

Research Digest

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TxDOT Research Publications

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Item 1

Guidelines for Analyzing the Capacity of D-Regions with Premature Concrete Deterioration of ASR/DEF

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

TTI 5997-P2 • 2015

The second edition to the 'Guidelines for Determining the Capacity of D-Regions with Premature Concrete Deterioration of ASR/DEF' in essence is an update of the first edition 0-5997-P1 (Mander et al., 2012a), with findings and improved analysis techniques developed since 2012. The two major additions to this edition are Chapters 4 and 5... Conventional U.S. design standards for D-regions have historically been based on empirically derived expressions... a SAT model only satisfies force equilibrium and is intentionally formulated as a lower bound (plastic) solution, the critical mode of failure (i.e., element or nodal failure) is often illusive to the designer. Thus the ultimate failure mechanism might lead to an undesirable brittle collapse when imposed to overload scenarios. Current nonlinear shear analysis models for structural concrete deep beams are generally complicated to use and have limited applicability or appeal to practicing engineers. Clearly, it is desirable to have a model that is derived from rational mechanics and validated with experimental evidence that can be implemented into commercially available structural analysis software. Therefore, a Compatibility Strut-and-Tie Model (C-STM) that is intended for the nonlinear analysis of shear critical reinforced concrete structures is presented. These guidelines seek to demystify the above mentioned dilemmas. More specifically, guidelines are presented for determining the capacity of D-regions without and with premature concrete deterioration, in particular ASR and DEF effects." -p.1-2
(xiii, 162 pages)

CONTENTS

- Preface to Second Edition
- Foreword
- Analysis Schema
- Compatibility Strut-and-Tie Formulation
- Modeling ASR/DEF Expansion in Reinforced Concrete Structures
- Worked Example: Determining Expansion Strains Caused by ASR/DEF
- Worked Example: Analysis Schema for C-Beam Specimens
- Closure
- References
- Appendix A

This report is available for free download (12 MB):

<http://tti.tamu.edu/documents/0-5997-P2.pdf>

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Item 2

Statewide Implementation of the Surface Performance-Graded (SPG) Specification for Seal Coat Binders in Service. Products -P1, -P4, & -P5

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)
TTI 6616-01-P1/P4/P5 • 2015

CD-ROM. No abstract available.
(4 PDFs / 809 KB)

CONTENTS

- P1. Seal Coat Binder Performance Specifications, 87th Annual Transportation Short Course, October 2013 [Technical Briefing Presentation, Task 1]
- P4. SPG Specification for 2015 Implementation
- P5. Binder Utilization Maps

This report is available for free download:

<http://tti.tamu.edu/documents/5-6616-01-P1.pdf>

<http://tti.tamu.edu/documents/5-6616-01-P4.pdf>

<http://tti.tamu.edu/documents/5-6616-01-P5.pdf>

Item 3

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

TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT). RESEARCH AND TECHNOLOGY IMPLEMENTATION OFFICE (RTI)
CTR 6635 PSR • 2015

"The Texas Department of Transportation (TxDOT) has funded a number of studies to investigate the pollutant removal associated with use of the permeable friction course (PFC) on highways... By removing water from the road surface, PFC improves safety by reducing splashing and improving visibility. In addition to safety benefits, the previous research by TxDOT demonstrated that PFC reduces concentrations of pollutants commonly observed in highway runoff... Based on the previous work, the Texas Commission on Environmental Quality (TCEQ) recognized PFC as an approved practice for complying with the water quality requirements; however, the approval was limited to the highway configurations previously tested, which included a maximum of two lanes of traffic and a rural cross section (no curb and gutter). The primary objective of this work was to determine whether the same water quality benefits would be realized on wider highways that included a curb and gutter drainage system."

(2 pages)

This report is available for free download (338 KB):

<http://library.ctr.utexas.edu/ctr-publications/psr/0-6635-s.pdf>

Research Digest

Item 4

Shear Behavior of Spliced Post-Tensioned Girders

UNIVERSITY OF TEXAS AT AUSTIN. CENTER FOR TRANSPORTATION RESEARCH (CTR)
CTR 6652-1 • 2015

"By its nature a spliced girder must contain a number of post tensioning tendons throughout its length. The focus of the experimental program described in this dissertation is the evaluation of the strength and serviceability of posttensioned girders loaded in shear, and, more specifically, how a post-tensioning duct located in the web of a girder affects the shear transfer mechanism of a bulb-tee cross-section. Due to the limited number of tests in the literature conducted on full-scale post-tensioned girders, eleven shear tests were performed on seven prestressed concrete bulb-tee girder specimens. Of these tests, ten were conducted on specimens that contained a post-tensioning duct within their web and additional pretensioning reinforcement in their bottom and top flanges. The remaining shear test was conducted on a control specimen that did not have a post-tensioning tendon but contained the same pretensioning reinforcement as the post-tensioned girder specimens. The behavioral characteristics of these eleven test specimens at service level shear forces and at their ultimate shear strengths were evaluated in regards to five primary experimental variables: (i) the presence of a post-tensioning duct, (ii) post-tensioning duct material (plastic or steel), (iii) web-width, (iv) duct diameter, and (v) the transverse reinforcement ratio. The findings of this experimental study are described in detail within this dissertation..."
(xv, 203 pages)

