatures of the recent years, several rutting failures have occurred with HMA mixes that had passed the Hamburg test in the laboratory. These failures occurred mostly in high shear locations, in particular with slow moving (accelerating/decelerating) traffic at controlled intersections, in areas of elevated temperatures, heavy/high traffic loading, and/or where lower PG asphalt-binder grades have been used. Earlier TxDOT studies had raised concerns about the Hamburg test in that it is run at one temperature (50 ºC) and it provides high confinement to the test sample. These studies also demonstrated that the repeated load permanent deformation (RLPD) test has a better correlation than the Hamburg to field rutting performance. The RLPD test also provides material properties, which can be used in mechanistic-empirical (M-E) pavement thickness design procedures. However, the current RLPD test set-up is relatively complex and not readily applicable for routine use. This makes it impractical to be used for routine HMA mix screening/acceptance and/or M-E design. As a supplement to the Hamburg test, research is therefore needed 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. The scope of work to accomplish these objectives will include the following activities:

- Data search and literature review,
- Computational modeling and shear stress-strain analysis,
- Modification and/or development of rutting-shear tests,
- Sensitivity and statistical analyses of the test methods,
- Correlation with field data and development of test procedures/specifications, and
- Test demonstration with a case study.

An extensive data search on the current rutting-shear tests along with comprehensive shear stress-strain analyses will be conducted in the first months of the project. Plans for modifying the existing tests and/or developing new test methods will be developed and after TxDOT approval, will be implemented by the research team. Procedures and guidelines for implementing the modified and/or new tests will also be submitted to TxDOT at the end of the study.

Project Manager

German Claros, RTI

Project Advisors

Gisel Carrasco, CST
Joe Leidy, CST
Mark Smith, WFS
Ramon Rodriguez, LRD

Research Supervisor

Lubinda Walubita, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$289,330	Texas A&M Transportation Institute	$144,265

0-6746—Validation of TxDOT Flexible Pavement Skid Prediction Model

Start Date: 11/9/2012 ***End Date:*** 10/31/2014

Abstract

Pavement skid resistance is primarily a function of the surface texture, which includes both microtexture and macrotexture. Microtexture is primarily an aggregate surface characteristic that provides a rough surface which in turn disrupts the continuity of the water film and produces frictional resistance between the tire and pavement by creating intermolecular bonds. Macrotexture is an overall asphalt mixture characteristic, which provides surface drainage paths for water to drain from the contact area between the tire and pavement. In recently completed TxDOT research project 0-5627, the researchers developed a method to predict asphalt pavement skid resistance based on inputs that describe aggregate texture before and after polishing, gradation of asphalt mixture, and traffic.

Although 0-5627 research team conducted extensive field testing on HMA surfaces, the evaluation of surface treatment skid resistance was limited to the analyses of corresponding data from PMIS database. There is need for further testing so that HMA asphalt prediction model can be tailored to the skid prediction model of surface treatment; and skid prediction model can be validated at wide variety of conditions and for more asphalt mixture types.

Building upon the developments in project 0-5627, researchers will investigate and examine a large number of asphalt mixtures and surface treatment test sections. The test sections will be periodically tested to measure their texture and skid resistance. Aggregate texture values before or after polishing will be measured or collected from existing database. Using the test results and incorporating appropriate traffic data, researchers will validate and modify the skid prediction model and expand the model to include skid prediction for surface treatment. Training materials on the application of the new model will be prepared as well.

This skid prediction capability will allow TxDOT to redesign their current method of achieving pavement friction. In the future, TxDOT could specify the level of pavement skid needed to meet the traffic demand of individual pavement sections instead of a surrogate surface aggregate classification. Aggregate texture could be incorporated into the Aggregate Quality Monitoring program and published in the Bituminous Rated Source Quality Catalog. The contractor could then use the skid prediction model to select combinations of aggregate sources and mixture gradations suitable to achieve the required skid number for that particular project. This procedure would work for both hot mix asphalt concrete and surface treatments.

Project Manager

German Claros, RTI

Project Advisors

Phillip Hempel, CST
Caroline Herrera, CST
John Wirth, CST

Research Supervisor

Arif Chowdhury, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$292,454	Texas A&M Transportation Institute	$140,771

0-6747—Seal Coat Quality: Does Low Cost Mean Low Quality?

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Recently TxDOT administration has provided direction on the types of seal coat material that can be used on a particular facility based on traffic volumes. The more expensive modified binders are reserved for use on higher volume facilities while the very low volume facilities must be sealed with unmodified binders. Given the cost-cutting needs the department faces, this guidance is justified. However, it is just as important (economically) to get the maximum life out of a seal coat. For example, on a very low volume, rural road, a Grade 3 aggregate placed with a polymer modified asphalt (though a more expensive seal coat) may provide a surface that needs no maintenance for 12+ years.

The objective of this study is to evaluate the performance of seal coats and materials used statewide and develop guidelines based on cost and performance data regarding what materials should be used and where. To accomplish this goal, districts will be surveyed to understand their experience with the performance and cost of different types of seal coat materials and also to identify sections for further evaluation. Seal coats from the 2011 and 2012 season will be evaluated as well as seal coats from recent research projects. Test sections will be constructed in the four environmental regions to provide a direct performance comparison of different types of seal coat materials. And finally, seal coats will be fabricated in the laboratory and tested to determine the wear resistance of different types of aggregates and the adhesive capabilities of different binders.

Project Manager

German Claros, RTI

Project Advisors

Carolyn Dill, MNT
Charles Smith, WAC
Jesse Fleming, WFS
Jules Zinsmeyer, SAT
Michael Boyd, SAT
Stacey Young, LBB

Research Supervisor

Cindy Estakhri, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$301,401	Center for Multidisciplinary Research in Transportation	$71,850
	Texas A&M Transportation Institute	$78,244

0-6748—Best Practice for Flexible Pavement Structure Widening Projects

Start Date: 09/01/2012 ***End Date:*** 08/31/2013

Abstract

The Texas Department of Transportation (TxDOT) has experienced problems with construction quality and performance on narrow widening projects (i.e., adding a 2- to 5- ft shoulder). The State of Texas has approximately 40,000 lane-miles of FM roads with 9- to 10ft wide lanes. [MapZapper 2011] In addition, approximately 20%, 26% and 36% respectively of roadways with 9', 10' or 11' lanes have either no shoulder or a 1' shoulder. [Machemehl 2006] These roads are potential candidates for lane or shoulder widening to improve safety performance and increase capacity. However, due to constraints regarding construction equipment limitations, material selection options and compatibility, construction methods and other issues, there can be problems with narrow widening projects. These challenges include inadequate compaction at the base layer joint interface, drainage within the pavement and at the pavement surface, either high, or, depressed surface layer construction joints and potential safety concerns. To effectively overcome these challenges, TxDOT has initiated this project to prepare a compendium of best practices and lessons learned regarding narrow widening projects. The primary goal of this project is to identify best practices for improving pavement performance on projects involving widening of narrow pavement structures. The objectives of this project are to:

1. review and document literature and current practices used by TxDOT districts, transportation agencies in other states and abroad, contractors and equipment developers;
2. seek to understand the mechanisms and actions that result in either poor or good pavement widening construction quality and pavement performance based on the literature, case studies, an expert panel Workshop and interviews;
3. develop a compendium of widening best practices, lessons learned and associated specifications / Design Standards that demonstrate the greatest potential;
4. conduct a training Workshop with case studies to assist districts in making the most effective design decisions, develop appropriate design details, and manage and inspect the construction of widening projects; and
5. prepare a comprehensive report that documents the information obtained during this study.

Project Manager

German Claros, RTI

Project Advisors

Brian Lamb, WAC
Henry Fojtik, SAT
Henry (Carl) Schroeder, BRY
Justin Obinna, MNT
Paul (Allen) Warden, BRY

Research Supervisor

Mike Murphy, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$110,221	Center for Transportation Research	$110,221

0-6749—Feasibility Study of Two-Lift Concrete Paving

Start Date: 09/01/2012 ***End Date:*** 08/31/2013

Abstract

Two-lift concrete paving (2LCP) involves placing two layers of concrete (wet-on-wet) instead of placing a single homogeneous layer, as is 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, Ft. 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 (one lift) concrete pavement used. Despite of all the above mentioned benefits, challenges of 2LCP are to have the proper paving equipment and pavement construction management, the right mixture proportions to ensure the use of local materials in the bottom lift to result in an economical placement, and the proper proportions and materials to ensure adequate surface friction in the top lift. This study is to evaluate feasibility and cost effectiveness of 2LCP, particularly in the state of Texas. A comprehensive literature review will first be 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 will be conducted on contractors and agencies with experience with 2LCP. A one-day workshop regarding 2LCP will be organized to obtain information from a wide range of agency, construction, equipment people and TxDOT personnel with experience or interests in 2LCP. The workshop will serve as a solicitation of ideas of the best practice, most cost effective approach, concerns and requirements associate with materials and construction of 2LCP. Information and inputs collected from surveys, interviews and the 2LCP workshop will be summarized to provide construction perspectives of implementation of 2LCP, including additional costs, requirements and impacts to project scheduling of implementation of this concept. A cost effectiveness analyses and feasibility study of the most promising 2LCP practice will also be conducted.

Project Manager

German Claros, RTI

Project Advisors

Clifford Halvorsen, HOU
Darlene Goehl, BRY
Elizabeth (Lisa) Lukefahr, CST

Research Supervisor

Jiong Hu, TSUSM

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$136,947	Center for Transportation Research	$65,000
	Texas State University–San Marcos	$71,947

0-6752—Study of Short Term Skid Improvements by Light Texturing with a Milling Machine

Start Date: 09/06/2012 ***End Date:*** 08/31/2014

Abstract

Skid problems on roads can result from flushing and bleeding where excessive road-mix binder can accumulate on a road's surface as well as general wear of the surface by traffic. This may result in a polished surface that may increase the chances of accidents due to the reduced skid resistance. Strategies to address this problem include mill and fill or overlay rehabilitation but another cost effective solution is to remove only the top portion of the surface course using light-texturing or micro-milling. Using this process a pavement milling machine can remove as little as 3/8 inches off the surface. Unlike a typical mill-and-fill operation, there is not an additional step in laying a new wearing course after milling has been completed. Instead, the newly exposed surface will already have the desired final texture and noise properties, and can be opened to traffic sooner. Some Texas districts have already implemented this technology and have achieved substantially improved skid resistance and reduced rutting with no detrimental effects to the existing pavement. However, these texturing improvements have not been studied to determine how well they improve skid and how long that skid improvement lasts. Therefore, there is an immediate need for conducting a study that can assist TxDOT districts better understand the effect of light-texturing in improving the skid resistance and also to identify the best practice of employing this technology. Consequently, the objective of this research is optimize the light-texturing process by evaluating variables such as the number of teeth on drum, speed of the milling machine, the depth of milling, cutting pattern, pavement type, type of aggregate, climatic zone, traffic loading, etc. Pre- and post-milled sections will be skid tested to investigate these influence variables. Based on a thorough statistical analysis of the data, recommendations and guidelines towards improving light-texturing procedures will be prepared.

Project Manager

German Claros, RTI

Project Advisors

John Bohuslav, SAT
Karl Bednarz, SJT
Larry Buttler, MNT
Wallace (Shan) Slaggle, WFS

Research Supervisor

Lu Gao, UH

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$297,468	Center for Transportation Research	$75,395
	University of Houston	$74,568

RMC 2 Active Projects

Project	Title	Start Date	Page
0-6626	Fleet Equipment Performance Measurement Preventive Maintenance Model (PM2)	9/2/2010	41
0-6629	Texas-Specific Drive Cycles and Idle Emissions Rates for Using with EPA's MOVES Model	9/1/2010	42
0-6635	Water Quality Performance of Permeable Friction Course on Curbed Sections	9/1/2010	43
0-6636	Photocatalytic NOx/HRVOC/O3 Removal in Transportation Applications	9/1/2010	44
0-6638	Preparing for EPA Effluent Limitation Guidelines	9/1/2010	45
0-6688	Evaluation of the I-10 Katy Freeway Managed Lanes	9/1/2011	46
0-6690-CTR	Selected 2012-2014 Trade Flows and Texas Gulf Ports: Panama Canal and South American Markets	9/1/2011	47
0-6690-UNT	Selected 2012-2014 Trade Flows and Texas Gulf Ports: Panama Canal and South American Markets	11/1/2011	48
0-6691	Managing the TDM Process: Developing MPO Institutional Capacity	9/1/2011	49
0-6692	Truck-Rail Intermodal Flows: A Corridor Toolkit	9/1/2011	50
0-6693	Equipment Replacement/Retention Decision Making	9/1/2011	51
0-6694	Identifying Best Practices for Managing Operating Costs for Rural and Small Urban Public Transportation Systems	9/1/2011	52
0-6696	Incorporating Greenhouse Gas (GHG) Emissions in Long Range Transportation Planning	9/1/2011	53
0-6697	Integration of Data Sources to Optimize Freight Transportation in Texas	12/8/2011	54
0-6698	Examining the Use of Existing Public Rights-of-Way for High-Speed Rail or Other Infrastructure	9/13/2011	55
0-6701	Linking Regional Planning with Project Planning in Support of NEPA	9/1/2011	56
0-6754	Review of Tolling Approaches for Implementation within TxDOT's Travel Demand Models	9/1/2012	57
0-6756	Determine the Cost for TxDOT to Process/Review/Approve Utility and Driveway Permits	9/1/2012	58

Project	Title	Start Date	Page
0-6758	Maintaining Project Consistency with Transportation Plans throughout the Project Life-Cycle with an Emphasis on Maintaining Air Quality Conformity.	9/1/2012	59
0-6759	Developing a Business Process and Logical Model to Support a Tour-Based Model Design for TxDOT	9/1/2012	60
0-6760	Improved Trip Generation Data for Texas Using Workplace and Special Generator Surveys	9/1/2012	61
0-6762	Maximizing Mitigation Benefits—Making a Difference with Strategic Inter-resource Agency Planning	9/1/2012	62
0-6763	Accounting for Electric Vehicles in Air Quality Conformity	9/1/2012	63
0-6764	Contribution of Bridge Dwelling Birds to Bacterial Water Quality Impairments	9/12/2012	64
0-6766	A Generic Mode Choice Model Applicable for Small and Medium-Sized MPOs	11/1/2012	65
0-6767	Evaluation of Existing Smartphone Applications and Data Needs for Travel Surveys	9/1/2012	66
0-6768	Development of an Accessibility Formulation to Measure Customers' Evaluations of Demand Responsive Transit (DRT) Systems	11/1/2012	67

0-6626—Fleet Equipment Performance Measurement Preventive Maintenance Model (PM2)

Start Date: 09/02/2010 ***End Date:*** 02/28/2013

Abstract

Objective: This research will develop an algorithm (through statistical modeling) that can be used to recommend appropriate oil change intervals based on engine data collected through on-board diagnostic systems to help refine predictions for when equipment maintenance should be performed.

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 over 17,000 pieces of on-road and off-road equipment. Consequently, fleet maintenance procedures represent a significant cost to the agency. TxDOT currently uses a fleet tracking program (FleetTrackS) to identify when specific fleet equipment require maintenance. This scheduling is dependent on simple variables such as vehicle miles or operational hours logged.

Newer engines and vehicles are equipped with on-board diagnostic systems that can provide data on engine operation including engine speed and throttle position (an indication of load value). There is the possibility of tracking these parameters (performance measures) over time and correlating to another performance measure (oil degradation). This can refine predictions for when equipment maintenance should be performed. The aim of this research is to provide a "proof of concept" for this idea by developing an algorithm (through statistical modeling) that can be used to recommend appropriate oil change intervals based on engine data collected through on-board diagnostic systems. Recommendations for an expanded implementation project will be made if the concept proves to benefit TxDOT and make good economic sense.

Project Manager

German Claros, RTI

Project Advisors

Johnie Muller, GSD
Lori Clark, NCTCOG
Richard (Rick) Walbrick, LBB
Ron Hagquist, OPE
Timothy Nicholes, AUS

Research Supervisor

Tara Ramani, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$295,414	Texas A&M Transportation Institute	$40,000

***0-6629*—Texas-Specific Drive Cycles and Idle Emissions Rates for Using with EPA's MOVES Model**

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: This study will provide TxDOT with local drive cycles for different regions of Texas for different vehicle classes and roadway types as well as cold start and idling emissions rates for heavy-duty diesel trucks.

The U.S. Environmental Protection Agency's (EPA) newest emissions model, MOtor Vehicle Emission Simulator (MOVES), utilizes 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.

Research activities will include the estimated emissions from MOVES for different vehicle classes being compared to real-world on-road emissions measurement. Furthermore, the technical and tactical issues of integrating the results of this study into MOVES for formal emissions analyses purposes will be investigated and recommendations will be made based on the findings.

Project Manager

Wade Odell, RTI

Project Advisors

Bill Knowles, TPP
Jackie Ploch, ENV
Janie Temple, TPP
Laura Norton, TPP

Research Supervisor

Mohamadreza Farzaneh, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$479,710	Texas A&M Transportation Institute	$120,000

0-6635—Water Quality Performance of Permeable Friction Course on Curbed Sections

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: The project will extend the applicability of Performance of Permeable Friction Course (PFC) by demonstrating that a comparable improvement in quality is also possible on highway sections that include curb and gutter allowing widespread use for highway widening projects in urban areas where limited ROW makes the rural cross-section infeasible.

The permeable friction course (PFC) has been demonstrated in TxDOT Project 0-5220 to provide a substantial improvement in the quality of highway runoff. This reduction in pollutant concentrations is sufficient to meet the requirements of the Texas Commission on Environmental Quality (TCEQ) for use as a permanent BMP on the Edwards Aquifer recharge and contributing zones. However, that approval was only extended to the configuration tested, which was a rural highway cross-section with a vegetated shoulder.

One goal of this project is to develop the information necessary to receive approval from TCEQ to use PFC on highway sections with curb and gutter. We will install water quality monitoring equipment to document the quality of runoff from selected test sites in the Austin area.

We also recognize that retrofitting existing sections of highway with PFC might also impact the drainage characteristics, particularly the flooded width of the shoulder during intense storm events. Consequently, the project will also investigate the hydraulic performance of PFC in this new configuration. In addition, the analysis will consider the effect of PFC pavement on drainage system sizing. PFC may reduce the rate of runoff or increase the time of concentration so that smaller pipes and inlets might be sufficient to convey the design storm.

Project Manager

Wade Odell, RTI

Project Advisors

Gary Lantrip, AUS
James Harris, CRP
Lucas Short, AUS
Richard De La Cruz, SAT
Richard Izzo, CST

Research Supervisor

Michael Barrett, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$502,247	Center for Transportation Research	$159,630

0-6636—Photocatalytic NOx/HRVOC/O3 Removal in Transportation Applications

Start Date: 09/01/2010 ***End Date:*** 08/31/2014

Abstract

Objective: The focus of this research is intensive and thorough testing of two commercial photocatalytic coatings applied to portland cement concrete to provide accurate data that are representative of highway applications.

