CENTER FOR TRANSPORTATION RESEARCH
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TxDOT PROJECT NUMBER 0-6581-CT

RTI SPECIAL STUDIES FOR TXDOT ADMINISTRATION IN FY 2011

Khali R. Persad
Zhanmin Zhang
Abdus Qazi
Rob Harrison
Manuel Trevino
Nabeel Khwaja

CENTER FOR TRANSPORTATION RESEARCH
BUREAU OF ENGINEERING RESEARCH
THE UNIVERSITY OF TEXAS AT AUSTIN

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16. Abstract
This research project was established by TxDOT's Research and Technology Implementation Office to address special studies required by the department's Administration during FY 2011. Three short-term, quick-turnaround tasks were completed and are documented.

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Center for Transportation Research
The University of Texas at Austin
1616 Guadalupe St
Austin, TX 78701

www.utexas.edu/research/ctr

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Project Engineer: Khali R. Persad
Professional Engineer License State and Number: 74848
P. E. Designation: Research Engineer

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Chapter 1. Introduction

1.1 Background

This research project was established by the Texas Department of Transportation's (TxDOT) Research and Technology Implementation Office (RTI) in Fiscal Year (FY) 2009 and renewed in FY 2010 and FY 2011 to evaluate transportation issues as requested by TxDOT's Administration, and develop findings and/or recommendations. The project was structured as a *rapid response* contract for two reasons:

1) Transportation research needs are sometimes 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 are not always sufficiently large enough to justify funding as a stand-alone research project, despite the fact that the issue may be an important one.

The Center for Transportation Research (CTR) contracted with RTI to provide rapid response teams when work requests came from TxDOT's Administration. Task teams were assembled based on the technical requirements in each case, and worked independently of other task teams. Each team coordinated directly with the Administration member requesting the study, and submitted a technical memorandum at the conclusion of the task, to provide TxDOT with implementation information in a timely manner. This report combines the various technical memoranda completed in FY 2011 for easy reference, and is a follow-up to Report 0-6581-1 and 0-6581-2, which documented the FY 2009 and FY 2010 work respectively.

1.1.1 Innovative Research Project

The traditional TxDOT research program planning cycle requires about a year to plan a research project and at least a year to conduct and report the results. With respect to some transportation issues, this type of program is best suited to addressing large, longer-range issues where an implementation decision can wait for 2 or more years for the research results. In recent years, the need for quick response to district engineers, TxDOT administration, elected officials, and public concerns has become more pressing, as information regarding ordinances, legislation, revenue forecasting, mobility, traffic control devices, intermodal systems, material performance, safety, and every aspect of transportation has become more critical to decision-making. When these initiatives are initially proposed, TxDOT has a very limited time in which to respond to the concept. While the advantages and disadvantages of a specific initiative may be apparent, there may not be specific data upon which to base the response. Due to the limited available time, such data cannot be developed within the traditional research program planning cycle.

As a result of these factors (smaller scope, shorter service life, lower capital costs, and the typical research program planning cycle), some transportation research needs are not addressed in the traditional research program because they do not justify being addressed in a stand-alone project that addresses only one issue. This research project was developed to address these types of research needs.

This type of research contract is important because it provides TxDOT with capabilities to accomplish the following:

1. Address important issues that are not sufficiently large enough (either funding- or duration-wise) to justify research funding as a stand-alone project.
2. Respond to issues in a timely manner by modifying the research work plan at any time to add or delete activities (subject to standard contract modification procedures).
3. Effectively respond to legislative initiatives.
4. Address numerous issues within the scope of a single project.
5. Address many research needs.
6. Conduct preliminary evaluations of performance issues to determine the need for a full-scale (or stand-alone) research effort.

1.2 Research Tasks

Succeeding the five tasks completed in FY 2009, and the six tasks undertaken in FY 2010 (two of which were extended into FY 2011), the following three tasks were undertaken in the period September 2010 to August 2011.

Task 10: Dallas District IH 30 Noise Project (continued from FY 2010)

The objective of this task was to conduct field measurements of traffic noise on a section of IH 30 in West Dallas, aid in implementing mitigation measures including noise wall treatments and porous friction course (PFC) overlays, and develop and support the implementation of a performance payment specification for a noise wall treatment at the location.

Task 11: Statistical Analysis of TxCAP and its Subsystems (continued from FY 2010)

The objective of this task was to conduct statistical analyses of the data used by TxDOT to develop Texas Condition Assessment Program (TxCAP) scores, and to recommend a sample size of the TxCAP system including the Pavement Management Information System (PMIS), the Texas Maintenance Assessment Program (TxMAP), and the Texas Traffic Assessment Program (TxTAP) sub-systems, with reasonable estimates of the likely levels of variance in the data.