CONTENTS

- Chapter 1. Introduction
- Chapter 2. Background and Literature Review
- Chapter 3. Experimental Program
- Chapter 4. Experimental Results and Observations
- Chapter 5. Database Analysis and Recommendations
- Chapter 6. Summary and Conclusions

This report is available for free download (9.1 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6652-1.pdf>

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Item 5

Spread Prestressed Concrete Slab Beam Bridges

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

TTI 6722-1 • 2015

TxDOT uses prestressed slab beam bridges for short-span bridges ranging from approximately 30-50 ft in length. 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 structures on a per-square-foot basis. The objective of this project was to investigate the use of slab beams that are spread apart with precast panel stay-in-place forms between beams and a cast-in-place concrete deck, and to develop appropriate design guidelines for this alternate spread slab beam bridge system. The project objectives were met through a series of tasks. The research team reviewed the relevant literature and the current state of the practice. Preliminary designs were developed to assess the potential of a spread slab beam bridge system. A full-scale spread slab beam bridge was constructed at the Texas A&M University Riverside Campus and tested to assess constructability, in-service performance, and behavior. Field testing was conducted for the Riverside Bridge and a US 69 on-system bridge to evaluate load distribution behavior and to provide data to guide analytical modeling of this bridge system. Additional analytical models were developed to investigate an array of possible bridge geometries and load sharing behavior. Based on these models, recommendations were developed for load distribution factor relationships for the design of spread slab beam bridges. (xx, 395 pages; 3.7 MB)

• Accompanying CD-ROM contains "Appendix E: Spread Slab Beam Bridge Construction at Texas A&M University Riverside Campus: Drawing Set [May 1, 2013, Revised September 1, 2013]"

CONTENTS

- Chapter 1. Introduction
- Chapter 2. Literature Review
- Chapter 3. Preliminary Designs for Spread Slab Beam Bridges
- Chapter 4. Experimental Study of Riverside Bridge
- Chapter 5. Experimental Study of US 69 Bridge
- Chapter 6. Modeling of Tested Spread Slab Beam Bridges
- Chapter 7. Load Distribution Factors for Spread Slab Beam Bridges
- Chapter 8. Summary, Conclusions, and Recommendations
- References
- Appendices

This report is available for free download (29.7 MB):

<http://tti.tamu.edu/documents/0-6722-1.pdf>

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Item 6

Project Consistency with Transportation Plans and Air Quality Conformity Workshops: Technical Report

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

TTI 6758-01-1 • 2015

This implementation project supports streamlined project delivery, one of the goals outlined by the Texas Department of Transportation (TxDOT) leadership to achieve an efficient and effective transportation system in Texas. The project benefits TxDOT divisions, districts, and metropolitan planning organizations during the project development process. This project was developed to help TxDOT implement the findings of TxDOT Project 0-6758: Maintaining Project Consistency with Transportation Plans throughout the Project Life Cycle with an Emphasis on Maintaining Air Quality Conformity. The research team organized and conducted four training workshops in Houston, El Paso, and Dallas District offices; and at the 2014 TxDOT Environmental Conference in Galveston. In addition to the training slides, the participants received the Project Consistency Guidebook, which documents procedures, tools, and recommendations to prevent and address project inconsistencies throughout the project development process. The research team collected and documented feedback from the participants. Researchers then finalized the training materials based on workshop feedback. The research team submitted the final training materials to TxDOT's Human Resources Training Program for inclusion in the TxDOT employee training catalog and the TxDOT iWay training system.