While published laboratory data suggest that TiO2-based materials can remove NOx and VOCs from air samples, the tests have not been designed to be representative of outdoor air conditions. Laboratory tests in this project will emulate roadway conditions. The results of these data will be used to model the effects of using photocatalytic materials in the Houston-Galveston and Dallas-Fort Worth areas, predict the impact on air pollutant concentrations, and provide a cost-per-ton of pollutant removal among other metrics. Long-term outdoor exposure tests will also examine the performance of the materials in real near-roadway locations in two different locations with varying pollutant concentrations and environmental conditions. Another critical component of the testing will be material evaluation, examining the effects of the concrete substrate on photocatalysis, the effect of the photocatalytic process on material degradation, and the longevity of the material.

Project Manager

Wade Odell, RTI

Project Advisors

Andy Naranjo, CST
Clifton (Cliff) Coward, CST
Elizabeth (Lisa) Lukefahr, CST
Jackie Ploch, ENV
Pat Henry, HOU

Research Supervisor

Maria Juenger, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$1,061,842	Center for Transportation Research	$224,448

0-6638—Preparing for EPA Effluent Limitation Guidelines

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objectives: In this project, monitoring and testing experiments will be conducted to determine "typical turbidity" representative of TxDOT's construction site discharges, collect performance data on innovative erosion and sediment control measures that might be expected to meet a forthcoming federal discharge standard, and produce Guidance Measures and Sampling Protocols for TxDOT to negotiate with TCEQ in the development of statewide monitoring/sampling procedures.

On December 1, 2009, the US Environmental Protection Agency (EPA) finalized and published a rule in the Federal Register establishing non-numeric and, for the first time, numeric effluent limitation guidelines (ELGs). The numeric ELGs include turbidity limits and sampling requirements for stormwater discharges from construction sites. All sites that disturb 20 or more acres of land at one time are required to comply with a turbidity limit. The EPA is requiring Texas to implement these new requirements when the Texas Commission on Environmental Quality (TCEQ) next renews the Texas Construction General Permit (CGP).

Three research institutes (Texas A&M Transportation Institute, The University of Texas at Austin and Texas Tech University) will collaborate on this project to cover the statewide differences in climate, soil types, slopes, and other factors that affect the performance of erosion control measures.

Project Manager

Wade Odell, RTI

Project Advisors

Amy Foster, ENV
John Mason, MNT
Jon Geiselbrecht, AUS
Kathleen Newton, BMT
Tasha Vice, DES

Research Supervisor

Jett McFalls, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$736,293	Center for Multidisciplinary Research in Transportation	$26,343
	Center for Transportation Research	$41,787
	Texas A&M Transportation Institute	$85,802

0-6688—Evaluation of the I-10 Katy Freeway Managed Lanes

Start Date: 09/01/2011 ***End Date:*** 02/28/2013

Abstract

Objective: The purpose of this study is to perform a comprehensive evaluation of the Katy Freeway Managed Lanes, including aspects such as congestion, safety, enforcement, maintenance, pricing, access design, lane separation, operating policy, public perception, and project delivery.

The Katy Freeway Managed Lanes on I-10 in Houston became fully operational in 2009. The managed lane facility, also referred to as the Katy Tollway, is the first constructed managed lane project in Texas and the first variably-priced operation in the state since the implementation of the QuickRide program on US 290 and I-10 HOV lanes in Houston more than ten years ago. The four-lane facility, which was constructed within the center of the existing freeway, can be described as a "second generation" managed lanes project that is more complex than earlier generation HOV-to-HOT conversions. In addition to the facility's unique operating characteristics, TxDOT developed the project in partnership with other local entities in an innovative delivery process for funding, operating and maintaining the managed lanes.

Using a combination of available data and new data collection, the evaluation will cover many of the critical areas of project development, design and operation with the purpose of supporting successful implementation of managed lanes across Texas.

Project Manager

German Claros, RTI

Project Advisors

Alex Power, TRF
Eddie Sanchez, PMO
Lucio Vasquez, TTA
Marcy Saenz, TTA
Patrick Gant, HOU

Research Supervisor

Ginger Goodin, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$294,800	Texas A&M Transportation Institute	$67,600

0-6690-CTR—Selected 2012-2014 Trade Flows and Texas Gulf Ports: Panama Canal and South American Markets

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Trade between the U.S., South America, and Asia highlights a growing opportunity for Texas ports. They are in a position to capture a larger share of Asian and South American imports to their customers, expand Texas export markets, and serve as global hubs. However, the ability of Texas ports to succeed and increase their significance in statewide transportation planning requires an understanding of how and why trade is conducted between these regions. The first year of this study examines a range of trade and marine transportation factors required to provide this understanding. U.S. trade with South American and Asian markets will be researched in a Policy Research Project (PRP) project and documented in a first-year report. Concurrently, a CTRJTTI team will undertake an evaluation of two specific technical areas: port channels and vessel operating costs. The PRP and technical work integrates to form the basis for a second-year work plan addressing strategic issues related to future South American and Asian trade volumes handled at Texas deep water ports, the role played by the expansion of the Panama Canal, and the impact of increased trade on the Texas transportation system.

Project Manager

Wade Odell, RTI

Project Advisors

Eduardo Hagert, FAO
Gus De La Rosa, FAO
Gus Khankarli, RSC-NORTH
John Sabala, OPE
Mark Werner, RRD
Raul Cantu, TPP
Scott Cunningham, AUS

Research Supervisor

Robert Harrison, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$322,134	Center for Transportation Research	$115,000
	Texas A&M Transportation Institute	$46,914

0-6690-UNT—Selected 2012-2014 Trade Flows and Texas Gulf Ports: Panama Canal and South American Markets

Start Date: 11/01/2011 ***End Date:*** 02/28/2013

Abstract

Economic diversification and trade are among the top reasons Texas weathered the Great Recession in comparatively strong fashion. Moreover, the ability of Texas businesses to engage in the global market is a key to future success. During 2010, Texas was the top exporting state in the nation with $206.6 billion of goods. The expansion of the Panama Canal will provide an opportunity for Texas to expand linkages with the growing economies of South and Central America. This research project will provide critical data to TxDOT and transportation planning entities, providing an opportunity for taking proactive roles in ensuring that the right conditions exist for future economic growth in the state. The research will obtain data and information from key individuals and organizations regarding current and projected future trade and freight routing and the impacts on trade from the expansion of the Panama Canal. Participants in the study will include the Panama Canal Authority, ocean carriers, Class I railroads, and third-party logistics providers. The data gathered will be combined with data and information from other sources to assess current trade patterns and provide trade forecasts for 2014, 2017, and 2020 by Texas port and major community group.

Project Manager

Wade Odell, RTI

Project Advisors

Eduardo Hagert, FAO
Gus De La Rosa, FAO
Gus Khankarli, RSC-NORTH
John Sabala, OPE
Mark Werner, RRD
Raul Cantu, TPP
Scott Cunningham, AUS

Research Supervisor

Terry Clower, UNT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$138,746	University of North Texas	$34,999

0-6691—Managing the TDM Process: Developing MPO Institutional Capacity

Start Date: 09/01/2011 ***End Date:*** 02/28/2013

Abstract

Objective: The goal is to assist MPOs in developing institutional capacity to undertake travel-related technical analyses in a complete and timely manner.

Within Texas, the development of urban travel models is a cooperative process between the Texas Department of Transportation and Metropolitan Planning Organizations. Though TxDOT Transportation Planning and Programming Division is responsible for developing and validating an MPO's travel model, MPOs play an important role in model development by providing the demographic data and regional roadway information required for model development and forecast applications. Like other MPOs nationwide, Texas MPOs struggle with the difficulties of limited resources, time, and staff for the development of accurate and reliable travel models.

Owing to the collaborative process between TxDOT and Texas MPOs, and the different sizes and staff resources among Texas MPOs dedicated to model development, the MPOs in Texas have different needs and challenges in this regard. This project will research current practices, trends, and innovations by MPOs in Texas and nationwide for managing this process. While the results from the study will include tiered recommendations appropriate for MPOs of all sizes, the focus will be on small and medium-size MPOs with limited staff and data resources for providing information for developing models.

Project Manager

Wade Odell, RTI

Project Advisors

Greg Lancaster, TPP
Isidro Martinez, SAMETROPLN
Janie Temple, TPP
Michael Medina, ELPMPO
Mike Carrizales, TPP

Research Supervisor

Karen Lorenzini, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$210,000	Center for Transportation Research	$25,000
	Texas A&M Transportation Institute	$37,826

0-6692—Truck-Rail Intermodal Flows: A Corridor Toolkit

Start Date: 09/01/2011 ***End Date:*** 06/30/2013

Abstract

Objective: The objective of this project is to combine mechanistic models for both trucks and rail into a PC model, calibrated for Texas and implemented through a series of study workshops for TxDOT and MPO planning staff.

Texas faces increased freight demands from population growth and economic success, with little prospect of adding substantial lane miles to the TxDOT principal highway networks. In Texas's truck-dominated intrastate corridors, can railroads offer competitive service and reduce truck volumes? Current mode choice models cannot capture the effects of weight, speed, engine power, grade, or curvature—key elements of any mechanistic approach. Moreover, they are incapable of fully internalizing external or social costs into their calculations. Therefore, in two critical areas for transportation planners—fuel costs and emissions—existing models are deficient. This proposal combines mechanistic models for both trucks and rail into a PC model, calibrated for Texas and implemented through a series of study workshops for TxDOT and MPO planning staff. The output of the toolkit allows planners to compare truck and rail service over a series of corridors in terms of overall cost, fuel costs, emissions per ton-mile, and related secondary costs such as pick-up and delivery costs for rail freight. Class One railroad companies—including BNSF, UP, and CSX—have expressed interest in calibrating the rail model, while the truck costs will be derived from TxDOT project 0-5974 and related models.

Project Manager

German Claros, RTI

Project Advisors

Gus Khankarli, RSC-NORTH
Orlando Jamandre, RRD
Rakesh Tripathi, HOU
Raul Cantu, TPP
Scott Cunningham, AUS

Research Supervisor

Robert Harrison, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$295,815	Center for Transportation Research	$125,815

0-6693—Equipment Replacement/Retention Decision Making

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objectives of this project are to examine the new Equipment Replacement Optimization process under conditions of uncertainty while also assessing the impacts of "Right-Sizing" the equipment fleet.

Maintenance of a robust TxDOT vehicle fleet is essential to accomplishing the daily departmental mission but costly. On one hand, reductions in fleet costs are potentially beneficial to the department as a whole and thereby beneficial to the taxpayers of the State of Texas. On the other hand, not being able to respond adequately under disaster/emergency conditions is unacceptable and therefore maintaining a fleet robust enough to capably respond in a multi-event contingency is also critical.

TxDOT's new equipment replacement optimization software (TERM2) produced through project 0-6412 can optimize the equipment keep/replacement decision process potentially resulting in substantial cost savings. However, as future funding levels become more uncertain, nonavailability of funds for vehicle replacement when optimally suggested by the software is very likely. If optimal timely replacement is impossible, then what is the cost to the department of NOT replacing equipment when it should be replaced? How will down time costs change as equipment ages and what are the potential impacts of future uncertain equipment purchase costs? How to determine "robust" alternatives for critical primary and support equipment assets - quantities and placement? The purpose of this project is to address these questions and provide robust optimal solutions for TxDOT.

Project Manager

German Claros, RTI

Project Advisors

Brandye Munn, MNT
David Bennett, MNT
Johnie Muller, GSD
Karen Dennis, GSD
Magdy Mikhail, CST
Michelle Veale, BRG
Ron Hagquist, OPE
Scott Hamilton, RSC-SOUTH

Research Supervisor

Wei Fan, UTTYL

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$256,746	Center for Transportation Research	$63,785
	University of Texas at Tyler	$65,850

0-6694—Identifying Best Practices for Managing Operating Costs for Rural and Small Urban Public Transportation Systems

Start Date: 09/01/2011 ***End Date:*** 03/31/2013

Abstract

Objective: The purpose of this project is to develop a guidebook for rural and small urban public transit providers to manage operating costs better.

Rural and small urban transit providers across the United States face fiscal challenges caused by the growing gap between the cost of providing transit service and available federal and state funding. In Texas, the fiscal challenges facing rural and small urban transit providers are compounded by an increasing population and growth in urbanization in some counties and declining population with increasing demand for transit service for an aging population in other counties. This research will better equip public transportation providers to understand, predict, and manage operating costs.

The guidebook will meet five objectives: (1) serve as a reference to better understand various drivers of operating costs; (2) explain how organizational structure, service characteristics, and management structures impact costs; (3) provide a tool for transit providers to analyze costs based on resource allocation; (4) demonstrate benchmarking and peer comparisons as a way to monitor costs and share best practices to manage costs; and (5) present an overview of national trends and innovative approaches to contain costs.

Project Manager

Wade Odell, RTI

Project Advisors

Delma Childress, SJT
Gary Rushing, HTCG
Gregory (Greg) Davis, WAC
Kelly Kirkland, PTN
Sonya Hudson, ATL

Research Supervisor

Suzie Edrington, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$148,600	Texas A&M Transportation Institute	$37,950
	Texas State University–San Marcos	$837

0-6696—Incorporating Greenhouse Gas (GHG) Emissions in Long Range Transportation Planning

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The aim of this research is to equip TxDOT with the necessary tools and information to address potential rules and regulations relating to long range transportation planning and GHGs.

Greenhouse gas (GHG) emissions continue to be an important focus area for state, local and federal agencies. Transportation agencies are also moving towards tackling the issue of GHG emissions. It is also likely that, in the future, transportation funding may be tied to demonstration of GHG reductions in long range transportation plans. TxDOT plays a major role not just in statewide long range transportation planning, but in working with MPOs and other stakeholders on their plans, in allocating federal funds, and planning and implementing transportation projects. This research will conduct a review of literature, policy and regulation, practices of other agencies, as well as TxDOT-specific practices, issues and needs. The research will then develop a framework by which GHG emissions can be incorporated into long range transportation plans, through appropriate control strategies, analysis methods, and performance measures. The outcome of this research project will directly benefit TxDOT and its partner agencies, including MPOs, by allowing TxDOT to proactively address the topic of GHG emissions through long range transportation planning.

Project Manager

Wade Odell, RTI

Project Advisors

Bill Knowles, TPP
Greg Lancaster, TPP
Jackie Ploch, ENV
Karie Brown, RSC-NORTH
Shundreka Givan, FHWA

Research Supervisor

Josias (Joe) Zietsman, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$300,000	Center for Transportation Research	$70,000
	Texas A&M Transportation Institute	$100,000

0-6697—Integration of Data Sources to Optimize Freight Transportation in Texas

Start Date: 12/08/2011 ***End Date:*** 12/31/2013

Abstract

Freight transportation is critical to the economic prosperity of any region. The challenge, however, lies in disaggregating freight transportation demand to flows that can be assigned onto a state and region's transportation network. Disaggregated freight flows are necessary to:

- provide a clear picture of freight movements on the transportation system;
- determine the impact of freight on a region's infrastructure and the implications in terms of funding;
- evaluate strategies for improving freight mobility;
- forecast system performance;
- mitigate impacts of truck traffic on general mobility, and
- to improve the safety performance of the transportation system.

The passage of the Intermodal Surface Transportation Efficiency Act (lSTEA) of 1991 initiated an increasing interest in freight modeling within statewide planning efforts, particularly the evaluation of current and future freight transportation capacity necessary to ensure freight mobility. Although freight models have started to emerge as tools to inform transportation policies, a critical challenge in the development of these models remains insufficient and inferior quality data. The objectives of this study are (a) to develop a strategy for integrating and collecting available freight data, (b) explore the feasibility of entering into a data sharing partnership with the freight community for the collection of detailed and robust freight data that will satisfy the needs of transportation planning agencies, (c) develop prototype Freight Data Architecture Business Process, Logical Data Model and Physical Data Model documents supporting a separate IT project developing a database, and (d) advise TxDOT on the cost-effectiveness of acquiring and maintaining a freight data sharing partnership to populate the Freight Data Architecture.

Project Manager

Wade Odell, RTI

Project Advisors

Brian Burk, AUS
Cary Karnstadt, TPP
Dieter Billek, TTA
Frank Phillips, LBB
Jennifer Moczygemba, RRD
Orlando Jamandre, RRD

Research Supervisor

C. Walton, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$471,654	Center for Transportation Research	$202,370
	University of Texas at El Paso	$23,188

0-6698—Examining the Use of Existing Public Rights-of-Way for High-Speed Rail or Other Infrastructure

Start Date: 09/13/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The primary purpose of this research work plan is to determine if and how existing TxDOT, public, utility and freight rail ROW can potentially accommodate high-speed intercity passenger rail (HSIPR) and/or dedicated freight transportation systems.

The administrative difficulties, delays, costs, and environmental impacts associated with the acquisition of property for transportation projects point to a need to consider utilizing existing right-of-way (ROW) resources to the greatest extent possible.

A number of states have considered and have chosen existing highway, public, freight rail, and utility ROW for preferred alignments for HSIPR, such as Florida (I-4, freight rail, utility, and Orlando airport ROW) and California (I-5, I-10, and freight rail).

To answer the research question for Texas, all potential ROW routes in Texas will be identified and their key characteristics considered for utilization by a spectrum of HSIPR and dedicated freight systems. At least four of those routes will be evaluated in greater detail for technical, political, and legal feasibility. For those four case studies, the study will develop potential solutions to engineering challenges encountered in the ROW, such as highway interchanges and narrow ROW width. The case study research will include meetings and interviews with affected ROW owners and critical stakeholders.

Project Manager

German Claros, RTI

Project Advisors

Charon Williams, ROW
Dan Perry, PAR
Don Toner, TTA
Mark Werner, RRD
Roger Beall, TTA

Research Supervisor

Stephen Mattingly, UTA

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$387,943	Center for Transportation Research	$85,000
	Texas Southern University	$24,108
	University of North Texas	$12,992
	University of Texas at Arlington	$63,529

0-6701—Linking Regional Planning with Project Planning in Support of NEPA

Start Date: 09/01/2011 ***End Date:*** 12/31/2012

Abstract

Objective: The objectives of this research study are to (a) review the effectiveness of the practices and efforts that have been implemented in Texas to deliver planning documentation that supports the environmental clearance process, (b) review the effectiveness of the practices and efforts that have been implemented in other states to link planning with project planning in support of NEPA, (c) assess the challenges in implementing identified practices and the need for additional resources and guidance, and (d) recommend process revisions, procedures for developing robust planning studies and NEPA documents, and changes to the allocation of resources.