Task 12: Assessment of TxDOT FTEs for Project Development and Construction, and PS&E Backlog Analysis (FY 2011)

The objective of this task was to examine full-time-equivalent (FTE) staffing needs for TxDOT project development and construction, and analyze needs for "backlogging" plans, specifications, and estimates (PS&E), i.e., preparing construction plans in advance and keeping them "on the shelf" for possible construction funding in the future.

1.3 Organization of This Report

This chapter presented the background and justification for this research effort, and the research tasks. At the completion of each task the research team submitted a technical memorandum to TxDOT. This report combines the technical memoranda for easy reference.

Chapters 2–4 present the results of Tasks 10–12 respectively. Conclusions and recommendations are contained within each task report.

Chapter 2. Dallas District IH 30 Noise Project

2.1 Introduction

Task 10: Dallas District IH 30 Noise Project

The objective of this task was to conduct field measurements of traffic noise on a section of IH 30 in West Dallas, aid in implementing mitigation measures including noise wall treatments and porous friction course (PFC) overlays, and develop and support the implementation of a performance payment specification for a noise wall treatment at the location.

2.2 Results

The following is a summary of work completed on this task. Additional work was requested by the TxDOT Dallas District Engineer, and is expected to be continued in FY 2012 under a separate contract between CTR and the Dallas District.

Technical Memorandum
Task 10 Dallas Sound Wall
August 31, 2011

by Manuel Trevino

2.2.1 Introduction

This document presents a summary of the activities conducted on Task 10, Dallas Sound Wall, for Project 0-6581 for the current fiscal year. During this reporting period, noise data was collected from the roadside of IH 30, as well as from the tire-pavement interface on the 2006 and 2010 PFC overlays. Additional noise tests were conducted with the impedance tube on the pavement. A computer model was developed using the Traffic Noise Model (TNM) program to estimate the benefit of the PFC. The subject of reflections from the retaining wall on the north side of the highway was investigated. Nelson Acoustics was sub-contracted to help develop a specification for the treatment to be applied to the wall to reduce its noise reflectivity. An in situ test was developed to evaluate reflections from the wall. This test became part of the specification, as the basis for awarding payment bonuses to the constructor. A pre-construction meeting was held to present the specification and explain the test to potential bidders for the construction of the wall treatment. Subsequently, the contract was awarded, and the reflection test prior to the start of construction was performed. Construction is expected to begin in mid-September 2011.

2.2.2 Background

The Dallas District has conducted several studies to mitigate the noise from IH 30, just west of downtown Dallas, which affects some of the residences in the Kessler Park neighborhood. This section of the Interstate is characterized by heavy commuter traffic and a high number of trucks. The neighborhood sits at a higher elevation relative to the highway, making noise barriers ineffective. In 2006, the District constructed a PFC overlay, placed over the original transversely tined continuously reinforced concrete pavement (CRCP). This 1.5-in. thick PFC layer covered the easternmost segment of interest, extending from Sylvan Avenue on the east, for about half a mile to the west. In the summer of 2010, a second PFC overlay was constructed. This 1-in. thick PFC is adjacent to the 2006 PFC, and extends to the west of it, for about ¾ mile to the Fort Worth Avenue Bridge, as illustrated in Figure 2.1, which also shows the location of some of the residences affected by the noise.