(vii, 9 pages)

CONTENTS

- Introduction
- Project Overview
- Workshop Feedback
- Integrated TxDOT Training

This report is available for free download (255 KB):

<http://tti.tamu.edu/documents/5-6758-01-1.pdf>

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Item 7

Improved Trip Generation Data for Texas Using Work Place and Special Generator Survey Data

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

TTI 6760-1 • 2015

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 compiled and analyzed data from more than a decade of work place and special generator travel surveys in Texas to develop (1) a generic set of trip attraction rates for different metropolitan planning organization (MPO) size categories in Texas, and (2) a Texas trip generation manual similar to the national Institute of Transportation Engineers' (ITE's) Trip Generation Manual, but based on local Texas data. The study results revealed that the Texas trip generation rates were generally lower than comparable rates in the ITE manual. The research team reviewed and assessed Texas Department of Transportation current work place survey methods and design. The researchers then made recommendations on changes that would enable ITE-type trip generation data to be collected, in addition to the data collected as part of this survey, to develop trip attraction rates for modeling. The study also used the master database of trip attraction data from Texas work place surveys to develop disaggregate trip attraction rates for modeling using numerous explanatory variables. Here, the data were grouped into 14 employment categories, and linear regression models were (1) developed for non-commercial and commercial trips, and (2) analyzed for various trip purposes and mode combinations. This analysis revealed the following significant indicators of attraction rates: parking availability, MPO area size, traffic analysis zone area type, employment density, and establishment type. These are factors that should be used in future studies. The disaggregate attraction rates could be used as a benchmark or reference for calibrating certain aspects of activity-based models.

(xii, 178 pages)

CONTENTS

- Chapter 1. Introduction
- Chapter 2. Texas Work Place Survey Design and methods
- Chapter 3. Work Place Survey Data and ITE Trip Generation Rates
- Chapter 4. Compilation and Analysis of Work Place Data and Development of Generic Attraction Rates
- Chapter 5. Conduct Analysis to Develop Trip Generation Rates for Land Development
- Chapter 6. Establish Criteria for Texas Trip Generation Manual
- Chapter 7. Evaluate Models and Potential Explanatory Variables
- Chapter 8. Summary, Conclusions, and Recommendations
- Appendix
- Bibliography
- References

This report is available for free download (3.7 MB):

<http://tti.tamu.edu/documents/0-6760-1.pdf>

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Item 8

Texas Trip Generation Manual. Volumes 1-4 -- 1st edition, DRAFT 8/15/14

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

TTI 6760-P1 • 2015

The purpose of this Manual is to provide a summary of Texas trip generation data for various Land Use Codes (LUCs) and time periods, for data obtained from workplace and special generator (WSG) surveys performed as part of the Texas Travel Survey Program (TTSP). Updates to the dataset will be performed periodically as new data become available. New data may become available in the form of new travel survey data, newly analyzed travel survey data, or Texas trip generation study data submitted by other groups, such as students or service organizations. The User's Guide portion of the Manual (Volume 1) provides an overview of the data, as well as recommendations of how to properly use the plots contained in the data portion of the Manual (Volumes 2-4), which contains plots showing the average vehicle trip ends plotted across different independent variables (i.e., employees, 1000 Sq. Feet Gross Floor Area, etc.). The data contained in this version of the Manual are taken from surveys performed in five Texas areas, between the years 2010 and 2013.

(4.9 MB)

CONTENTS

- Volume 1. User's Guide
- Volumes 2-4. Trip Generation Rates, Plots and Equations

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

<http://tti.tamu.edu/documents/0-6760-P1.pdf>

Item 9

Improved Trip Generation Data for Texas Using Workplace and Special Generator Surveys: Workshop Materials

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

TTI 6760-P2 • 2015

On August 18, 2014, Researchers from TTI and CTR presented a 4-hour workshop to TxDOT as part of their fulfillment of Task 8 for TxDOT Research Project 0-6760. Workshop objectives: Present Texas Trip Generation Manual (How developed / How it can be used, built upon / Provide examples and discuss); Present Generic WP Attraction Rates; Review Trip Attractions and Advanced Models

(4.4 MB)

CONTENTS

- RMC Project 6760 Improved Trip Generation Data for Texas Using Workplace and Special Generator Surveys, Task 8: Half-Day Workshop / Presented by TTI and CTR (0-6760-P2_WorkshopMaterial.pdf)
- [Workshop Agenda] (6760WSAgenda.pdf)

This report is available for free download (2.6 MB):

<http://tti.tamu.edu/documents/0-6760-P2.zip>

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Item 10

Emerging Transportation Technologies White Papers

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

CTR 6803-P2 • 2015

(13 pages)

CONTENTS

- Volume 1: Autonomous Vehicle Technologies
- Volume 2: Connected Vehicle Technologies
- Volume 3: Cloud Computing and Crowdsourcing