Multiple benefits can arise from a more efficient link between transportation planning and project planning in support of NEPA that will ultimately facilitate the preparation of legally sufficient documents and prevent delays in project implementation. These benefits include (a) agency benefits resulting, for example, from a reduction in paperwork; (b) socio-economic benefits if the time from planning to construction of a project is reduced so that the benefits of the project become available sooner to the traveling public, and (c) broader environmental benefits when multiple stakeholders are involved early in the process to ensure environmental protection through collaboration and the identification of mitigation sites. As the RFP has highlighted, and as the FHWA and other resource guides have noted, there are, however, components of regional planning that are either not conducted, or conducted inadequately, which slows down the environmental clearance process. The results have been delayed construction, cost escalation, and challenges in acquiring right-of-way.

Project Manager

Wade Odell, RTI

Project Advisors

Doug Booher, TTA
Karie Brown, RSC-NORTH
Melissa Neeley, ENV
Susan Theiss, HOU

Research Supervisor

Jolanda Prozzi, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$212,996	Center for Transportation Research	$27,151
	Texas A&M Transportation Institute	$14,524
	University of North Texas	$6,325

0-6754—Review of Tolling Approaches for Implementation within TxDOT's Travel Demand Models

Start Date: 09/01/2012 ***End Date:*** 11/30/2013

Abstract

The primary objective of this project is to evaluate and recommend to the Transportation Planning and Programming (TPP) Division of TxDOT (TxDOT-TPP) a menu of potential procedures to account for toll demand that could be selected for implementation in the current TxDOT modeling platform. This project will research current practices, tools and trends in implementing approaches to account for fixed-fee toll roads in both the base and forecast conditions using the current trip-based 24-hour travel demand models developed by TxDOT-TPP. Practices in place nationally as well as in the state, including those used in TxDOT's Statewide Analysis Model (SAM), will be included in the review portion of this project. A secondary objective of the project will be to describe, demonstrate and evaluate the challenges associated with and benefits of implementing different approaches. All recommendations developed as a part of this research will be context-sensitive to provide TxDOT-TPP with the flexibility that will be needed given differing urban and toll facility characteristics.

Project Manager

Wade Odell, RTI

Project Advisors

Bruce Uphaus, TPP
David Bruno, BRY
Greg Lancaster, TPP
Janie Temple, TPP
Mike Bolin, RSC-NORTH
Mike Schofield, TPP
Mollie Klenzendorf, TPP

Research Supervisor

Kevin Hall, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$160,941	Center for Transportation Research	$67,051
	Texas A&M Transportation Institute	$66,250

0-6756—Determine the Cost for TxDOT to Process/Review/ Approve Utility and Driveway Permits

Start Date: 09/01/2012 ***End Date:*** 02/28/2014

Abstract

Reviewing and processing utility and driveway permits requires a considerable amount of involvement and coordination by TxDOT personnel, both at the district and division levels. Although many utility and driveway permits are routine and straightforward, a substantial number of permits require much more effort and time. Contrary to most cities and other government agencies, TxDOT does not charge a fee for utility or driveway permits. An appropriate administrative fee might help TxDOT recover some or most of the permit processing costs. However, the feasibility of the fee needs to be assessed. In addition, highly urbanized or developed areas typically involve more permits than rural areas. Due to limited staffing levels in some TxDOT offices, it might be more feasible for the permitting function to be transferred to larger municipalities under municipal maintenance agreements. The research will study the time and costs for processing various types of utility and driveway permits; recommend a fee schedule to cover these costs if costs are significant; study the feasibility of, and threshold for, transferring permitting functions to municipalities; and outline a process for TxDOT to ensure access management compliance if permit review is transferred to municipalities.

Project Manager

German Claros, RTI

Project Advisors

Charon Williams, ROW
Daniel Schrader, WFS
Gary Ray, HOU
Ken Davenport, SAT
Shannon Ramos, LFK
Tommy Jones, ABL

Research Supervisor

Cesar Quiroga, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$287,000	Texas A&M Transportation Institute	$197,000

***0-6758*—Maintaining Project Consistency with Transportation Plans throughout the Project Life-Cycle with an Emphasis on Maintaining Air Quality Conformity**

Start Date: 09/01/2012 ***End Date:*** 03/31/2014

Abstract

Streamlined project delivery is one of the goals outlined by the Texas Department of Transportation (TxDOT) leadership to achieve an efficient and effective transportation system in Texas. Any unnecessary delay in the project delivery process may exacerbate the cost of the project. This issue is especially critical for projects in nonattainment and maintenance areas since individual projects conformity is directly linked to consistency of those projects with appropriate transportation plans and improvement programs; i.e., a project is no longer conforming to the State Implementation Plan if it becomes inconsistent with the Metropolitan Transportation Plan/Transportation Improvement Plan or State Implementation Plan/Statewide Transportation Improvement Plan. This results in withholding of federal funding from the Federal Highway Administration/Federal Transit Administration which in turn causes significant delays in project delivery. This study will provide TxDOT with a Project Consistency Guidebook including procedures and tools required for conducting a project consistency analysis and communications by different TxDOT units as part of the TxDOT Project Development Process. This will help TxDOT to avoid the risk of conformity re-evaluation or failure caused by project re-design during the project development process as well as to implement improved work processes as one of the stated goals of TxDOT's modernization effort.

Project Manager

German Claros, RTI

Project Advisors

Julia Ragsdale, ENV
Michelle Conkle, TPP
Timothy (Tim) Wood, ENV

Research Supervisor

Mohamadreza Farzaneh, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$129,830	Texas A&M Transportation Institute	$75,378

0-6759—Developing a Business Process and Logical Model to Support a Tour-Based Model Design for TxDOT

Start Date: 09/01/2012 ***End Date:*** 08/31/2013

Abstract

The changing modeling needs over the past few years, spurred by the evolving policy contexts of transportation planning, have led the planning community to explore tour-based and activity-based modeling paradigms as an alternative to the traditional trip-based modeling paradigm. As a leading travel model practitioner, the TxDOT-Transportation Planning and Programming Division (TxDOT-TPP) sponsored an earlier study to synthesize tour-based modeling approaches in the country and identify potential benefits and costs of transitioning to this emerging modeling paradigm in Texas. Based on the results of the study, TxDOT-TPP is now moving forward to develop a business case (justification and need) and logical data model, including step-by-step actions and procedures to support the design and development of a tour-based travel model. This plan will not only justify the need for tour-based models, but also proactively identify potential challenges and constraints that may arise in implementation, and provide pathways to address them. It also will address the need to continue to operate trip-based models in parallel with tour-based where needed or required, and assess any impacts of tour-based modeling on the Technological Services Division (TSD) of TxDOT.

Project Manager

Wade Odell, RTI

Project Advisors

Greg Lancaster, TPP
Janie Temple, TPP
John Ibarra, TPP
Mike Schofield, TPP

Research Supervisor

Chandra Bhat, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$150,000	Center for Transportation Research	$90,000
	Texas A&M Transportation Institute	$60,000

0-6760—Improved Trip Generation Data for Texas Using Workplace and Special Generator Surveys

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Travel estimates from models and manuals developed from trip attraction rates having high variances due to few survey observations can reduce confidence and accuracy in estimates. This project will utilize data from more than a decade of workplace and special generator travel surveys in Texas to develop a consistent set of attraction rates for small and medium-size Texas MPOs, to determine whether a generic attraction model can be used for different urban areas, and to establish an attraction rate manual for Texas that can be for modeling and local land development purposes. Analyses will be performed on a statewide basis where data from all of Texas' modeling areas are combined and on groupings of survey data where data from modeling areas have been compiled into small, medium, and large size areas. The analyses will identify similarities, differences, and trends in attraction rates and variances and evaluate them across area types, land use types, and employment types. The project will review and evaluate the structure of cross-classification attraction models, assess workplace survey design in Texas, the standardization of area types in Texas for modeling purposes, and how attraction rates and data are used in trip and activity based models.

Project Manager

Wade Odell, RTI

Project Advisors

Bruce Uphaus, TPP
Charlie Hall, TPP
James Burnett, TPP
Janie Temple, TPP
Mike Schofield, TPP

Research Supervisor

Edwin Hard, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$268,000	Center for Transportation Research	$51,456
	Texas A&M Transportation Institute	$77,184

0-6762—Maximizing Mitigation Benefits—Making a Difference with Strategic Inter-resource Agency Planning

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

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 will be 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 research project will identify implementable tools, practices, processes, stakeholders and decision points that can form the framework to begin a new approach to mitigation. This project intends to build upon previous national research efforts that have documented successful practices and provide TxDOT with its own framework for the future.

Project Manager

German Claros, RTI

Project Advisors

Andrew Blair, ENV
Dan Perge, DAL
Gretchen Stoeltje, OPE
Mark Fisher, ENV
Susan Shuffield, ENV

Research Supervisor

John Overman, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$293,882	Texas A&M Transportation Institute	$114,500
	University of North Texas	$29,853

0-6763—Accounting for Electric Vehicles in Air Quality Conformity

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Electric vehicles (EVs), including hybrid, plug-in hybrid and fully-electric or battery electric vehicles are becoming increasingly accessible to the general public, with many new and affordable models coming in to the market, and increased the availability of supporting infrastructure. It is therefore expected that EVs will have an increased share in the future vehicle fleet mix. The U.S. Environmental Protection Agency's (EPA) current mobile source emissions estimation model, MOtor Vehicle Emission Simulator (MOVES), does not adequately account for electric vehicles with regards to location-specific market penetration, driving characteristics, and emissions rates. However, MOVES provides for the flexibility to accurately incorporate these aspects. As the market share of EVs increases it becomes critical to have this estimation capability for emissions estimation and air quality conformity. The aim of this project is to provide TxDOT with a methodology and an application of incorporating EVs into MOVES emissions estimation relevant to Texas. This will be accomplished through the development of EV market penetration scenarios, Texas-specific drive schedules and emissions rates for EVs. These findings will be applied to develop a MOVES utility to incorporate the effect of increase EV market shares in Texas. The project will also include a detailed application in a major nonattainment area in Texas.

Project Manager

Wade Odell, RTI

Project Advisors

Bill Knowles, TPP
Laura Norton, TPP
Mollie Klenzendorf, TPP
Ron Hagquist, OPE

Research Supervisor

Josias (Joe) Zietsman, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$365,061	Texas A&M Transportation Institute	$165,806

0-6764—Contribution of Bridge Dwelling Birds to Bacterial Water Quality Impairments

Start Date: 09/12/2012 ***End Date:*** 11/30/2014

Abstract

Approximately 50,000 bridges exist in Texas and some can be occupied by large nesting colonies of Cliff Swallows. Significant amounts of feces from these colonies can contaminate water resources either directly or as runoff from shore line following precipitation. We will quantitatively determine bacterial loads (all bacteria, and Escherichia coli as indicator for fecal contamination) up- and downstream of bridges with Cliff Swallows colonies during dry weather and runoff conditions during two years. Sampling will coincide with periods when birds are not present, arriving, nestlings having hatched, and nestlings leaving, respectively, and thus represent times with no, little, medium and high release of feces from colonies in the environment. Additionally, source-tracking analyses that characterize E. coli strains up-and down-stream as well as in feces and quantify signature bacteria only present in bird feces will allow us to discern if bird feces are a contamination source. These methods will also allow feces load and microbe quantification in the water/soil samples. Microbial data will be contrasted with bird feces input estimates derived from nesting phenology and feces accumulation quantification. These variables will be analyzed to develop mathematical functions that describe their relationships.

Project Manager

Wade Odell, RTI

Project Advisors

John Bryant, SAT
Mark Fisher, ENV
Michael (Mike) Rhodes, WAC
Stirling Robertson, ENV

Research Supervisor

Ivan Castro-Arellano, TSUSM

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$390,014	Texas State University–San Marcos	$199,242

0-6766—A Generic Mode Choice Model Applicable for Small and Medium-Sized MPOs

Start Date: 11/1/2012 ***End Date:*** 12/31/2013

Abstract

Population growth projections show that the Texas population will significantly increase in the coming years. This trend, and the continued increase in total motorized vehicle miles traveled in the urban areas of Texas (and the associated congestion, air quality, and energy dependence problems), has led the Texas Department of Transportation (TxDOT) to examine multi-modal solutions to manage the growing auto travel demand. As part of this effort, TxDOT's Transportation Planning and Programming (TPP) Division is initiating another enhancement of their travel demand modeling system to be able to analyze alternative transportation modes (carpooling, public transportation, and bicycling/walk modes) and evaluate (and prioritize) multimodal projects at the regional level. Accordingly, the focus of this project is to develop an operational stand-alone generic mode choice model for Texas urban regions.

Project Manager

German Claros, RTI

Project Advisors

James Burnett, TPP
Gabriel Contreras, TPP
Greg Lancaster, TPP
George Petrek, TPP
Mike Schofield, TPP
Janie Temple, TPP

Research Supervisor

Chandra Bhat, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$100,000	Center for Transportation Research	$65,000

0-6767—Evaluation of Existing Smartphone Applications and Data Needs for Travel Surveys

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Current and reliable data on traffic movements play a key role in transportation planning, modeling, and air quality analysis. Traditional travel surveys conducted via paper-and-pencil or computer-aided are costly, time consuming, and labor intensive for survey conductors; and place significant burden to the survey participants. Furthermore the accuracy and completeness are susceptible to participants' after-fact memory. On the other hand, smartphones are an integral part of daily life for many people in the world today. According to the Pew Internet & American Life Project's survey, in May 2011, 83% of U.S. adults have a cell phone and 42% of them own a smartphone. Many people today interact with their cell phones constantly to some degree through checking messages or emails, playing games, and talking. Smartphone applications have a great potential to lower the costs, reduce the burden, and increase the accuracy and completeness of travel surveys.

The objective of this project is to evaluate existing smartphone applications for conducting travel surveys. Towards this objective, we will achieve four goals. The first goal is to compile a list of the pioneering smartphone travel survey efforts and lessons learned, compare them, and analyze their applicability to serve TxDOT survey needs. The second goal is to identify and install a list of smartphone travel survey applications to thoroughly evaluate and compare their capabilities. The third goal is to summarize and classify the data elements collected by TxDOT surveys and identify portion of the elements that are advantageous to be collected by smartphone applications. The fourth goal is to provide perspectives with supporting facts on the opportunities and challenges in fully realizing the potential of using smartphone applications for travel surveys.

Project Manager

Wade Odell, RTI

Project Advisors

Bruce Uphaus, TPP
Charlie Hall, TPP
David Cook, TPP
James Burnett, TPP
Kelli Reyna, FAO
Robert Williams, TPP

Research Supervisor

Yan Huang, UNT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$164,230	University of North Texas	$81,761

0-6768—Development of an Accessibility Formulation to Measure Customers' Evaluations of Demand Responsive Transit (DRT) Systems

Start Date: 11/1/2012 ***End Date:*** 08/31/2014

Abstract

Demand response transit (DRT) is a critical form of transportation for mobility-impaired, low income, elderly, and rural populations in Texas. There are 38 rural transit providers in Texas, and all of them contend with challenges specific to the characteristics of the area and the profile of their respective DRT markets. As populations in these rural communities age, or when elderly population from other areas move into these areas, the challenges will get amplified, potentially resulting in reduced mobility and stunted economic growth. In addition, the prevalence of multiple service providers with different agendas and jurisdictions further complicate the effective administration and optimization of DRT service. While the earlier DRT tool developed for the TxDOT-Public Transportation (TxDOT-PTN) Division helped in assessing the accessibility levels in a detailed manner, there are several limitations. The earlier tool could not handle multiple service providers, seasonal changes in demand patterns, different demand patterns and operating hours on different days of the week, and trips with one end outside the service area. Moreover, the models were estimated using data from only one DRT operating in Brownsville, Texas, and the models were applied using the dated 2000 Census data. In this project, we will classify the 38 DRT service providers into one of much fewer and distinct categories, and estimate models specific to each of these categories. The intent is that the existing DRT tool will be customized for each category, and then may be used by all DRT agencies within the category after modifications to fleet characteristics and demographic characteristics (but the behavioral model parameters embedded in the model will remain the same for agencies in each category). The tasks involved in this project include identifying participant transit providers, collecting and assembling available data, estimating new models of patron demand and scheduling, updating the existing DRT accessibility tool that can then be used for proactive DRT planning, conducting a DRT accessibility sensitivity analysis, and identifying final recommendations.

Project Manager

Wade Odell, RTI

Project Advisors

Bolivar Bolanos, PTN
Wanda Carter-Dyer, YKM
Lynn Castle, PTN
Karen Dunlap, PTN
Gretchen Stoeltje, OPE

Research Supervisor

Chandra Bhat, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$190,000	Center for Transportation Research	$95,000

RMC 4 Active Projects

Project	Title	Start Date	Page
0-6639	Testing of Alternative Support Materials for Portable Signs for Maintenance Work Zones	9/1/2010	71
0-6702	Development of Pedestrian Crash Countermeasures and Appropriate Crash Reduction Factors (CRF)	9/1/2011	72
0-6703	Prevention of Backing Fatalities in Construction Work Zones	9/1/2011	73
0-6704	Reduction of Motorists' Delay and Crash Potential Upstream of Highway Work Zones	9/1/2011	74
0-6705	Effectiveness of Performance Based Pavement Marking Maintenance Contracts	9/1/2011	75
0-6706	Design and Scope of Impact of Auxiliary Lanes	9/1/2011	76
0-6708	Traffic Control for Access Points within a Lane Closure on a Two-Lane, Two-Way Road	9/1/2011	77
0-6711	Short Radius MASH TL-3 Guardrail Treatment	9/1/2011	78
0-6712	Evaluation of Measures and the Development of a Plan to Reduce the Number and Mitigate the Severity of Crashes Involving Motorcyclists on Texas Highways	9/1/2011	79
0-6713	Quantitative Relationship between Safety and Reduced Roadway Condition Maintenance	9/1/2011	80
0-6714	Surface Treatments to Alleviate Crashes on Horizontal Curves	9/1/2011	81
0-6769	Wrong Way Driving Countermeasures	9/1/2012	82
0-6771	Development of Longitudinal Barriers for Use on High-Speed Roadways	9/1/2012	83
0-6772	Development of New Delineator Material/Impact Testing Standard to Prevent Premature Failures Specific to Installation Application	9/1/2012	84
0-6773	Warrants and Sunset Requirements for ITS Equipment Installations on Texas Highways	9/1/2012	85
0-6775	NTCIP-Based Traffic Signal Evaluation and Optimization Toolbox	10/22/2012	86
0-6781	Improved Nighttime Work Zone Channelization in Confined Urban Projects	9/1/2012	87

Project	Title	Start Date	Page
0-6782	Development of Design Standards for Mounting Temporary Large Guide Signs	9/1/2012	88
9-1001	Traffic Control Device Evaluation Program	9/1/2009	89
9-1002-12	Roadside Safety Device Crash Testing Program	9/1/2011	90

0-6639—Testing of Alternative Support Materials for Portable Signs for Maintenance Work Zones

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objectives: This research project will examine wind loading on portable roll-up signs, find alternative materials to support the flexible faces of these signs, and propose designs for portable roll-up signs on modified supports, if necessary.