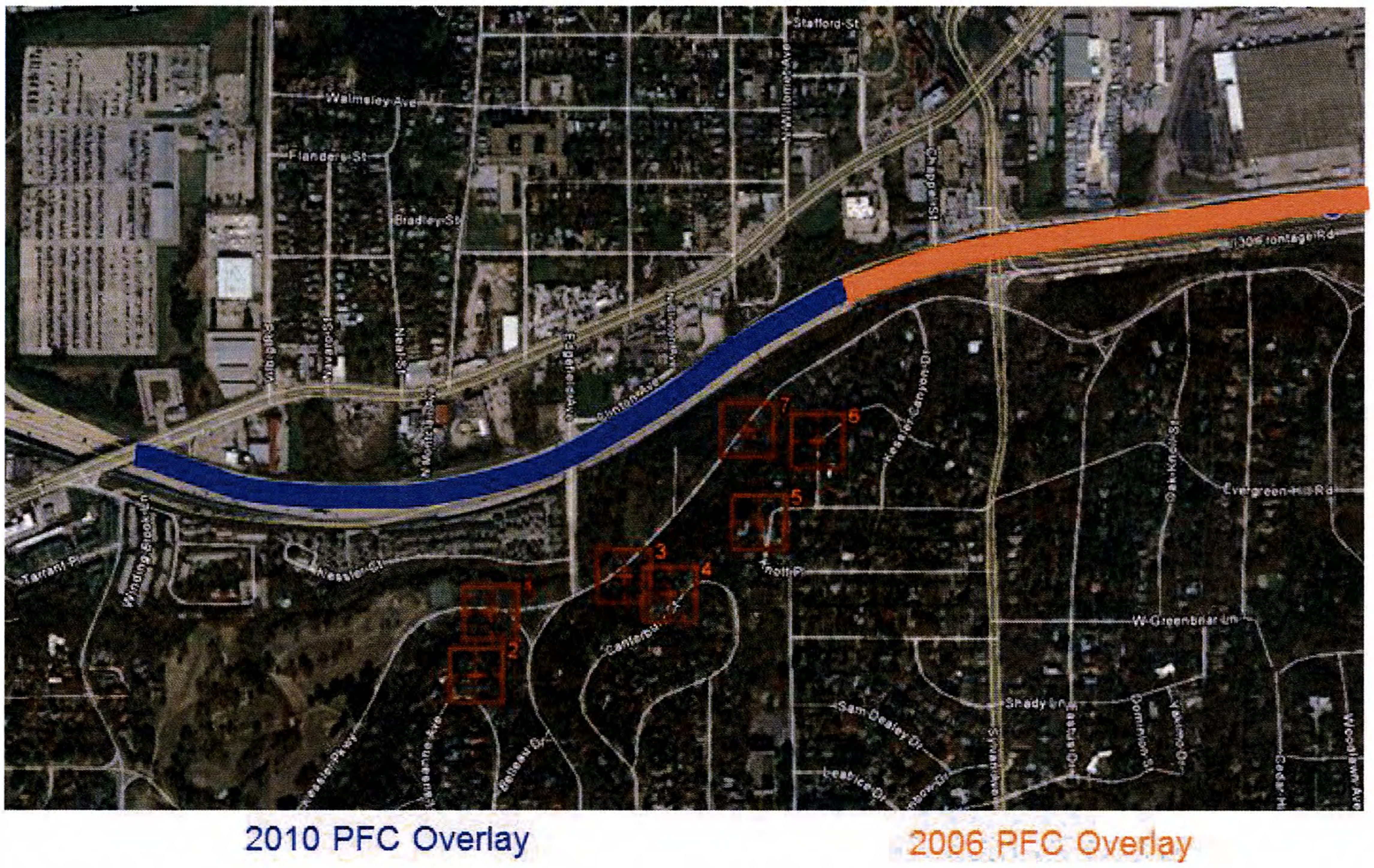

Figure 2.1: Project location, showing extent of overlays and residential measurement sites

Data collected throughout this project includes on-board sound intensity (OBSI) noise levels before and after the 2010 PFC overlay, wayside noise measurements taken at various times and locations within the Kessler Park neighborhood, and impedance tube measurements of absorption spectra for cores taken from the 2006 and 2010 overlays, as well as in situ impedance tube measurements on the 2010 PFC . CTR also developed a model using the TNM program to compare actual and predicted noise values. In addition to the good pavement performance demonstrated by the OBSI results, the district looked for additional noise reduction from mitigating the reflections from the north side retaining wall on IH 30.

2.2.3 OBSI Results

The analysis of the data showed that the new overlay is affording significant reduction of tire noise at key frequencies compared to the existing CRCP, thereby reducing the noise levels in the neighborhood. The majority of total roadway noise produced by both passenger vehicles and trucks is generated at the tire-pavement interface as the tire impacts the pavement.

The result of the OBSI tests and the comparison with the previous result is shown in Figure 2.2, which indicates a significant reduction in noise levels has been achieved with the construction of the PFC overlay.