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

<http://library.ctr.utexas.edu/ctr-publications/0-6803-P2.pdf>

Item 11

0-6803, Technology Task Force

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

CTR 6803 PSR • 2015

"Texas' 83rd Legislature charged the Texas Department of Transportation (TxDOT) with examining and evaluating innovative transportation technologies for purposes of reducing costs, reducing traffic congestion, enhancing safety, and increasing economic productivity. As a result, the Texas Transportation Task Force (TTTF) was formed, encompassing a group of experts who discussed four areas of emerging transportation technologies: connected vehicles, autonomous vehicles, electric systems, and cloud computing/crowdsourcing technologies... TTTF took a multifaceted approach to summarize four areas of emerging technologies: · Connected vehicles—vehicles able to communicate with other vehicles and roadway infrastructure through wireless communication technologies. · Autonomous vehicles—also known as automated or self-driving vehicles. · Electric systems—the charging system innovations for electric vehicles such as DC fast-charging and in-road inductive charging stations for electric vehicles. Cloud computing/crowdsourcing technologies—transportation data and information collection, processing, and dissemination technologies taking advantage of the superior computational and storage power of commercial cloud systems and social media services." --Background

(2 pages)

This report is available for free download (359 KB):

<http://library.ctr.utexas.edu/ctr-publications/psr/0-6803-s.pdf>

Research Digest

Item 12

A Report on the Development of Guidelines for Applying Right-Turn Slip Lanes

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

CTR 6810-1 • 2015

This report serves as a summary of the research process regarding the application of right-turn slip lanes in the state of Texas. The work plan was divided into three phases: a review of available literature on the design and operation of right-turn slip lanes, focus group meetings to discuss the synthesis findings with TxDOT representatives, and production of design guidelines pertaining to right-turn slip lanes that accommodate mobility as well as pedestrian and bicyclist safety.

The new construction guidance provided for urban and suburban roadways is inspired by the City of Ottawa's "urban smart channel" design that incorporates a sharp angle of entry into the cross street (~70 degrees) and delineates a narrow turning path for passenger cars using pavement markings. This design promotes slower turn speeds and enhances visibility of the pedestrian crossing location. The sharp angle of entry reduces the head turning required of motorists to search for gaps in oncoming traffic and thus, improves driver comfort. The design includes a crosswalk located in the middle of the channelized roadway that is perpendicular to the turning roadway. The rural design guidance mainly centers on facilitating mobility through the slip lane, as regular pedestrian activity is not typical at rural intersections. Accordingly, the design promotes larger sweeping turns, the use of acceleration lanes, unpaved channelizing islands, and a flatter angle of entry into the cross street. The design guidelines also include a section on retrofitting treatments, targeting issues commonly found at right-turn slip lanes: absence of proper refuge for pedestrians, motorist noncompliance in yielding to crossing pedestrians, pedestrian noncompliance with the crosswalk location, high speeds in the channelized roadway, low visibility of crossing pedestrians, and excessive head turning to spot oncoming traffic. (xviii, 105, D-21 pages)

CONTENTS

- Introduction
- Literature Review
- Focus Groups
- Design Guidelines
- Appendix A. Right-Turn Slip Lane Design Guidelines

This report is available for free download (3.5 MB):

<http://library.ctr.utexas.edu/ctr-publications/0-6810-1.pdf>

Research Digest

Item 13

Reducing Lane and Shoulder Width to Permit an Additional Lane on a Freeway: Technical Report

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

TTI 6811-1 • 2015

This research effort identified the operational and safety implications of using reduced lane and shoulder widths for a variety of freeway configurations. The research team used speed, crash, and geometric data for freeways in Dallas, Houston, and San Antonio. The operational analysis identified an increase of about 2.2 mph in speed for a 12-ft lane as compared to an 11-ft lane. The shoulder width is significant when the adjacent lane is 11-ft wide, but not when it is 12-ft wide which suggests that left shoulder width is more important with a reduced lane width. Operating speeds on Texas freeways are 2 mph lower during night time (with roadside lighting present) than during the day. Speeds were higher (by 1.5 mph) on the weekends (Saturday) than on the week day studied (Wednesday). The safety analysis determined a crash difference when comparing freeways with 12 ft to 11 ft lanes. There is a reduction in KAB crashes that ranges from 5% for 2-lane freeways up to 12% for 5-lane freeways, other roadway characteristics equal. Similarly, there are crash reductions associated with each additional lane, increased left shoulder widths, and increased right shoulder widths. While constructing an additional lane is beneficial in terms of safety, a larger safety detriment caused by narrow lanes or shoulders annuls such benefit. However, if it is possible to increase the total paved width when adding a travel lane, the safety model allows the analyst to identify lane and shoulder widths so that the number of crashes along the corridor will expectedly remain unchanged. (xii, 92 pages)

CONTENTS

- Chapter 1. Introduction
- Chapter 2. Literature Review
- Chapter 3. Site Selection and Data Collection
- Chapter 4. Operational Analysis
- Chapter 5. Safety Analysis
- Chapter 6. Conclusions and Recommendations
- References

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

<http://tti.tamu.edu/documents/0-6811-1.pdf>