Portable roll-up signs are currently used by the Texas Department of Transportation (TxDOT) for identification of short-term maintenance/work zones and emergency operations. These signs have fiberglass frames to directly support the diamond-shaped and rectangular flexible sign faces. It has been reported that the fiberglass frames have failed due to bending-even in breezes caused by passing vehicles. The cost of these failures is more than the marginal cost of replacing the broken frame members that directly support the sign face. It includes the safety cost to workers and the traveling public. Research studies to date on sign structures have focused on permanent signs with rigid faces. However, there has been little formal and in-depth research on wind loading on roll-up signs with flexible facing materials. This research project is proposed to address three major issues: (1) understanding of wind loading on portable roll-up signs, (2) finding alternative materials to support the flexible faces of these signs, and (3) proposing designs of portable roll-up signs on modified supports, if necessary. The results of this research project will be presented in the form of specifications that can be incorporated into TxDOT General Services Division Specification Number 801-60-66 - Sign Face, Roll-up, Reflective, Construction and Work Zone.

Project Manager

Wade Odell, RTI

Project Advisors

Charlie Wicker, TRF
Jacen Lemons, CHS
James Combes, LBB
Johnnie Miller, CST
Lewis Nowlin, SJT
Martin Kalinowski, HOU
Ted Moore, LBB

Research Supervisor

Sangwook Bae, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$508,663	Center for Multidisciplinary Research in Transportation	$96,834
	Texas A&M Transportation Institute	$99,074

0-6702—Development of Pedestrian Crash Countermeasures and Appropriate Crash Reduction Factors (CRF)

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objectives: The objectives of this project are to:

- Identify characteristics of pedestrian crashes in Texas;
- Identify potential safety treatments or combinations of treatments that reduce pedestrian fatalities and injuries;
- Evaluate selected pedestrian treatments; and
- Document findings so that the information can be used by TxDOT in selecting appropriate pedestrian treatments.

This TxDOT project is to assist the state with identifying characteristics of Texas pedestrian crashes and appropriate countermeasures to address those crashes. For Texas, the average number of pedestrian fatalities for the past five years is about 400 per year. Texas is considered by FHWA to be an "opportunity" state due to the high number of pedestrian crashes. This project can assist TxDOT with making decisions regarding pedestrian treatments. It will also provide a better understanding of the characteristics of crashes associated with pedestrians. Tasks within the proposed project include reviewing the literature, understanding the Texas environment, determining Texas pedestrian crash characteristics, identifying the best approach for evaluating pedestrian countermeasures, conducting evaluation of selected countermeasures, and documenting the findings from the research.

Project Manager

Wade Odell, RTI

Project Advisors

Amanda Martinez, TRF
Christopher Lindsey, DES
Debra Vermillion, TRF
Scott Cunningham, AUS
Steve Higgins, BRY

Research Supervisor

Kay Fitzpatrick, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$323,033	Texas A&M Transportation Institute	$168,150

0-6703—Prevention of Backing Fatalities in Construction Work Zones

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to review current practices and procedures to prevent backing fatalities and test commercially available systems for prevention of backing fatalities. An educational module will be developed to consist of a set of guidelines demonstrating how to implement the recommended commercially systems for prevention of backing fatalities in construction work zones.

Construction, repair and maintenance work zones are always hazardous environments especially because of the dangerous combinations of pedestrian workers and large trucks, bulldozers, rollers and other moving machinery. Between 70 and 80 pedestrian construction workers are struck or killed each by construction vehicles within a work zone. From 1995 to 2002, 844 worker deaths occurred in roadway work zones, i.e. over 100 deaths annually. 91% of these deaths were related to motor vehicle traffic or construction equipment, or both. The American Road & Transportation Builders Association (ARTBA) named run-overs and back-overs as the leading cause of death for roadway construction workers, with over half occurring when workers were struck by construction vehicles or equipment inside the work zone. This study will seek to review current practices and procedures to prevent backing fatalities, identify and analyze appropriate responses, and test commercially available systems for prevention of backing fatalities, and provide worker training modules. This study will propose recommendations for TxDOT traffic control practices, incorporating commercially available systems for prevention of backing fatalities.

Project Manager

Wade Odell, RTI

Project Advisors

Daniel Bly, PAR
Samuel Salazar, OCC
Tom Hunter, LFK
Connie Flickinger, BRY

Research Supervisor

Wei Fan, UTTYL

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$296,864	Center for Transportation Research	$76,761
	University of Texas at Tyler	$76,942

0-6704—Reduction of Motorists' Delay and Crash Potential Upstream of Highway Work Zones

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this research is to identify the appropriate lane control treatments for intermediate-and long-term highway lane closures due to work zones.

Lane closures due to highway work zones introduce many challenges to the goal of ensuring smooth traffic operations and a safe environment for drivers and workers. In addition, merging has been found to be one of the most stressful aspects of driving and a merge process that is viewed as "unfair" (e.g., due to queue-jumping) can lead to further unsafe behaviors stemming from "road rage." To address these issues, the work in this project will focus on lane control solutions for intermediate and long-term highway work zones. Tasks included in this project are i) evaluate innovative lane control measures such as fixed cycle signals and continuous merge signals; ii) collect and analyze observational data at workzones; iii) use mesoscopic dynamic traffic assignment modeling to estimate the diversion rate; iv) input the vehicle flow output from the mesoscopic model into a microscopic model to evaluate driver behavior; v) input the vehicle trajectories from the microscopic model into a safety analysis model for predicting conflict rates; vi) develop a decision tree to guide TxDOT towards the appropriate lane control measure in each potential scenario; and vii) present the results in a pilot training workshop and final report.

Project Manager

Wade Odell, RTI

Project Advisors

Brian Burk, AUS
Dustin Wiggins, TRF
Flor Tamez, TRF
Greg Malatek, AUS
Will Lockett, BRY

Research Supervisor

Randy Machemehl, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$215,184	Center for Transportation Research	$83,836
	Texas Southern University	$18,025

0-6705—Effectiveness of Performance Based Pavement Marking Maintenance Contracts

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objectives: The objectives of this research are to gather information to evaluate the effectiveness of Performance Based Pavement Marking Maintenance Contracts (PBPMMCs). Some of the questions this research intends to answer are:

- What is the delivered pavement marking performance resulting from PBPMMCs?
- What is the safety performance of roadways under PBPMMCs?
- What are the potential cost savings ofPBPMMCs?
- What performance measures and measurement protocols are most suitable for inclusion in PBPMMCs?
- When and where should PBPMMCs be used?

Pavement markings play a vital role in the safe and efficient movement of traffic on the Texas Department of Transportation's (TxDOT's) roadways. In 2010, the Federal Highway Administration (FHWA) started rulemaking to adopt minimum pavement marking retroreflectivity levels. These minimum levels will require that pavement markings of adequate visibility are present on the nation's roadways. Performance-based pavement marking maintenance contracts (PBPMMC) are one of the latest mechanisms used to maintain adequate pavement marking performance and to share the risk of maintaining minimum performance levels. TxDOT has issued two PBPMMCs, but the effectiveness of these contracts as compared to other contracting mechanisms (annual district-wide, warranty, or hybrid contracts) from a risk management, cost, performance, or safety perspective has not been evaluated.

This project will gather information to evaluate the effectiveness of PBPMMCs by addressing the following objectives:

- What is the delivered pavement marking performance resulting from PBPMMCs?
- What is the safety performance of roadways under PBPMMCs?
- What are the potential cost savings of PBPMMCs?
- What performance measures and measurement protocols are most suitable for inclusion in PBPMMCs?
- When and where should PBPMMCs be used?

Project Manager

Wade Odell, RTI

Project Advisors

Brian Stanford, TRF
David Valdez, TRF
Justin Obinna, MNT
Michael Fowler, AMA
Tony Moran, WAC
Judith Friesenhahn, SAT

Research Supervisor

Adam Pike, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$256,935	Texas A&M Transportation Institute	$129,803

0-6706—Design and Scope of Impact of Auxiliary Lanes

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this research is to develop guidelines on the design of freeway auxiliary lanes and provide methods for assessing the impacts of such design solutions.

While auxiliary lanes are widely used in urban freeway interchanges throughout Texas, broader understanding is necessary of the design and impacts of auxiliary lanes, and their role in access-controlled facility function and operations. The goal of this project is to define the conditions under which auxiliary lanes are implemented in design and rehabilitation projects, and to investigate the impacts of auxiliary lanes in a broad scope. To this end, the research will: (1) review and synthesize state-of-the-art/practice, (2) survey transportation engineers, (3) examine the operational impacts of the auxiliary lanes at both segment level and corridor level, (4) suggest performance measures that can effectively measure the impacts of auxiliary lanes, (5) synthesize best practices on the use of auxiliary lanes, and (6) develop implementation-oriented guidelines on the design and use of auxiliary lanes.

Project Manager

Wade Odell, RTI

Project Advisors

Cynthia Flores, TRF
Cynthia Landez, DES
Jane Lundquist, DES
Kevin Dickey, WAC
Richard Harper, PAR

Research Supervisor

Yi (Grace) Qi, TSU

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$251,213	Texas Southern University	$95,982
	University of Texas at El Paso	$26,868

0-6708—Traffic Control for Access Points within a Lane Closure on a Two-Lane, Two-Way Road

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objectives: The objectives of this research project are to identify and evaluate traffic control technologies and strategies that could be used to control traffic entering from access points, and develop guidelines regarding the appropriate traffic control for access points within a lane closure on a two-lane, two-way road.

When a lane is closed on a two-lane, two-way road provisions must be made to alternate one-way movement of the two original travel lanes through the work area using methods such as flagger control or portable traffic signals. However, quite often there are access points (such as residential or business driveways and county roads) within the one-lane section of roadway. There is the potential for drivers entering the roadway from these access points to misunderstand the direction of traffic, enter the roadway going in the wrong direction, and collide with a vehicle travelling through the work zone. While these access points should be monitored, flagger control or portable traffic signals are not always feasible based on conditions such as work duration, traffic volume, time of day, and cost of the method. Research is needed to identify and evaluate traffic control technologies and strategies that could be used to control traffic entering the one-lane section from access points.

Project Manager

Wade Odell, RTI

Project Advisors

Charlie Wicker, TRF
Kit Black, AMA
Michael Chacon, TRF
Randall (Randy) Bowers, FTW
Will Lockett, BRY

Research Supervisor

Melisa Finley, TTI

The technical objectives of the proposed research project are to:

- identify and evaluate traffic control technologies and strategies that could be used to control traffic entering from access points and
- develop guidelines regarding the appropriate traffic control for access points within a lane closure on a two-lane, two-way road.

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$297,911	Texas A&M Transportation Institute	$156,377

0-6711—Short Radius MASH TL-3 Guardrail Treatment

Start Date: 09/01/2011 ***End Date:*** 11/30/2013

Abstract

Objectives: The objectives of this research project are to develop a short radius guardrail design that is MASH TL-3 compliant to be used by TxDOT on roadways at intersections with restrictive features.

When a road intersects a highway with restrictive features, such as bridge rail or culvert, it is difficult to fit the proper guardrail length along the primary roadway. Site constraints, such as private driveways and county roads may intersect the primary road and not allow the placement of a properly designed guardrail. In these cases, the alternatives are to shorten the guardrail length, provide a curved guardrail design, or relocate the site constraint.

Although numerous tests have been conducted for different short radius guardrail designs, none of them passed National Cooperative Highway Research Program (NCHRP) Report 350 TL-3 requirements. The crash testing guidelines have been updated to the Manual for Assessing Safety Hardware (MASH) standards, which increases the impact severity for TL-3 tests. Satisfying such impact severity will be more challenging for the short radius systems.

The objective of this project is to develop a MASH TL-3 compliant short radius design for TxDOT. Conceptual designs will be developed and rated for their potential impact performance and cost-effectiveness. The candidate designs will then be evaluated through detailed computer simulations. The analysis results will be used to recommend a design for full-scale crash testing. A final design will be developed based on the testing.

Project Manager

Wade Odell, RTI

Project Advisors

A. Rory Meza, DES
Christopher Lindsey, DES
Cynthia Landez, DES
Don Miller, WAC

Research Supervisor

Akram Abu-Odeh, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$625,776	Texas A&M Transportation Institute	$360,990

0-6712—Evaluation of Measures and the Development of a Plan to Reduce the Number and Mitigate the Severity of Crashes Involving Motorcyclists on Texas Highways

Start Date: 09/01/2011 ***End Date:*** 02/28/2013

Abstract

Objectives: The objective of this project is to develop a broad-based plan that includes countermeasures and outreach activities to prevent and/or mitigate motorcycle crashes and associated injuries and fatalities in Texas.

According to data from the TxDOT Crash Records Information System (CRIS), motorcycle fatalities fell by 19% – from 531 in 2008 to 432 in 2009. This is extremely good news considering that motorcycle deaths increased by 31% from 2007 to 2008 (CRIS, 2010) Although too early to determine, declines have been attributed to less motorcycle travel due to the economy, fewer beginning motorcyclists, and increased motorcycle safety and awareness among drivers and riders. While optimistic that these downward trends will continue, when compared to all traffic fatalities, the percentage of motorcycle deaths is still significant, representing 14 percent of Texas' motor vehicle fatalities, compared to 15 percent in 2008 (CRIS, 2010). While the overall decline in rider deaths is encouraging, nearly 1 in 7 people killed on our roadways last year were riding a motorcycle.

Project Manager

Wade Odell, RTI

Project Advisors

Debra Vermillion, TRF
Frank Phillips, LBB
James Bailey, WAC
Josh Verastique, TRF
Lloyd Wolf, BRG
Maurice Maness, BRY
Michael Jedlicka, BRY
Nicholas Nemec, BRG
Shirley Ashbrook, TRF
Victor Vargas, AUS
Will Bozeman, AUS

Research Supervisor

Patricia (Patty) Turner, TTI

The principal goal of this project is to develop a broad-based plan that includes countermeasures and outreach activities to prevent and/or mitigate motorcycle crashes and associated injuries and fatalities in Texas. The plan will ultimately aid in the reduction of motorcycle crashes, fatalities and injuries on Texas roadways and provide a baseline from which the districts and TxDOT can effectively measure and track implemented countermeasures and programs, and, if necessary, make changes.

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$184,305	Texas A&M Transportation Institute	$63,205

0-6713—Quantitative Relationship between Safety and Reduced Roadway Condition Maintenance

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this research is to develop a relationship between skid resistance and accidents on Texas highways.

TxDOT is responsible for maintaining over 192,000 lane miles of highways. With an increase in material costs and a decrease in revenue, TxDOT will not be able to maintain roadways at previous levels with the current funding allocations. Not performing these types of treatments in a timely manner not only compromises the pavement's structural integrity, but it can also have a negative impact on safety. Since asphalt pavements are more susceptible to surface distresses such as cracking, raveling, rutting, and loss of skid resistance and make up the vast majority of TxDOT's roadway network, it is important to understand the long term impact of reduced maintenance funding. Extending the time interval between routine and preventive maintenance treatments can have a negative impact on the pavement's skid resistance. This can translate into an increase in wet surface related crashes also known as road departure accidents and an overall decrease in safety. Having fewer maintenance dollars to invest makes the project selection criteria a top priority. Understanding the relationship between skid resistance and accidents will allow TxDOT's pavement engineers to maintain highways with an acceptable level of skid resistance even under reduced program funding.

Project Manager

Wade Odell, RTI

Project Advisors

Debra Vermillion, TRF
Mark Shafer, BRY
Rebecca Wells, ATL
Scot Reaves, WFS
Terry Paholek, BRY

Research Supervisor

Zhanmin Zhang, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$273,894	Center for Transportation Research	$138,814

0-6714—Surface Treatments to Alleviate Crashes on Horizontal Curves

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objectives of this research are to determine contributing factors to run-off-the-road crashes at horizontal curves, identify appropriate surface treatments to alleviate crashes, conduct field analysis to determine operational benefits of surface treatments, and develop guidance regarding the application of surface treatments and other traffic control devices at horizontal curves.

The primary objective of this project is to improve safety for motorists through the identification of appropriate usage of surface treatments at horizontal curves. Researchers believe that the application of such treatments at appropriate horizontal curve locations throughout the state will result in better driver performance and thereby reduce the number of crashes experienced at horizontal curves. The project will contain tasks that:

- Identify the current state-of-the-practice with regard to high-friction surface treatments;
- A crash analysis of horizontal curve characteristics factoring into run-off-the-road crashes;
- Evaluation of current high-friction surface treatments available; and
- Field studies of surface treatment installations at horizontal curves.

Project Manager

Wade Odell, RTI

Project Advisors

Bill Orr, DES
Darren McDaniel, TRF
Ellen Perry, PAR
Robert Lee, CST
Victor Vargas, AUS

Research Supervisor

Michael Pratt, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$318,598	Texas A&M Transportation Institute	$169,998

0-6769—Wrong Way Driving Countermeasures

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Municipal police departments in major urban areas in Texas are alerted to hundreds of wrongway driving events each year. The vast majority of these events (60 to 70 percent or more) that result in crashes are known to involve a driver who was impaired. The severity of wrong-way crashes is a major concern given the likelihood of a head-on crash, and historical data from Texas show that half of wrong-way crashes result in a fatality or incapacitating injury. While standard and innovative countermeasures are available, it is not clear what methods are most successful at getting the attention of wrong-way drivers and conveying to them that they are going the wrong direction on a freeway ramp or the main lanes. Guidance on where to deploy wrong-way countermeasures is also needed. The objectives of this research are to:

- Evaluate the effectiveness of wrong-way driving countermeasures.
- Develop recommendations regarding the implementation of wrong-way driving countermeasures.

Project Manager

Wade Odell, RTI

Project Advisors

Brian Fariello, SAT
John Gaynor, HOU
John Gianotti, SAT
Martin Gonzalez, WFS
Michael Chacon, TRF
Omar Madrid, ELP
Rick Cortez, DAL
Roy Parikh, FTW
Ted Clay, BMT

Research Supervisor

Melisa Finley, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$321,889	Texas A&M Transportation Institute	$180,977

0-6771—Development of Longitudinal Barriers for Use on High-Speed Roadways

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

The 82nd Texas Legislature amended Section 545.353 of the Transportation Code by adding Subsection (h-2), which permits speed limits up to 85 miles per hour on parts of the state highway system. An 85 mph speed limit can be posted if an engineering and traffic investigation determines that the speed limit is reasonable and safe for that part of the highway system. Longitudinal barriers (e.g., guardrails, median barriers, bridge rails) are currently tested and evaluated at a design impact speed of 62 mph. For economic reasons, many existing barrier systems are optimized for the current design impact conditions and have little or no factor of safety for accommodating more severe impacts. New or modified barrier designs may be required to maintain the desired level of safety for motorists traveling on high-speed sections of highway. Under TxDOT research project 0-5544, recommended design impact speeds for high design speed roadways were derived and can be used in this project. The scope of the project includes consideration of longitudinal barrier systems. Other devices such as crash cushions and guardrail end terminals are proprietary in nature and the upgrading of these systems for use on high-speed roadways can be accomplished by their respective manufacturers.

Project Manager

Wade Odell, RTI

Project Advisors

A. Rory Meza, DES
Gregg Granato, SAT
John Holt, BRG
Taya Retterer, BRG
Vincent Parker, DES

Research Supervisor

Roger Bligh, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$500,715	Texas A&M Transportation Institute	$219,061

0-6772—Development of New Delineator Material/Impact Testing Standard to Prevent Premature Failures Specific to Installation Application

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Delineators have become popular across the state of Texas and are being used in several different applications with unique impact conditions and/or impact frequency. Currently, TxDOT selects products based primarily on cost and only requires that delineators survive up to 10 impacts regardless of application. This testing requirement is effective in preventing some failures; however, it does not adequately evaluate the resilience of delineator used in high-durability impact applications, low speed angled impacts or heavy vehicle impacts. These applications have different impact conditions, impact frequency, and durability requirements. Some states such as Florida have moved to a specification that addresses different use conditions. While Florida has maintained the 10 impact standard for normal delineation, they have also instituted a high durability testing requirement (50 impacts) for instances such as lane separation on high speed roadways. However, the Florida specification does not address the impact conditions in Houston and left turn restrictions. By developing a categorical testing specification, delineator products can be better evaluated for each use application. This enhanced evaluation will lead to the proper selection of the best delineator for a certain application. By pairing delineators with their proper application, one would expect a reduction of delineator failures and therefore reduction in long-term maintenance costs.

Project Manager

Wade Odell, RTI

Project Advisors

Arturo Perez, CST
John Gianotti, SAT
Johnnie Miller, CST
Michael Chacon, TRF
Robert Ornelas, ODA

Research Supervisor

Dusty Arrington, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$171,133	Texas A&M Transportation Institute	$107,362

0-6773—Warrants and Sunset Requirements for ITS Equipment Installations on Texas Highways

Start Date: 09/01/2012 ***End Date:*** 08/31/2013

Abstract

Over the past several decades, the Texas Department of Transportation (TxDOT) has made a significant investment in deploying and developing intelligent transportation systems (ITS) devices, such as closed-circuit television (CCTV), traffic sensors, and dynamic message signs (DMS), to assist in managing traffic operations. However, as these systems matured and as financial resources have become more constrained, TxDOT needs to become more strategic in their decision-making as to when and where to deploy new ITS devices and systems, and when and where to continue supporting and/or upgrading systems that have met their life expectancy. The goal of this project is to develop guidelines, criteria, and procedures to assist TxDOT in their decision-making specific to installing, repairing, and/or removing ITS field devices and systems. Specifically, this project will assist TxDOT by 1) developing warrant conditions and criteria for assessing when and where to install new ITS devices and systems, 2) providing sunset requirements and criteria for determining when to no longer support deployed ITS devices and systems, and 3) developing an analytical framework for identifying and prioritizing mission-critical devices and systems for upgrade and maintenance.

Project Manager

Wade Odell, RTI

Project Advisors

Bradley Miller, WAC
Gordon Harkey, BWD
Jianming Ma, TRF
Rebecca Wells, ATL

Research Supervisor

Kevin Balke, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$132,377	Texas A&M Transportation Institute	$132,377

0-6775 — NTCIP-Based Traffic Signal Evaluation and Optimization Toolbox

Start Date: 10/22/2012 ***End Date:*** 08/31/2014

Abstract

A recent National Transportation Operations Coalition report gave a grade of "D" to the health of the nation's existing traffic signal systems. The report cited lack of resources as a major cause of this state and identified a need to increase investments to enable operating agencies to employ more proactive management and maintenance practices. Like most departments dealing with traffic signal operations and maintenance, various TxDOT districts lack staff and tools needed to keep the health of their systems at the desirable level and need cost-effective means to accomplish this job. This project has been initiated by TxDOT to leverage National Transportation Communications for ITS Protocol (NTCIP) communications standard to automate the process of managing and maintaining traffic signal control systems.

The specific objective is to develop and field-test a toolbox that uses NTCIP communications protocols and object definitions for online assessment of signal performance at intersections and diamond interchanges and for automating the transfer of outputs from popular signal timing optimization programs to traffic controllers. By using NTCIP standards as the basis, the toolbox will not be limited by, or reliant on, proprietary features of controllers and any special communications drivers. In addition, it will be applicable to all brands/types of controllers meeting NTCIP specifications.

Reliable, recurring traffic signal timing optimization is one of the key components in maintaining highway level of service (the efficiency and speed we move traffic from origin to destination). It is also a key component in preventing or mitigating both congestion and excessive pollution emissions. Studies have been done on the efficacy of signal timing in reducing congestion, reducing pollution, and maintaining acceptable levels of service. This research is for the next step—providing TxDOT technicians with tools needed to optimize signal timing consistently in the real world.

Project Manager

Wade Odell, RTI

Project Advisors

John Benes, TRF
Steve Chiu, HOU
Ted Clay, BMT
Mark Johnson, TRF
Derryl Skinnell, TRF
Rebecca Wells, ATL

Research Supervisor

Nadeem Chaudhary, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$272,000	Texas A&M Transportation Institute	$134,500

0-6781—Improved Nighttime Work Zone Channelization in Confined Urban Projects

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

Confined or dense urban work zones present challenges to drivers to identify the locations of key decision points – such as driveways, intersections, and lane shifts – so that they maneuver their vehicle safely and efficiently. This task becomes even more difficult during nighttime conditions when visual cues may be masked in the dark. This is a concern because without the ability to identify these key decision points, the overall mobility and safety of the traffic stream is compromised due to erratic behaviors by drivers such as stopping in a travel lane or making a sharp turn without proper turn signal indications. There is no standardized channelizing variation at this time that is used to provide better positive guidance at these decision points. This project will identify alternative strategies for the design and placement of channelizing devices at decision points such as driveways or intersections, evaluate these strategies in controlled and field conditions, and develop guidance for the effective use of channelizing devices at these points. This will be achieved through the following project tasks:

- Identify potential strategies for improving positive guidance through a critical review of current and experimental practices.
- Run a closed course strategy evaluation involving a human factors study.
- Conduct a field study evaluation of priority strategies including human factors eye-tracking evaluation and operational studies.
- Develop guidance documents for manuals and traffic control plan sheets.

Project Manager

Wade Odell, RTI

Project Advisors

Andy Bollman, TYL
Derryk Blasig, TRF
Gary Tarter, TRF
Jennifer Mascheck, BRY
Joseph Marchione, TRF
Paul Kieke, SAT
Tracy Cooper, AUS

Research Supervisor

LuAnn Theiss, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$281,734	Texas A&M Transportation Institute	$129,993

0-6782—Development of Design Standards for Mounting Temporary Large Guide Signs

Start Date: 09/01/2012 ***End Date:*** 08/31/2014

Abstract

It is a common occurrence to temporarily relocate large roadside guide signs as part of highway construction projects. Existing aluminum signs may need to be temporarily relocated (many of these may be larger than 100 square feet) or new guide signs may need to be fabricated for temporary use (could be plywood or aluminum substrate). Since these installations may need to be moved multiple times during a construction project, it is impractical to remove existing foundations and install new concrete foundations each time a sign needs to be moved. There is also a need to locate large signs on a hard surface, such as asphalt or concrete.

Wood supports are often used for temporary applications. FHWA letter HNG-14/SS-25 states that signs may be supported by various size wood posts in single and dual support configurations. Dual configurations are only approved if the supports are placed 7 or more feet apart. This requirement can significantly restrict the permissible sign configurations.

New temporary sign support standards for signs up to 128 square feet need to be developed that meet *MASH* requirements. *MASH* requires up to three full scale crash tests to fully evaluate the crashworthiness of a sign support structure.

Project Manager

Wade Odell, RTI

Project Advisors

Carlos Ibarra, ATL
Doug Skowronek, TRF
Felicia (Roxanne) Cortez, DAL
Gary Tarter, TRF
Guillermo (Willie) Dougherty, LRD
Jeremy Dearing, LBB
Jesus Leal, PHR

Research Supervisor

Roger Bligh, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$334,938	Texas A&M Transportation Institute	$185,280

***9-1001*—Traffic Control Device Evaluation Program**

Start Date: 09/01/2009 ***End Date:*** 08/31/2013

Abstract

Objective: This project will provide the Texas Department of Transportation a mechanism to quickly and effectively conduct high priority limited scope evaluations of traffic control devices (TCD). The information provided through the project will support the development of TCD related policy, standards, guidelines, handbooks, and training.

The traffic control device issues to be evaluated in this project may represent a new device or technology, a new application of an existing device or technology, or a change in TxDOT practices regarding a traffic control device. The research efforts of this project are specifically oriented to provide results that will lead directly to implementation of results.

Project Manager

Wade Odell, RTI

Project Advisors

Arturo Perez, CST
Carlos Ibarra, ATL
Ismael Soto, CRP
John Gianotti, SAT
Johnnie Miller, CST
Michael Chacon, TRF
Ricardo (Rick) Castaneda, SAT
Roy Wright, ABL
Sylvester Onwas, HOU

Research Supervisor

Paul Carlson, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$800,000	Texas A&M Transportation Institute	$200,000

9-1002-12—Roadside Safety Device Crash Testing Program

Start Date: 09/01/2011 ***End Date:*** 08/31/2014

Abstract

Objective: The objective of this research is to identify roadside safety issues and address them through a series of safety evaluations for the benefit of the motoring public.

This project provides TxDOT with a mechanism to quickly and effectively evaluate high priority issues related to roadside safety devices. Roadside safety devices shield motorists from roadside hazards such as non-traversable terrain and fixed objects. To maintain the desired level of safety for the motoring public, these safety devices must be designed to accommodate a variety of site conditions, placement locations, and a changing vehicle fleet. As changes are made or in-service problems encountered, there is a need to assess the compliance of existing safety devices with current vehicle testing criteria and, if problems are identified, to modify the device or develop a new device with enhanced performance and maintenance characteristics.

Under this project, roadside safety issues will be identified and prioritized for investigation. The selected safety issues will be evaluated through crash data analyses, engineering analyses, computer simulation, dynamic impact testing, and full-scale vehicular crash testing as appropriate. Factors such as impact performance, maintenance, and cost will be considered. Each roadside safety issue will be addressed with a separate work plan, and the results will be summarized in an individual technical memorandum. Each technical memorandum will include new guidelines or drawings to be incorporated into design manuals and new or revised standard detail sheets, as appropriate.

Project Manager

Wade Odell, RTI

Project Advisors

A. Rory Meza, DES
Chris Hehr, DES
Duane Browning, BMT
John Holt, BRG
Jon Ries, BRG
Michael Chacon, TRF
Vincent Parker, DES

Research Supervisor

Roger Bligh, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$1,500,000	Texas A&M Transportation Institute	$500,000

RMC 5 Active Projects

Project	Title	Start Date	Page
0-4562	Corrosion Resistance of Grouted Post-tensioning Systems	9/1/2002	93
0-5722	Lap Splice and Development Length Performance in ASR and/or DEF Damaged Concrete Elements	9/1/2006	94
0-5997	Structural Assessment of "D" Region Affected by Premature Concrete Deterioration	9/1/2007	95
0-6564	Improved Cross Frame Details	9/1/2009	96
0-6603	Long-Term Performance of Drilled Shaft Retaining Walls	9/1/2009	97
0-6649	Development of Design Guidelines and Mitigation Strategies for Wind-Induced Traffic Signal Structure Vibrations	9/1/2010	98
0-6651	Continuous Prestressed Concrete Girder Bridges	9/1/2010	99
0-6652	Spliced Texas Girder Bridges	9/1/2010	100
0-6654	Empirical Flow Parameter Distributions—A Tool for Hydraulic Model Validity Assessment	9/1/2010	101
0-6656	ASR Testing: A New Approach to Aggregate Classification and Mix Design Verification	9/1/2010	102
0-6715	Interaction between Drilled Shafts and Mechanically Stabilized Earth (MSE) Walls	9/1/2011	103
0-6716	Design Parameters and Methodology for Mechanically Stabilized Earth (MSE) Walls	9/1/2011	104
0-6717	Investigation of Alternative Supplementary Cementing Materials (SCMs)	9/1/2011	105
0-6718	Strength of Horizontal Shear Reinforcement with Limited Development	9/1/2011	106
0-6719	Strengthening Continuous Steel Girders with Post-installed Shear Connectors	9/1/2011	107
0-6720	Shear Behavior of Thin Prestressed Slab Beams in Bridges	9/1/2011	108
0-6722	Spread Prestressed Concrete Slab Beams	9/1/2011	109
0-6723	Development of Rapid, Cement-Based Repair Materials for Transportation Structures	9/1/2011	110
0-6724	Assessment of the Effects of Regional Channel Stability and Sediment Transport on Roadway Hydraulics Structures	9/1/2011	111

Project	Title	Start Date	Page
0-6731	Repair Systems for Deteriorated Bridge Piles	9/1/2011	112
0-6783	Bi-directional Application of Carbon Fiber Reinforced Polymer (CFRP) with CFRP Anchors for Shear-Strengthening and Design Recommendations/Quality Control Procedures for CFRP Anchors	9/1/2012	113
0-6784	Creep Behavior of Soil Nail Walls in High Plasticity Index (PI) Soils	9/12/2012	114
0-6785	Extending Use of Elastomeric Bearings to Higher Demand Applications	9/1/2012	115
0-6786	Live Load Effects of Railroads on Retaining Walls and Temporary Shoring	9/12/2012	116
0-6788	Reliability Based Deep Foundation Design Using Texas Cone Penetrometer (TCP) Test	9/12/2012	117
0-6789	Automated Crack Documentation Using Digital Images—Scoping Study	9/1/2012	118
0-6792	Synthesis on Geosynthetic-Reinforced Steep Slopes	9/1/2012	119

0-4562—Corrosion Resistance of Grouted Post-tensioning Systems

Start Date: 09/01/2002 ***End Date:*** 08/31/2013

Abstract

Objective: This project will identify and develop recommendations for implementation of alternate corrosion-resistant post-tensioning systems.

Numerous examples of corrosion in post-tensioning systems and failures of tendons have been observed in Europe and the United States in recent years. Examples have been cited recently in some of Florida's major bridges. The cause of corrosion and accelerated deterioration of post tensioning systems can be traced to several sources, including: incomplete flushing of water prior to the grouting process, incomplete grouting of post-tensioning tendons, excessive bleed water, leaky precast joints, cracking of polyethylene pipe, and poor post-tensioning system details that permit recharge of tendons, to list a few. The proposed first phase of this project will identify oils or other products that will provide temporary corrosion protection in post-tensioned tendons which have not yet been stressed and grouted during the construction process. This first phase of the research will investigate how these oils affect friction losses during post-tensioning, determine the impact that emulsifiable oils have on bond strength of multi-strand tendons, and examine how flexural capacity is affected by the expected loss in bond strength. The second phase of the project will identify post-tensioning systems and materials candidates for alternate corrosion-resistant post-tensioning systems, examine physical and mechanical properties of new materials, identify and evaluate potential accelerated corrosion test methods, plan and implement a series of tests to examine the durability of post-tensioning materials and systems, consider the constructability and behavior of post-tensioning systems incorporating corrosion-resistant materials or details identified through durability testing, and develop recommendations for implementation of alternate corrosion-resistant post-tensioning systems.

Project Manager

German Claros, RTI

Project Advisors

Brian Merrill, BRG
Keith Ramsey, BRG
Paul Virmani, FHWA

Research Supervisor

John Breen, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$1,170,144	Center for Transportation Research	$80,000

0-5722—Lap Splice and Development Length Performance in ASR and/or DEF Damaged Concrete Elements

Start Date: 09/01/2006 ***End Date:*** 08/31/2014

Abstract

Objective: This research will assess the influence of ASR/DEF on bond.

Bridge structures in Texas are exhibiting damage from alkali silica reactions (ASR) and delayed ettringite formation (DEF). Significant work has been performed on evaluating the mechanisms of deterioration and methods to slow or stop these mechanisms. However, limited work has been performed to evaluate the implications of this damage on the performance of a structure exhibiting these deteriorating mechanisms. Some work has been performed on bending and shear of reinforced concrete structural members exhibiting damage from ASR and/or DEF. However, very limited work has been performed to assess the influence of ASR and/or DEF on the bond, development length, and lap length. Existing structures encounter significant forces at several locations where bond is critical to the structure performance. Cracking resulting from ASR or DEF can reduce this bond and development length. The research proposed herein is to perform a comprehensive, statistically valid research program that will assess the influence of ASR/DEF on bond. The study will generate sufficient data such that visual inspections can be correlated with structural reliability, and will evaluate various repair strategies such that recommendations can be made when there is a future potential for bond failure.

Project Manager

Wade Odell, RTI

Project Advisors

Keith Ramsey, BRG
Ricardo Gonzalez, FTW
Robert Owens, FTW

Research Supervisor

Carl (Gene) Buth, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$1,277,512	Texas A&M Transportation Institute	$14,891

0-5997—Structural Assessment of "D" Region Affected by Premature Concrete Deterioration

Start Date: 09/01/2007 ***End Date:*** 08/31/2014

Abstract

Objective: The objective of project is to develop guidelines for applying strut-and-tie models to large structural elements subject to varying conditions of premature concrete deterioration.

Recent TxDOT studies (0-1857,0-4069, and 0-5218) have developed techniques for evaluating the extent of structural damage to concrete elements with premature concrete deterioration and for delaying or mitigating such damage. In addition, TxDOT study 0-5722 is developing similar techniques for evaluating the bond performance of critical column splice sections affected by premature concrete deterioration. TxDOT studies 0-4371 and 0-5253 have provided insight into the use of strut-and-tie modeling and results indicate reassurance with respect to many reinforced and prestressed concrete elements commonly used by TxDOT. However, much less assurance exists with respect to large structural elements that are affected by premature concrete deterioration, such as the bents of the San Antonio "Y" (such as Bents H19C and I5C). The safety of such structures can be evaluated using strut-and-tie models suggested either by the configuration of existing cracks, or by the configuration of cracks that form during destructive testing. However, few reliable guidelines currently exist for such evaluations and strut-and-tie provisions of AASHTO LRFD Specifications are based on sound concrete. While premature concrete deterioration reduces the elastic modulus and tensile strength of concrete much more than the compressive strength, it is not clear if these reductions will impact the ultimate strength of such large elements as computed by strut-and-tie modeling and if modification factors can be used to accurately predict their ultimate strength. Using a combination of strut-and-tie modeling and large-scale physical testing, the objective of the proposed work is to develop guidelines for applying strut-and-tie models to large structural elements subject to varying conditions of premature concrete deterioration.

Project Manager

Wade Odell, RTI

Project Advisors

Dean Van Landuyt, BRG
Jon Kilgore, SAT
Yuan Zhao, BRG

Research Supervisor

John Mander, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$926,349	Texas A&M Transportation Institute	$14,850

0-6564—Improved Cross Frame Details

Start Date: 09/01/2009 ***End Date:*** 08/31/2013

Abstract

Objective: The research consists of designing and developing improved details for cross frame systems.

The critical stage for the stability of straight and curved steel I-girder systems generally occurs during placement of the concrete bridge deck. The capacity of the girders is improved by incorporating bracing in the form of cross-frames that restrain twist of the girders. The cutting, fitting, and welding of the cross frame members are very labor intensive. Cross frames are the most expensive component per unit weight on the steel bridge and a significant component of the final cost of the superstructure. Conventional cross frames are usually fabricated using two diagonals and two horizontal struts. The cross frames are typically fabricated from steel angles for the diagonals and either angles, WT, or W-sections for the horizontal struts. The angles are connected along one leg producing eccentric connections that cause bending of the angle and relatively poor structural behavior because of their low bending stiffness. In addition, connection requirements for the intersecting diagonals and top and bottom struts typically necessitate turning over the cross frame during fabrication. Torsional deformations in the girders often result in a tension diagonal and a compression diagonal of the cross frame; however because of the relatively low buckling strength of angles, traditional cross frames are normally designed by conservatively neglecting the compression diagonal thereby relying on a "tension-only" diagonal system cross frame. Better structural behavior and a significant reduction in the handling requirements may be possible if tubular members are used for the cross frame. Since tubular members have a substantial buckling strength, cross frames with a single diagonal member are possible, resulting in fewer connections and a reduction in the handling requirements for the braces. Tubular members will lead to better structural behavior since the connection can be made concentric with the centroid of the symmetric tubular member. The difficulty in utilizing the tubular members is developing a practical connection method for the tubes that is simple and reliable.

The use of tubular sections can lead to significant improvement in the structural behavior and ease of fabrication of these critical bracing elements. The team's extensive experience will be used to aide in identifying the range of stability design forces that frequently occur in Texas steel bridges. These forces will be used to standardize the tubular member sizes required for stability considerations. A three-year study is proposed. Researchers will work with casting manufacturers to develop a practical yet effective connection design and conduct laboratory and computational studies to evaluate the performance of the cross frame system. The use of the improved cross frame details for bracing applications in straight and curved girders will be evaluated and design methodologies will be developed and verified.

Project Manager

Wade Odell, RTI

Project Advisors

Dacio Marin, BRG
Estanislado Ybarra, BRG
Jamie Griffin, BRG
Michelle Romage-Chambers, BRG
Teresa Michalk, CST
Yuan Zhao, BRG

Research Supervisor

Todd Helwig, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$611,685	Center for Transportation Research	$159,773

***0-6603*—Long-Term Performance of Drilled Shaft Retaining Walls**

Start Date: 09/01/2009 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to provide TxDOT with guidance for the design of drilled shaft retaining walls in expansive clay soils.

The range of assumptions being used today in design practice when dealing with expansive clay soils produces more than factor of two differences in the maximum bending moment in the shaft, which could lead to either excessively costly walls or under-designed walls. The guidance produced from this project will include the following:

1. Design recommendations for the distribution of lateral earth pressures for drilled shaft retaining walls in expansive clay soils, including the magnitude of the earth pressures and the shape of the distribution with depth above and below the cantilever.
2. Design recommendations for how to consider the effects of time and moisture cycles in expansive clay soils on the distribution of lateral earth pressures.
3. Guidelines on how to analyze these walls using software such as LPILE, including assumptions for p-y curves in the foundation soil.

The work plan will involve instrumenting a full-scale drilled shaft retaining wall constructed in an expansive clay soil and monitoring its performance over three years. The wall will be instrumented with Optical Strain Gauges, which are the state-of-the-art in measuring strains in drilled shafts, particularly over a long time duration. These optical strain gauges are not susceptible to zero drift in electronics, to moisture and to changes in temperature, making them far superior to conventional gauges that measure electrical resistance. Inclinometers will be used to measure the deflected shape of the shaft versus time. We will also continuously monitor the moisture content of the soil behind the wall at different depths below the ground surface.

The strain gauge and inclinometer data will be analyzed to estimate the lateral earth pressures applied by the retained soil as a function of depth below the ground surface and time. This analysis will be conducted with LPILE, the state-of-the-art in modeling soil-structure interaction for drilled shaft retaining walls.

In addition to the instrumented wall, we also propose to assess existing drilled shaft retaining walls constructed by TxDOT in expansive clay soils. This assessment will include determining their design basis and documenting available performance information.

An External Advisory Panel of distinguished practicing engineers has been assembled to ensure that the information and design guidance produced from this project are relevant and practical.

Project Manager

Wade Odell, RTI

Project Advisors

Dina Dewane, BRG
Eliza Paul, HOU
John Delphia, BRG
Mark Sturrock, TYL
Steve Beard, BRG

Research Supervisor

Robert Gilbert, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$731,754	Center for Transportation Research	$149,721

0-6649—Development of Design Guidelines and Mitigation Strategies for Wind-Induced Traffic Signal Structure Vibrations

Start Date: 09/01/2010 ***End Date:*** 08/31/2014

Abstract

Objectives: The research project will develop guidelines for the design, fabrication, and implementation of traffic signal structures, such as limitations on placement and sizes of items placed on signal pole arms, and develop mitigation strategies for reducing or eliminating wind induced vibrations.

It has now been well-documented that mast-arm type structural supports for traffic signals can exhibit large-amplitude vibrations under wind excitation. Such vibrations can result in reduced fatigue life of the arm to pole shaft connection, and are believed to be the cause of many failures of traffic signal structures that have been reported in the state of Texas as well as in other states within the US. Extensive research has been conducted to study the causes of the vibrations and to develop corresponding mitigation strategies. To this date, however, the excitation mechanisms and the vibration characteristics are yet to be fully understood, and countermeasures that are both effective and efficient remain to be successfully developed.

The objectives of this research project are: (1) to further understand the mechanisms of traffic signal structure vibrations and to develop analytical models that enable statistically assessing the failure risk of Texas standard traffic signal structures; (2) to develop guidelines for the design, fabrication, and implementation of traffic signal structures , such as limitations on placement and sizes of items placed on signal pole arms; and 3) to develop mitigation strategies for reducing or eliminating wind induced vibrations.

We will conduct four phases of study to achieve the prescribed objectives. In phase I, we will conduct full-scale field measurements of representative traffic signal structures and wind tunnel tests of sectional models to further understand the excitation mechanisms and the vibration characteristics. In phase II, we will develop analytical models based on understandings from phase I for predicting wind-induced vibration characteristics and estimating fatigue loads of traffic signal structures of various configurations. In phase III, we will develop statistical methodologies for assessment of failure risk by integrating structure-specific vibration characteristics and fatigue capacity with site-specific wind climate data. In phase IV, we will use the combination of analytical simulation and full-scale measurements to develop guidelines for design, fabrication, and implementation of traffic signal structures, as well as to develop, test, and optimize mitigation devices for reducing or eliminating wind-induced vibrations of support structures for traffic signals.

Project Manager

Wade Odell, RTI

Project Advisors

Jim Yang, BRG
Karl Janak, CST
Mark Johnson, TRF
Michael Smith, CST
Tim Bradberry, BRG

Research Supervisor

Delong Zuo, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$506,600	Center for Multidisciplinary Research in Transportation	$128,892

0-6651—Continuous Prestressed Concrete Girder Bridges

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: This project will review, evaluate, and recommend details for the design of durable and constructible connections that achieve structural continuity between specific precast, prestressed concrete girder sections.

Aesthetic and economic demands often result in the need for longer spans, fewer columns and minimal bent cap cross sections in bridges. Urban areas often require long-span bridges to cross over major roadways. Although prestressed bridges constructed to have continuous spans have been in service for many years in a number of states, there has been limited verification of the ability of the connection to provide the predicted continuity. As a result, some states, including Texas, design the girders as simple spans for both dead load and live load, neglecting any moment resistance of the connection.

The objectives of this project are to review, evaluate, and recommend details for the design of durable and constructible connections that achieve structural continuity between the specific precast, prestressed concrete girder sections that are used in Texas with a goal of longer span-to-depth ratios and greater economy. This will include consideration of continuity for deck weight, superimposed dead load, and live load. Alternatives include cast-in-place connections between girders over the piers and the use of inflection point and other in-span splices. Other promising approaches will also be investigated. Specifications and continuity details will be recommended, along with evaluation of proposed details through experimental testing.

Project Manager

German Claros, RTI

Project Advisors

Dacio Marin, BRG
Geoffrey (Shane) Cunningham, TYL
John Holt, BRG
Kevin Pruski, BRG
Michael Hyzak, BRG
Thomas Stout, BRG

Research Supervisor

Mary Beth Hueste, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$716,551	Texas A&M Transportation Institute	$276,329

0-6652—Spliced Texas Girder Bridges

Start Date: 09/01/2010 ***End Date:*** 08/31/2014

Abstract

Objective: The findings from this study will be used to support the development of design specifications and standards for spliced girder construction within the State of Texas.

The recent introduction of the TX girder series has sparked tremendous interest in low-cost spliced girder technology within the State of Texas. In anticipation of TxDOT's full-scale implementation efforts, this project will resolve two outstanding issues related to the strength and serviceability of spliced TX girder bridges:

- Shear Performance of Post-Tensioned TX Girders: Large-scale shear tests will provide results relating to the shear performance of TX Girders with post-tensioning ducts. The effects of the duct diameter to web width ratio, duct material, and grout consolidation will be examined. A complementary panel-testing effort will provide a basis for comparison to the current design code approach.
- Detailing of Cast-in-Place Splices: A comprehensive literature review and industry survey will provide an understanding of the design and construction considerations unique to cast-in-place girder splices. Following a review of successful past practices, the best splice details will be evaluated experimentally through splice region testing. Large-scale testing will ensure that conditions necessary for safe efficient force transfer in field-spliced structures are simulated in the laboratory.

Project Manager

German Claros, RTI

Project Advisors

Greg Turco, BRG
Jason Tucker, CST
Leon Flournoy, BRG
Michael Hyzak, BRG

Research Supervisor

Oguzhan Bayrak, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$999,923	Center for Transportation Research	$249,913

0-6654—Empirical Flow Parameter Distributions—A Tool for Hydraulic Model Validity Assessment

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: This research will develop an independent way to assess computed velocities (of streamflow measurements) based on prior, authoritative, observational experience.

Water-surface profile modeling assembles models based on generalizations of parameter values from textbooks, professional literature, computer program documentation, and from engineering experience. Stage-discharge relations or measurements of streamflow at or adjacent to the modeling locale are seldom available for use in refining model parameters. In streamflow measurement at least three components are important; depth, width, and velocity. At field scale depth and width are straightforward but the velocity measurement is a significant contributor to overall uncertainty, complicated because a mean section velocity (as reported in a model) requires a spatial integration of the measured velocity field. As a result, modeling efforts by even experienced engineers are assembled and often judged to be valid based entirely on experiences from earlier modeling efforts for hydraulically similar settings.

This situation often leads engineers in good faith to report velocities (needed for assessing forces on bridge piers, and assessing erosion and scour potential) that are unusually large and in some instances absurd.

The results of this research will permit an engineer to rapidly evaluate or review modeling efforts and determine if the modeled results are comparatively common or unusual, with the explicit caveat that unusual results could very well be reliable, but that additional explanation should be expended in these unusual situations. The results of this research (graphs and statistical distributions) will additionally provide an assessment of modeling risk that could be used to balance the cost of additional modeling with the cost of accepting an unusual result for design.

Project Manager

Wade Odell, RTI

Project Advisors

Amy Ronnfeldt, DES
Jaime Villena-Morales, RSC-WEST
John Delphia, BRG
Jorge Millan, DES
Matthew Wingfield, SJT
Stan Hopfe, AUS

Research Supervisor

Theodore Cleveland, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$519,485	Center for Multidisciplinary Research in Transportation	$46,131
	United States Geological Survey	$38,000
	University of Houston	$14,429
	University of Texas at San Antonio	$35,196

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

Start Date: 09/01/2010 ***End Date:*** 08/31/2013

Abstract

Objective: The main objective of this study is to develop a fast, reliable test method to determine aggregate alkali silica reactivity (ASR) with respect to the overall alkalinity of the concrete.

A volumetric expansion measurement device (VEMD) developed at Texas A&M Transportation Institute will aid in this research. The VMED simulates the aggregate-pore solution reaction in concrete and measures free ASR volume expansion over time. This test uses as-received aggregates and occurs over a short period of time (4 days). The expansion-time trend is modeled to determine the rate constant. The rate constants at multiple temperatures are then used to determine activation energy (Ea) based on rate theory. Researchers will determine the Ea of a large number of aggregates and develop an Ea-based aggregate classification system. A relationship between Ea and alkalinity will be developed and will be the basis to determine reactivity at field level of alkalinity and threshold alkalinity. The proposed fast, reliable test method could be used as a replacement for ASTM C 1567 and improve the protection provided under option 8 of item 421. An effective way of tailoring mix design depending on the level of protection needed will be developed based on threshold alkalinity and concrete pore-solution chemistry.

Project Manager

German Claros, RTI

Project Advisors

Andy Naranjo, CST
Brian Merrill, BRG
Edward Morgan, CST
Elizabeth (Lisa) Lukefahr, CST
Jason Dupree, ATL
Ryan Barborak, CST

Research Supervisor

Anol Mukhopadhyay, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$433,823	Texas A&M Transportation Institute	$146,937

0-6715—Interaction between Drilled Shafts and Mechanically Stabilized Earth (MSE) Walls

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to study the interaction between drilled shafts and MSE walls and propose design guidelines.

Due to space constraints, drilled shafts supporting superstructures are often constructed within MSE walls. The interaction between the drilled shafts and the MSE wall is not well known and not typically incorporated in the design.

The objective of this project is to investigate this interaction and propose design guidelines. To do so, a field study of 3 sites and a series of numerical simulations will be performed. The field study will consist of instrumenting two TxDOT sites identified by TxDOT where the movements and pressures will be monitored. The third site will be the National Geotechnical Experimentation Site at Texas A&M University where two drilled shafts and an MSE wall will be built and instrumented and brought to failure.

The numerical model will be calibrated against the large scale experiment. Then, simulations will extend the investigation to situations not covered by the field study. The parametric studies include cases where the drilled shafts affect the wall and vice versa. The load on the drilled shaft and the earth pressures to be resisted by the MSE wall will be quantify for each case.

Based on the results of the field study and of the numerical simulations, design guidelines will be proposed.

Project Manager

German Claros, RTI

Project Advisors

Bryan Esmaili-Doki, PAR
Dina Dewane, BRG
John Delphia, BRG
Marcus Galvan, BRG
Michael Steward, ELP
Sean Yoon, BRG
Taya Retterer, BRG

Research Supervisor

Jean-Louis Briaud, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$314,699	Texas A&M Transportation Institute	$95,955
	University of Texas at San Antonio	$54,650

0-6716—Design Parameters and Methodology for Mechanically Stabilized Earth (MSE) Walls

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to develop recommendations for the update and modification of current TxDOT design parameters and methodologies for mechanically stabilized earth (MSE) walls, and construction practice.

Since its appearance in 1970s, MSE walls have become a majority among all types of retaining walls due to their economics and satisfactory performance. TxDOT has primarily adopted the guidelines published by FHWA and AASHTO for design of MSE walls. However, TxDOT engineers have expressed concerns about both design assumptions and methodology, including soil parameter selection, required factor of safety (FOS), and possible failure modes. Some of the concerns relate to the deviations of TxDOT practice from FHWA/AASHTO guidelines, while others relate to intrinsic assumptions of the guideline. Validation of the assumptions and design methods are needed now since these uncertainties may lead catastrophic failure. This project will examine the assumptions and the analysis methods based on: data collected from TxDOT and other projects, laboratory testing, statistical analyses, back analyses of the historical data, and numerical simulations. The main assumptions to be examined include material parameters used for TxDOT backfills, minimum reinforcement length, and the FOS required for external stability. To validate the MSE walls design method, the bearing capacity analysis method will be evaluated for its rationality and adequacy. The possible modes for compound failure will be checked and an improved method for compound failure analysis will be recommended.

Project Manager

German Claros, RTI

Project Advisors

Dina Dewane, BRG
John Delphia, BRG
Jon Kilgore, SAT
Marcus Galvan, BRG
Sean Yoon, BRG

Research Supervisor

Charles Aubeny, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$227,436	Texas A&M Transportation Institute	$77,397
	University of Texas at San Antonio	$37,721

0-6717—Investigation of Alternative Supplementary Cementing Materials (SCMs)

Start Date: 09/01/2011 ***End Date:*** 08/31/2014

Abstract

Objective: This project will identify, screen, and thoroughly test alternative sources of SCMs for use in Texas concrete.

Supplementary cementing materials (SCMs) provide many benefits to concrete mixtures in terms of cost, long-term strength, and durability. Fly ash is the most widely used SCM in Texas. However, the dependence in Texas on fly ash for improving concrete performance is risky because the future availability of this material is questioned. Therefore, it is imperative to identify, screen, and thoroughly test alternative sources of SCMs for use in Texas concrete. There are many potential sources of alternative SCMs in Texas, including natural materials such as zeolites, diatomaceous earth, and calcined clays, and waste materials such as agricultural waste ashes and spent fluid cracking catalysts. In order to implement these materials into concrete mixtures, they must be thoroughly characterized and their performance in concrete mixtures thoroughly tested. The work aims to (1) identify all low cost, high availability sources of SCMs in Texas, (2) chemically and physically characterize them, (3) rapidly screen them for reactivity and performance, (4) determine optimum dosage amounts based on workability, reactivity/strength, and durability, and (5) test their performance in concrete mixtures. Particular attention will be paid to areas where SCMs traditionally have excellent or poor performance, including setting time, workability, early and long-term strength, drying shrinkage, and resistance to alkali silica reaction and sulfate attack. Because many of the lowest cost and most available materials that possess some pozzolanic reactivity may not meet current ASTM C618 Class N specifications, methods for enhancing their performance will be explored to enable their successful use. Further, because the performance of these materials may be different in concrete mixtures than currently used SCMs, guidelines for incorporating them into concrete mixture designs will be suggested.

Project Manager

German Claros, RTI

Project Advisors

Andy Naranjo, CST
Courtney Holle, BRG
Darlene Goehl, BRY
Kevin Pruski, BRG
Robert Owens, FTW
Terry Paholek, BRY

Research Supervisor

Maria Juenger, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$495,000	Center for Transportation Research	$183,000

0-6718—Strength of Horizontal Shear Reinforcement with Limited Development

Start Date: 09/01/2011 ***End Date:*** 08/31/2014

Abstract

The objective of this project is to determine if adequate horizontal shear capacity is provided by the 5-inch concrete deck on slab and box beams, despite lack of reinforcement development. Horizontal cracks between the precast beams and the cast-in-place decks were noticed in several TxDOT bridges. Those cracks could be due to stresses induced by shrinkage or shear forces. In any case, this shows that that current TxDOT details might not provide sufficient horizontal shear resistance in those members.

The work plan is to first conduct small scale tests to investigate the three major components of horizontal shear resistance: (1) cohesion and/or aggregate interlock, (2) friction between the crack faces, and (3) dowel action of the reinforcement. A simple bar pullout test will also be used to evaluate the influence of the bend curvature on the bond and slip characteristics of the horizontal shear reinforcement. Alternative details for surface roughness and bar geometries will be investigated. The second phase of this research will be testing several full-scale composite box and slab beams with current and proposed alternative details to investigate the overall composite behaviors that may be overlooked in the small scale tests.

Project Manager

German Claros, RTI

Project Advisors

Amy Smith, BRG
Andrea Keller, BRG
Geetha Chandar, BRG
Nicholas Nemec, BRG
Peter Ross, HOU

Research Supervisor

Shih-Ho Chao, UTA

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$413,142	University of Texas at Arlington	$148,492

0-6719—Strengthening Continuous Steel Girders with Post-installed Shear Connectors

Start Date: 09/01/2011 ***End Date:*** 08/31/2015

Abstract

Objective: The objective of this research is to identify ways to economically strengthen older continuous steel girder bridges using post installed shear connectors.

A number of older bridges in Texas are constructed with floor systems consisting of a noncomposite concrete slab over steel girders. A potentially economical means of strengthening these floor systems is to connect the existing concrete slab and steel girders to permit the development of composite action. TxDOT Research Project 0-4124, completed in 2007, developed methods to strengthen existing non-composite steel girder bridges in positive moment regions by post-installing shear connectors, permitting substantial increases in load ratings. This project will extend the concepts developed in Project 0-4124 to permit the use of post-installed shear connectors to strengthen continuous multi-span non-composite bridges with inadequate capacity in negative moment regions. The project will investigate two strengthening approaches. The first approach will be to install shear connectors in negative moment regions to increase negative moment capacity through composite action. The second approach will be to install shear connectors in positive moment regions and allow redistribution of moments from negative to the strengthened positive moment regions. These approaches will be investigated through a comprehensive series of experimental, analytical, and computational studies, with the ultimate goal of providing practical guidelines for economical strengthening of older continuous steel girder bridges.

Project Manager

German Claros, RTI

Project Advisors

Dingyi Yang, BRG
Jamie Farris, BRG
Leon Flournoy, BRG
Manuel Padron, FTW
Michelle Romage-Chambers, BRG
Paul Rollins, BRG
Yuan Zhao, BRG

Research Supervisor

Michael Engelhardt, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$854,454	Center for Transportation Research	$229,074

0-6720—Shear Behavior of Thin Prestressed Slab Beams in Bridges

Start Date: 09/01/2011 ***End Date:*** 08/31/2014

Abstract

Objective: The objective of this project is to develop shear design provisions for thin prestressed slab beams.

A precast prestressed concrete (PPC) slab beam has been recognized as a good alternative to a fully cast-in-place (CIP) reinforced concrete (RC) slab beam in terms of constructability, cost-effectiveness, structural performance, and maintenance. Accordingly, TxDOT plans to add an 8 in. thick PPC slab beam up to 30 ft. long to its current 12 in. and 15 in. thick PPC slab beams spanning from 25 ft. to 50 ft. for creek crossing, especially on off-system roadways. There is concern whether the shear provision in current AASHTO LRFD code is cost-effective and safe for one-way PPC slab beams. This research project will conduct the experimental and analytical investigation on the one-way shear behavior of PPC slab beams with respect to; i) shear span-to-depth (a/d) ratio, ii) shear reinforcement (none/minimum per code/reduced), iii) concrete strength (normal/high), iv) alternate shear reinforcement (welded wire reinforcement), and v) effect of bearing pad (punching shear). Shear provisions of existing design codes, especially AASHTO LRFD code, will be reevaluated through the experimental approach. Detailed analysis will be carried out to support the experimental observation and enhance the weak archival data encompassing unconsidered parameters. Finally, a rational shear design method will be established for the one-way PPC slab beams.

Project Manager

Wade Odell, RTI

Project Advisors

Michael Carlson, HOU
Thomas Stout, BRG
Victoria McCammon, BRG
Yongqian Lin, HOU

Research Supervisor

Yi-Lung Mo, UH

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$448,781	University of Houston	$149,744

0-6722—Spread Prestressed Concrete Slab Beams

Start Date: 09/01/2011 ***End Date:*** 08/31/2014

Abstract

Objective: The objective of this project is to explore the use of slab beams that are spread apart.

TxDOT uses prestressed slab beam bridges for shorter spans, such as stream crossings. These bridges have precast, pretensioned slab beams placed immediately adjacent to one another with a cast-in-place slab made composite with the beams. While these bridges are used extensively, they are more expensive than traditional prestressed I-beam and I-girder structures on a per square foot basis. This modified bridge type could significantly reduce the cost of shorter span bridges, while being easily mass produced, transported and constructed.

The project objectives will be met through a series of tasks. The research team will review the literature and the current state-of-the-practice, and develop preliminary designs to assess the potential of this system. Laboratory and field testing will provide important information on the in-service and ultimate performance of the spread slab beam system. In addition, the AASHTO LRFD approximate live load distribution factors for spread box beams will be reviewed for their applicability to spread slab beams, and new factors will be developed, if appropriate. Finally, the research team will develop design guidelines and examples, along with the final project reports.

Project Manager

German Claros, RTI

Project Advisors

Jefferey Tomkins, BRG
John Holt, BRG
Manuel Padron, FTW
Mark Steves, BRG
Rex Costley, PHR
Tommy Abrego, BRG

Research Supervisor

Mary Beth Hueste, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$509,890	Texas A&M Transportation Institute	$182,863

0-6723—Development of Rapid, Cement-Based Repair Materials for Transportation Structures

Start Date: 09/01/2011 ***End Date:*** 08/31/2014

Abstract

Objective: The focus of this research is to evaluate potential approaches (materials, mixture proportions, placement techniques, etc.) and to provide recommendations on the most efficient, economical, and durable repair materials and methodologies.

The state of Texas has been plagued by various durability-related issues in recent years, including deterioration from alkali-silica reaction (ASR), delayed ettringite formation (DEF), corrosion of reinforcing steel, and volume changes (plastic shrinkage, drying shrinkage, thermal effects, etc.), just to name a few. These durability-related issues, coupled with other factors that contribute to reductions in service life (e.g., service loads, defects, etc.), have resulted in the need to repair concrete structures and to do so in a timely, efficient fashion, with minimal disruption to the traveling public. Thus, the need for rapid, cement-based repair materials has emerged, especially in highly-congested urban areas. The focus of this proposed research is to evaluate potential approaches (materials, mixture proportions, placement techniques, etc.) and to provide recommendations on the most efficient, economical, and durable repair materials and methodologies. This project involves a comprehensive laboratory-based program, as well as a significant field component, and the research team will evaluate the key technical characteristics that govern rapid and durable repairs, especially for horizontal applications (e.g., full- or partial-depth bridge deck repairs). A wide range of materials will be evaluated in this project, and key data on fresh, hardened and durability properties will be generated.

Project Manager

German Claros, RTI

Project Advisors

Bryan Esmaili-Doki, PAR
Graham Bettis, BRG
Kevin Pruski, BRG
Leon Flournoy, BRG
Ryan Barborak, CST

Research Supervisor

Kevin Folliard, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$493,500	Center for Transportation Research	$163,000

0-6724—Assessment of the Effects of Regional Channel Stability and Sediment Transport on Roadway Hydraulics Structures

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

Objective: The objective of this project is to develop analysis procedures for assessing regional channel stability and design guidelines for hydraulic structures that interface with streams.

Water and sediment regimes in rivers evolve all the time. As a result, no stream channel is absolutely stable. Channels evolve at various speeds both vertically (degradation/aggradation) and horizontally (planform migration). They also respond to man-made changes ranging from instream modifications (such as bridges) to watershed changes (such as land use change and urbanization). Design of roadway hydraulic structures should consider their dynamic coupling with the river channels at various geomorphic scales (from local to regional). However, the current practice of using HEC-RAS in TxDOT to calculate local scour around hydraulic structures does not fully consider the effects of regional channel stabilities. The lengthy Federal Highway Administration (FHWA) guidelines on steam instabilities (e.g., HEC-11, 18, 20, and 23 series) are not consulted unless risks are apparent. This project will conduct a comprehensive investigation of the subject and synthesize findings from literature review, survey of existing models, and field observations. Effective analysis procedures and guidelines will be proposed for the design of roadway hydraulic structures in unstable channels in Texas. The results will permit an engineer to rapidly determine whether the regional geomorphic change in a channel could result in reduced safety and how engineering enhancement should be sought.

Project Manager

Wade Odell, RTI

Project Advisors

Amy Ronnfeldt, DES
Chuck Steed, CHS
Daniel Richardson, ABL
Jorge Millan, DES
Kathleen Newton, BMT
Matthew Wingfield, SJT

Research Supervisor

Xiaofeng Liu, UTSA

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$248,247	Texas A&M Transportation Institute	$40,000
	University of Houston	$19,905
	University of Texas at San Antonio	$64,984

0-6731—Repair Systems for Deteriorated Bridge Piles

Start Date: 09/01/2011 ***End Date:*** 10/31/2014

Abstract

Objective: The objective of this research is to develop a durable repair system for deteriorated steel bridge piles that can be implemented without the need for dewatering.

The objective of the proposed research project is to develop a durable repair system for deteriorated steel bridge piles that can be implemented without the need for dewatering. A rigorous survey of the relevant practice nationwide will be conducted to inform and direct the remaining research efforts. The current state-of-practice will be critically reviewed and the most promising alternatives will be identified for detailed investigation. The structural performance, constructability, and economy of the existing systems will be considered. A simplified but reliable framework for assessing the condition of deteriorated piles will be developed. The proposed framework will be used to direct the full-scale testing of artificially deteriorated and repaired piles. Accelerated environmental exposure tests will also be conducted to evaluate the durability of the different repair systems. The results of the full-scale tests and the environmental durability tests will be used to direct a life-cycle cost analysis to identify the most economical repair systems based on initial costs, life-cycle costs, agency costs, and user costs. To evaluate the performance of the repair systems in 'real' applications, field testing and long-term monitoring will be conducted at two bridge sites. Based on the research findings, guidelines for the design, construction, and maintenance of the proposed systems will be developed to facilitate transfer of the technology to TxDOT bridge maintenance operations. The successful completion of the proposed research project is expected to lead to the development of a new method and guidelines for repair of steel bridge piles which will significantly enhance the safety and economy of existing bridge infrastructure throughout the state.

Project Manager

Wade Odell, RTI

Project Advisors

Bernie Holder, PAR
Dingyi Yang, BRG
Greg Timmons, FTW
Leon Flournoy, BRG
Nicasio Lozano, DAL
Rex Costley, PHR

Research Supervisor

Mina Dawood, UH

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$457,548	Center for Multidisciplinary Research in Transportation	$61,657
	University of Houston	$90,232

***0-6783*—Bi-directional Application of Carbon Fiber Reinforced Polymer (CFRP) with CFRP Anchors for Shear-Strengthening and Design Recommendations/Quality Control Procedures for CFRP Anchors**

Start Date: 09/01/2012 ***End Date:*** 12/31/2015

Abstract

The objective of the study is to demonstrate the feasibility of using bi-directional CFRP for shear strengthening of large bridge I and U-beams. This project is an outgrowth of project 0-6306 in which it was demonstrated that uni-directional CFRP strips and CFRP anchors could be used to improve the shear strength of reinforced concrete elements. The prime objective of that study was to evaluate the role of CFRP anchors. The tests showed that without anchors, the CFRP strips debonded and there was no significant improvement in the shear capacity. With CFRP anchors, it was possible to achieve a 40-50% increase in shear capacity. Tests of four 54-in. deep I-beams with both uni-directional and bi-directional CFRP strips indicated that the use of bidirectional strips led to significantly greater increases in shear capacity. It would not have been possible to strengthen the I-beams without the use of anchors to prevent debonding of the CFRP at reentrant corners of the cross section. Because the data on the bi-directional layout of CFRP was limited, additional work is needed to understand the behavior of the CFRP in strengthening thin webs subjected to large shear forces.

Project Manager

Wade Odell, RTI

Project Advisors

Leon Flournoy, BRG
Manuel (Bernie) Carrasco, BRG
Nicholas Horiszny, HOU
Victoria McCammon, BRG

Research Supervisor

James Jirsa, CTR

Since the anchor installation is a key element of the strengthening technique, there is a need for quality control procedures to make sure that the materials are used properly and the installation meets the design requirements. At present there are no quality control procedures available for CFRP anchors.

The objectives of the research include the following items:

- Identify parameters that influence the shear strength provided by the bi-directional application of CFRP strips with CFRP anchors.
- Determine the extent of I-beam and U-beam benefits from bi-directional CFRP shear strengthening with CFRP anchors.
- Provide design guidelines for shear strengthening using bi-directional application of CFRP strips with CFRP anchors.
- Provide engineers with design guidelines for CFRP anchors (e.g. embedment depth, spacing, and configuration pattern).
- Provide construction procedures that detail installation of CFRP anchors.
- Determine minimum material properties which will enable the anchor to fully develop the strength of the CFRP material.
- Develop in-situ anchor testing methodology for quality control of installation.

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$995,026	Center for Transportation Research	$313,658

0-6784—Creep Behavior of Soil Nail Walls in High Plasticity Index (PI) Soils

Start Date: 09/12/2012 ***End Date:*** 08/31/2014

Abstract

The objective of this project is to investigate the creep behavior of soil nail walls in high-plasticity clays. Creep behavior depends mainly on load level. Field investigation, laboratory tests and numerical modeling will be used to study the effect of the load level on creep behavior of soil nails. Field studies will comprise: loading tests at National Geotechnical Experimental Site (NGES); and monitoring an actual soil nail wall to be selected by TxDOT. The tests at NGES will focus on creep behavior of soil nails in a natural clay deposit. It will comprise four soil nails to be installed; and around 10 existing tendons (installed in 1991). An actual soil nail wall (ideally in an embankment fill) will be tested and monitored for a long term. Laboratory tests will complement the information gathered from the field. Numerical models (based on limit state analysis and finite element method) will be calibrated with the information gathered from the experimental sites. Those models will be used to study in more details the behavior of soil nails in high plasticity clays. This will be done by simulating different field and operation conditions. Design guidelines for soil nail wall in high-plasticity clays will be prepared.

Project Manager

Wade Odell, RTI

Project Advisors

John Delphia, BRG
Karen Hicks, FTW
Marcus Galvan, BRG

Research Supervisor

Marcelo Sanchez, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$281,030	Texas A&M Transportation Institute	$188,013

0-6785—Extending Use of Elastomeric Bearings to Higher Demand Applications

Start Date: 09/01/2012 ***End Date:*** 08/31/2015

Abstract

Steel girders are often used in Texas for moderate- to long-span bridge applications that usually include skewed supports and/or horizontally curved geometry. The long spans coupled with potential support skew and curved geometry result in significant demands on the bearings at the supports to accommodate rotations and complex bridge movements from both thermal loads and daily truck traffic. Expensive pot bearings are commonly used in steel bridge applications. However, past studies sponsored by TxDOT (Study 0-5040) have shown that these expensive bearings do not perform well with regard to accommodating bridge translations. Pot bearings accommodate longitudinal and transverse movements by allowing the girder to slide relative to the bearing. Sliding bearings usually incorporate polytetrafluoroethylene (PTFE —i.e., Teflon) to reduce the frictional resistance; however, significant force is often still required to overcome the static friction at the bearing. As a result, pier flexure is often the primary mechanism that accommodates bridge translations. The elastomeric bearing pads that are routinely used in concrete bridge systems generally provide a much more reliable means of accommodating translations and the pads are significantly cheaper than pot bearings. Previous studies sponsored by TxDOT and the National Cooperative Highway Research Program (NCHRP) focused on the behavior of elastomeric bearing pads. These studies have resulted in a well-defined design procedure for elastomeric bearings. However, the studies have focused primarily on bearing pads for use in short-to-moderate span systems. The typical steel I-girder or tub girder systems used in Texas bridges have larger vertical reactions and more significant translational and rotational demands than intended by the previous research studies on elastomeric bearings. Although in recent years, TxDOT has successfully used elastomeric pads in steel bridge applications, no full size tests on the large bearings have been conducted to demonstrate the ability of the bearings to satisfy the long-term performance requirements. In the absence of these tests, it is not clear if manufacturers have the ability to consistently produce bearings for high demand applications. The bearings are an important structural element that accommodates the necessary movements from thermal and traffic loading, and poor performance can lead to long-term problems that may shorten the life of the bridge. The research outlined in this project consists of laboratory testing, field monitoring, and parametric computational modeling that will provide the supporting data so that elastomeric bearings can be confidently used in the wide range of bridge applications throughout the state of Texas. The use of elastomeric bearings in steel bridge applications will result in systems that are easier to fabricate, erect, and maintain while also improving the long-term bridge behavior.

Project Manager

German Claros, RTI

Project Advisors

Greg Turco, BRG
Jeff Cotham, BRG
Karl Janak, CST
Paul Cepak, WAC
Tim Bradberry, BRG
Yongqian Lin, HOU

Research Supervisor

Todd Helwig, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$604,416	Center for Transportation Research	$184,054

0-6786—Live Load Effects of Railroads on Retaining Walls and Temporary Shoring

Start Date: 09/12/2012 ***End Date:*** 08/31/2014

Abstract

Highway construction activities sometimes require retaining walls and temporary shoring in close proximity to railroads. Railroad loading typically involves a large component of live load surcharge on retaining structures relative to most other situations. Current design guidelines for estimating live load effects can give widely varying predictions of loads and deflections. In the case of shored systems, the requirements for allowable deflections are quite strict. Thus, uncertainty in predicting live load effects coupled with the strict deflection limitations can lead to uneconomical designs.

To address this problem, the research will comprise three major thrusts: monitoring instrumented cantilever sheetpile and soldier pile/lagging test sections constructed by the Union Pacific Railroad (UPRR), numerical modeling to extrapolate the results to other wall types and soil conditions, and evaluation/modification of existing design methodology. The field instrumentation program will measure lateral wall deflections, vertical settlement of the railroad track, and strains in the walls. Data will be collected during installation to evaluate system response to soil self-weight loading, when trains pass to measure live surcharge load effects, and cumulative deformations over time. A research report will document the findings and provide recommendations for improved design methods for more economical railroad underpass structures.

Project Manager

Wade Odell, RTI

Project Advisors

Dina Dewane, BRG
John Delphia, BRG
Manuel Padron, FTW
Michael Hyzak, BRG

Research Supervisor

Charles Aubeny, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$399,591	Texas A&M Transportation Institute	$175,022
	University of Texas at San Antonio	$44,684

0-6788—Reliability Based Deep Foundation Design Using Texas Cone Penetrometer (TCP) Test

Start Date: 09/12/2012 ***End Date:*** 08/31/2014

Abstract

The goal of this study is to update Texas Department of Transportation (TxDOT) design guidance for deep foundations to reflect the reliability of the Texas Cone Penetration (TCP) based design method. The study will evaluate the performance of the TCP method and will include calibration of the resistance factors for LRFD design of axially loaded drilled shafts and driven piles designed using TCP data. These resistance factors will be established from a database of instrumented load test data obtained from Texas archive files and supplemented by load test data leveraged from neighboring states.

Project Manager

German Claros, RTI

Project Advisors

Mainul Khan, HOU
Marcus Galvan, BRG
Rex Costley, PHR
Sean Yoon, BRG

Research Supervisor

William (Bill) Lawson, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$399,845	Center for Multidisciplinary Research in Transportation	$270,132

0-6789—Automated Crack Documentation Using Digital Images—Scoping Study

Start Date: 09/01/2012 ***End Date:*** 08/31/2013

Abstract

The Texas Department of Transportation (TxDOT) inventory contains approximately 53,000 bridges. About 60% of these bridges have reinforced/prestressed concrete structures. Inventory maintenance requires regular inspection which includes detecting, documenting, and tracking of cracks. Current TxDOT bridge inspection is manual and based on human visual inspection. This introduces several issues including: inspection accuracy, reliability, safety, duration, and cost. Automating parts of the process, and assisting inspectors with other parts, might be desirable. Yet several considerations including feasibility, cost, and usability of the system have to be considered. For this end, this scoping study will explore the feasibility of developing a simple, usable, economical, and safe crack documentation, detection, and inspection system (CDD-IS).

Project Manager

German Claros, RTI

Project Advisors

Bonnie Longley, BRG
Lucio Trujillo, BRG
Tim Bradberry, BRG

Research Supervisor

Yijuan Lu, TSUSM

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$94,376	Texas State University–San Marcos	$94,376

0-6792— Synthesis on Geosynthetic-Reinforced Steep Slopes

Start Date: 09/01/2012 ***End Date:*** 08/31/2013

Abstract

Geosynthetics provide a means to mechanically stabilize earth's structures by improving strength and tensile reinforcement. When incorporating these polymeric materials in the application of stabilizing steep slopes, geosynthetic reinforcement can accommodate budgetary restrictions and alleviate space constraints. Currently, TxDOT has limited use of geosynthetics; therefore, a synthesis study on geosynthetic reinforced steep slopes is needed to enhance the present understanding of this technology. This study will summarize the advantages and disadvantages of utilizing geosynthetic reinforcement, and will investigate current design and construction methods in order to determine best practices. Additionally, due to the potential of geosynthetics to provide significant savings in material costs and construction time, the cost effectiveness of geosynthetic reinforced steep slopes will be examined utilizing a value engineering analysis. Case studies will also be identified and assessed to determine optimal soil conditions, geometry of the slope, design criteria, construction specifications, and performance measures. The synthesis study will summarize best practices, existing methodologies and recommendations for the use of geosynthetic reinforced steep slopes in Texas.

Project Manager

German Claros, RTI

Project Advisors

Andrew Holick, BRY
Marcus Galvan, BRG
Marie Fisk, BRG
Pamela Anderson, HOU
Patricia (Patty) Trujillo, BRG

Research Supervisor

Yoo Jae Kim, TSUSM

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$49,995	Texas State University–San Marcos	$49,995

RMC P Active Projects

Project	Title	Start Date	Page
0-6581-CT	TxDOT Administration Research	10/23/2008	123
0-6581-TI	TxDOT Administration Research	10/10/2008	124
0-6672	Intelligent Transportation System (ITS) Strategic Plan	10/25/2010	125
0-6727	Using “Fair Division” Methods for Allocating Transportation Funds	9/1/2011	126
0-6734	Center for Transportation and Electricity Convergence (CTEC)	5/31/2011	127
0-6735	Best Practices for TxDOT on Handling Wildfires	6/6/2011	128
0-6736	Rider 36 OS/OW Vehicle Fees Study	10/19/2011	129
0-6737	Methods to Maximize Toll Revenues	11/14/2011	130
0-6793	Snow and Ice Chemicals for Texas Roads	1/31/2012	131
0-6800	Impacts on Texas Ports from the Panama Canal Expansion	5/7/2012	132
0-6802	Texas Highway Funding Options & Alternatives	5/30/2012	133

0-6581-CT—TxDOT Administration Research

Start Date: 10/23/2008 ***End Date:*** 08/31/2013

Abstract

This research project will evaluate numerous individual transportation issues and develop findings and/or recommendations based on results. This project has been structured to: 1) respond to transportation research needs that are identified in a manner that necessitates a quick response that does not fit into the normal research program planning cycle, and 2) individual transportation research needs that are not large enough to justify funding as a stand-alone research project, despite the fact that the issue may be an important one.

Project Manager

Frank Espinosa, Jr., RTI

Research Supervisor

Khali Persad, CTR

Total Project Budget	***Research Universities***	***FY 2013 Budget***
$1,105,000	Center for Transportation Research	$250,000

0-6581-TI—TxDOT Administration Research

Start Date: 10/10/2008 ***End Date:*** 08/31/2013

Abstract

This research project will evaluate numerous individual transportation issues and develop findings and/or recommendations based on results. This project has been structured to: 1) respond to transportation research needs that are identified in a manner that necessitates a quick response that does not fit into the normal research program planning cycle, and 2) individual transportation research needs that are not large enough to justify funding as a stand-alone research project, despite the fact that the issue may be an important one.

Project Manager

Frank Espinosa, Jr., RTI

Research Supervisor

Josias (Joe) Zietsman, TTI

Total Project Budget	***Research Universities***	***FY 2013 Budget***
$1,080,000	Texas A&M Transportation Institute	$250,000

0-6672—Intelligent Transportation System (ITS) Strategic Plan

Start Date: 10/25/2010 ***End Date:*** 08/31/2013

Abstract

The Texas Department of Transportation (TxDOT) is facing unprecedented financial constraints while being asked to maximize the safety and mobility of the existing state transportation system. TxDOT's public agency partners are facing similar constraints delivering transportation services as well. The ability of TxDOT's partners to support and lead aspects of operating and managing the transportation network varies by region of the state. At the same time, technology and communication are evolving as well as the private sector's ability to deliver data, equipment, and services. Within this environment, TxDOT needs to set a new direction for participating and delivering intelligent transportation systems. Recent efforts to solicit stakeholder input have produced data important to long range decision making, as well as promoting good will with the stakeholders. Strategic planning for ITS-related services has similar strong potential. Through effective listening to key stakeholders, TxDOT will be able to identify the highest priority needs with which stakeholders may be willing to assist, as well as low priority services that all agree can be discontinued. The focus can be directed to critical outcomes, regardless how delivered, rather than on legacy equipment or services that may or may not actually be beneficial. With the focus on the priority outcomes, TxDOT can then explore alternative approaches to accomplishing the goals. During the course of this project, the Texas A&M Transportation Institute (TTl), will solicit input from key (but not all) stakeholders in each region that currently enjoys any meaningful level of ITS services. To the degree possible, these interviews will be done in small groups, organized to include people with common, not conflicting, interests. TTl will work to build consensus among participating agencies in the production of planning documents for ITS Strategic Solutions.

Project Manager

Wade Odell, RTI

Project Advisors

Brian Fariello, SAT
Carol Rawson, TRF
Charlie Farnham, TRF
David Fink, HOU
Edgar Fino, ELP
Meg Moore, TRF
Natalie Bettger, NCTCOG
Rick Cortez, DAL
Stuart Corder, HOU

Research Supervisor

Edward Seymour, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$1,112,022	Texas A&M Transportation Institute	$330,589

0-6727—Using "Fair Division" Methods for Allocating Transportation Funds

Start Date: 09/01/2011 ***End Date:*** 08/31/2013

Abstract

The objective of this project is to investigate fair division algorithms and methods for the allocation of transportation funds and/or resources among competing interests at TxDOT. The project involves identifying critical tier allocation areas and formulating an overall comprehensive model to enhance current allocation decision making processes. Enhanced allocation methods should lead to envy-free, efficient, and equitable distribution of funds and resources.

Project Manager

German Claros, RTI

Project Advisors

John Ibarra, TPP
John Sabala, OPE
Michelle Veale, BRG
Ron Hagquist, OPE
Sarah Bagwell, ADM
Teresa Lemons, ADM

Research Supervisor

Carlos Chang Albitres, UTEP

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$187,185	University of Texas at El Paso	$100,624

0-6734—Center for Transportation and Electricity Convergence (CTEC)

Start Date: 05/31/2011 ***End Date:*** 08/31/2014

Abstract

The University of Texas at Austin has joined with Texas A&M University and the National Science Foundation to operate the "PHEVIEBVs: Transportation and Electricity Convergence" Center (The Center). The Center provides an opportunity for researchers, industry and government agencies to work together to understand how public policy goals for transportation systems may be impacted if a significant plug-in hybrid electric vehicle (PHEV) or electric battery vehicle (EBV) fleet is achieved in the United States.

The Texas Department of Transportation (TxDOT) is providing support for operation of The Center to bring a state department of transportation perspective to the operations of The Center and to the selection of specific research projects for study by The Center.

Project Manager

Wade Odell, RTI

Project Advisors

Scott Burford, GSD

Research Supervisor

Randy Machemehl, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$352,000	Center for Transportation Research	$88,000

0-6735—Best Practices for TxDOT on Handling Wildfires

Start Date: 06/06/2011 ***End Date:*** 12/31/2012

Abstract

The proposed research project 0-6735 will document lessons learned for recent wildfire events and study the role of TxDOT in the mitigation, containment and response to wildfires. It will develop a comprehensive protocol to help TxDOT effectively respond to wildfire situations that may occur in the State. This protocol will be presented in the form of "Best Practices" based on information gathered from many sources both from within TxDOT and from agencies outside the Department. This research will also develop a training course for TxDOT personnel who have to deal with wildfire situations and will conduct four regional training workshops.

Project Manager

Wade Odell, RTI

Project Advisors

Darwin Lankford, CHS
Gilbert Jordan, MNT
Richard Schiller, FTW
Samuel Salazar, OCC

Research Supervisor

Phillip Nash, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$172,412	Center for Multidisciplinary Research in Transportation	$58,070

0-6736—Rider 36 OS/OW Vehicle Fees Study

Start Date: 10/19/2011 ***End Date:*** 10/31/2012

Abstract

There is a lack of clear understanding among the general public and the State Legislature regarding the damage that oversized and overweight (OS/OW) vehicles traffic cause on the Texas transportation infrastructure and the related operational costs. In order to be sustainable, Texas' transportation system must be properly funded, with cost allocation correctly aligned to each user through permit fees.

During this project the research team will evaluate the damage that OS/OW vehicles (including exempt vehicles) cause to the transportation infrastructure (including roads and bridges). Based on this evaluation the researchers will perform a thorough cost analysis to quantify all direct and indirect cost associated with this damage and associated expenses that result from this damage. Once all cost elements are determined, the researchers will provide recommendations for permit fees and fee structure adjustments including highway maintenance fees to properly compensate for the damages caused.

To address the damage determination, the researchers will calculate the ratio of the overall impacts to the infrastructure between freight vehicles operating within defined, legal GVW and axle load limits and those the state allows to operate beyond those limits. This will be done by applying the concepts of Load Equivalency Factor (LEF) and Equivalent Damage Factor (EDF). A mechanistic approach calibrated to Texas conditions will be applied that is consistent with the approach proposed by Federal Highway Administration (PaveDAT) and based on the Mechanistic-Empirical Pavement Design Guide (MEPDG), which is endorsed by AASHTO. By selecting this approach, the research will provide the Department and the State a method that is also supported and promoted at the federal and state levels.

By reviewing and summarizing existing databases, representative axle configurations and vehicles, routes and pavement structures will be identified to calculate an average fee structure for the state; however, the developed methodology will be implemented in an Excel spreadsheet and will enable the calculation of specific fees for a given vehicle configuration on a given route. This methodology is consistent with the current approach used by the Motor Carrier Division but it will be updated to provide a more realistic fee structure.

Project Manager

German Claros, RTI

Project Advisors

Becky Blewett, OGC
Carol Davis, MCD
Duwayne Murdock, MCD
Jay Bond, FAO
John Sabala, OPE
Justin Obinna, MNT
Manuel (Bernie) Carrasco, BRG
Scott McKee, MCD

Research Supervisor

C. Walton, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$472,383	Center for Transportation Research	$50,600
	University of Texas at San Antonio	$6,975

0-6737—Methods to Maximize Toll Revenues

Start Date: 11/14/2011 ***End Date:*** 08/31/2013

Abstract

The Texas A&M Transportation Institute (TTI) is directed by the Texas Legislature through Rider 44 to the appropriations bill for the Texas Department of Transportation (TxDOT) to conduct an analysis that identifies strategies to maximize toll revenues collected on the TxDOT - operated toll roads in the state.

Project Manager

Wade Odell, RTI

Project Advisors

Glen Bates, TPP
Jimmy Bailey, TOD
Joseph Carrizales, AUS
Loretta Brown, TOD
Pat Henry, HOU
William (Bill) Reichert, TTA

Research Supervisor

Curtis Beaty, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$250,000	Texas A&M Transportation Institute	$101,007

0-6793—Snow and Ice Chemicals for Texas Roads

Start Date: 01/31/2012 ***End Date:*** 08/31/2013

Abstract

Currently, TxDOT districts that use snow and ice chemicals primarily use NaCl or MgCl2 (with or without additives), but often this choice is not based on a quantitative assessment. In addition, the use of natural brines as an inexpensive local source of salts has been proposed by TxDOT. This project will quantify and qualify the relative merits of common snow and ice chemicals used by TxDOT in its maintenance operations as well as natural brines (e.g. Kent County Brine). This project will consider all aspects of these chemicals including effectiveness, availability, environmental concerns, environmental regulations, and impact on infrastructure durability (corrosion). Finally, taking all of these considerations into account, we will evaluate the cost effectiveness of each chemical as a function of intended use and location. The project will consist of a series of literature and best practice reviews, supported by required lab testing where data gaps exist, and further evaluation in a limited field trial. Anticipated outcomes include characterization of the effectiveness and cost of snow and ice control chemicals, including natural brines, for various treatment strategies for Texas roads and weather conditions. We will also explore the durability impacts to infrastructure caused by snow and ice control chemicals and recommendations on how to conduct maintenance operations to minimize corrosion and scaling, as well as current environmental regulatory guidance for snow and ice control chemicals and recommendations on a compliance strategy. Finally, we will develop recommendations on usage, transport, storage, and application rates for snow and ice control chemicals, including natural brines, for various treatment strategies for Texas roads and weather conditions.

Project Manager

German Claros, RTI

Project Advisors

Darwin Lankford, CHS
Dennis Markwardt, MNT
Gilbert Jordan, MNT
Kevin Pruski, BRG
Lauren Garduno, ABL
Lowell Choate, AUS
Paul Martinez, ABL
Russell Luther, AMA
Wendy Simmons, TYL

Research Supervisor

Andrew Jackson, TECHMRT

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$230,994	Center for Multidisciplinary Research in Transportation	$138,837

***0-6800*—Impacts on Texas Ports from the Panama Canal Expansion**

Start Date: 05/07/2012 ***End Date:*** 12/31/2013

Abstract

This project will assist TxDOT in identifying approaches to maximizing the benefits and opportunities to Texas ports from the Panama Canal expansion. Researchers will facilitate a Panama Canal Stakeholder Working Group to obtain input on issues and opportunities associated with the Panama Canal expansion and ways to facilitate and expedite the movement of trade - both imports and exports - through Texas deep water ports.

Project Manager

Wade Odell, RTI

Project Advisors

Eduardo Hagert, FAO

Research Supervisor

Katherine Turnbull, TTI

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$100,000	Texas A&M Transportation Institute	$39,508

0-6802—Texas Highway Funding Options & Alternatives

Start Date: 05/30/2012 ***End Date:*** 07/31/2013

Abstract

The purpose of this project is to examine Texas highway funding options and alternatives in preparation for the next Texas Legislative session, in doing so, this research project will:

- Identify a menu of practical funding options to support state highway infrastructure investments in the movement of people and freight, as well as alternative mechanisms designed to ensure the optimum use of existing infrastructure. Options will include: 1) U.S. and foreign tax-based strategies for increasing revenues; 2) toll and road-pricing schemes; 3) debt-financing models; and 4) special situations such as how best to address impacts associated with heavy-vehicle use of roadways related to energy exploration, drilling and extraction.
- Assess the comparative merits of viable options in terms of revenue generation potential, equity considerations, administrative costs, technical feasibility of implementation, legal ramifications, potential impacts on economic development, political acceptability, and ability to address special situations and objectives.
- Explore alternative programs and practices used in other states and countries to "Educate and inform the public regarding the seriousness of the transportation challenges ..."

Project Manager

Wade Odell, RTI

Project Advisors

Research Supervisor

Leigh Boske, CTR

Total Project Budget	*Research Universities*	*FY 2013 Budget*
$152,627	Center for Transportation Research	$125,000

Index

Project #	page	Project #	page	Project #	page	Project #	page
0-4562	93	0-6665	18	0-6712	79	0-6756	58
0-5722	94	0-6672	125	0-6713	80	0-6758	59
0-5997	95	0-6673	19	0-6714	81	0-6759	60
0-6274	7	0-6674	20	0-6715	103	0-6760	61
0-6564	96	0-6675	21	0-6716	104	0-6762	62
0-6581-CT	123	0-6676	22	0-6717	105	0-6763	63
0-6581-TI	124	0-6679	23	0-6718	106	0-6764	64
0-6603	97	0-6682	24	0-6719	107	0-6766	65
0-6610	8	0-6683	25	0-6720	108	0-6767	66
0-6613	9	0-6686	26	0-6722	109	0-6768	67
0-6614	10	0-6687	27	0-6723	110	0-6769	82
0-6617	11	0-6688	46	0-6724	111	0-6771	83
0-6618	12	0-6690-CTR	47	0-6727	126	0-6772	84
0-6619	13	0-6690-UNT	48	0-6731	112	0-6773	85
0-6620	14	0-6691	49	0-6734	127	0-6775	86
0-6622	15	0-6692	50	0-6735	128	0-6781	87
0-6626	41	0-6693	51	0-6736	129	0-6782	88
0-6629	42	0-6694	52	0-6737	130	0-6783	113
0-6635	43	0-6696	53	0-6738	28	0-6784	114
0-6636	44	0-6697	54	0-6740	29	0-6785	115
0-6638	45	0-6698	55	0-6741	30	0-6786	116
0-6639	71	0-6701	56	0-6742	31	0-6788	117
0-6649	98	0-6702	72	0-6744	32	0-6789	118
0-6651	99	0-6703	73	0-6746	33	0-6792	119
0-6652	100	0-6704	74	0-6747	34	0-6793	131
0-6654	101	0-6705	75	0-6748	35	0-6800	132
0-6656	102	0-6706	76	0-6749	36	0-6802	133
0-6658	16	0-6708	77	0-6752	37	9-1001	89
0-6663	17	0-6711	78	0-6754	57	9-1002-12	90