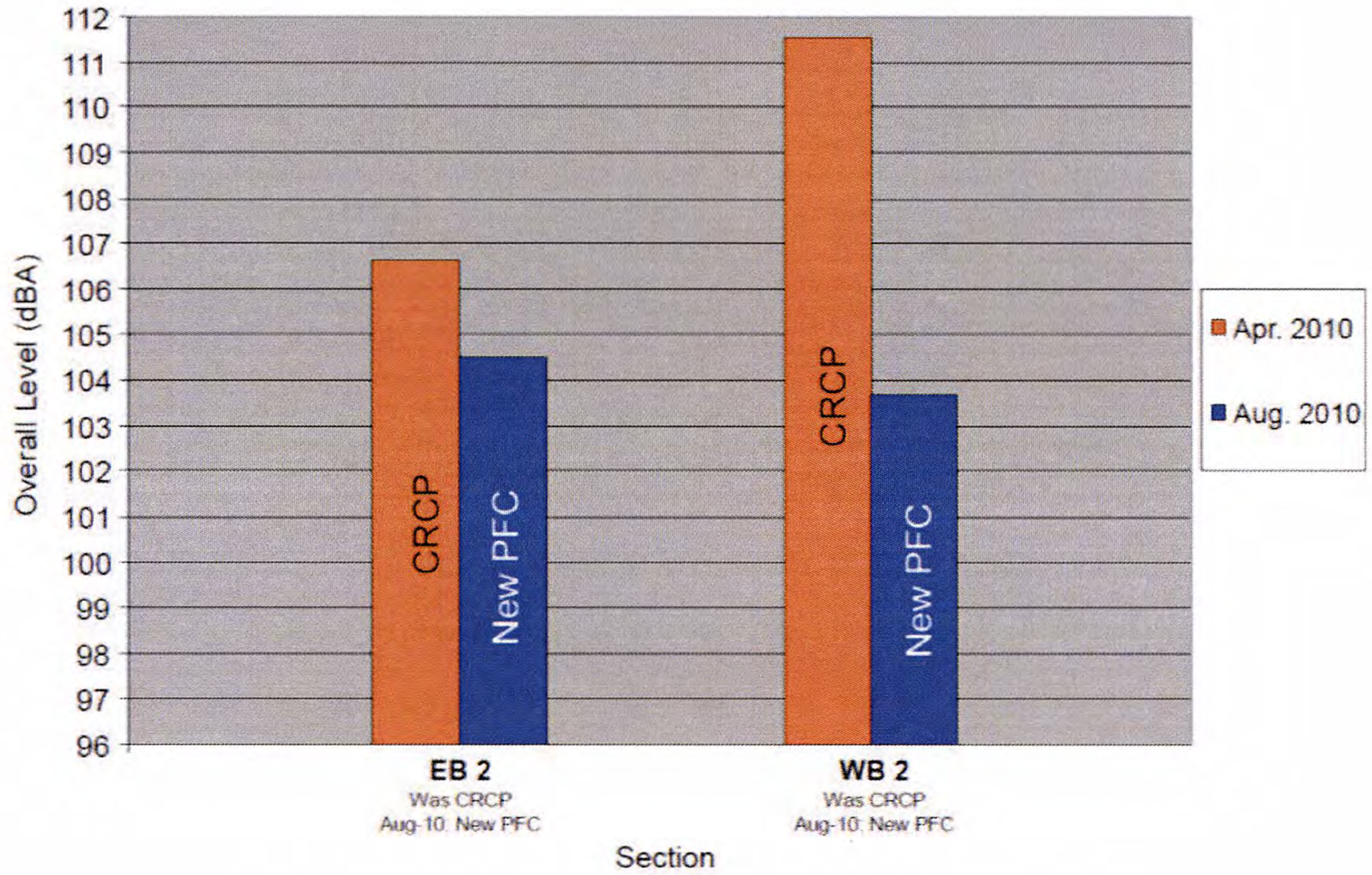

Figure 2.2: IH 30 Dallas OBSI results

As Figure 2.2, the reduction in noise levels at the tire-pavement interface was significant: 2 dBA on the eastbound side, and a substantial 7 dBA on the westbound side. The difference in the amount of reduction is not surprising as the PFC overlay essentially replaces (from an acoustic standpoint) the surface below, whatever it might be—in this case, transversely tined CRCP. This replacement effect has been noted on many pavements and well documented in the literature, including TxDOT research studies 0-5185 and 0-5836. With this positive result, the District then contemplated the possibility of further reducing neighborhood noise levels by lowering reflected noise from the retaining wall on the north side of the IH-30 section.

2.2.4 Model Using TNM

A noise model for the IH-30 project was developed with the Federal Highway Administration's (FHWA) TNM program. The model was based on the geometry of the roadway, as well as the adjacent neighborhood, including all median barriers, retaining walls, traffic counts by lane and vehicle type, vehicle speeds, terrain elevations, and pavement types. The purpose of the model was to estimate noise levels at IH 30 in the proximity of the Kessler neighborhood, and to compare them with previous measurements conducted at the residential locations in April 2010. The model was also used to evaluate the change in sound levels as a result of a modification in the pavement characteristics. And once the model was calibrated, it was used to estimate reflections from the retaining wall, making use of hand calculations outside the model to predict the reflections, and adding those to the original model's results.

2.2.5 Retaining Wall Study

A tall retaining wall of varying heights exists on the north side of the highway, by Edgefield Avenue, which reflects noise back to the neighborhood. The length of this wall is about 2,600 ft.

The District proposed to treat the wall with a noise-absorptive material to mitigate the reflected noise.

A decision was made to employ a performance (A+B) specification for the retrofitting of the wall, where the contract amount "A" is awarded to the low bidder, and the "B" portion, or bonus, is paid if the wall meets a minimum noise reduction level. This type of performance specification agreement with the constructor was adopted to minimize the risk to TxDOT. CTR conducted a literature review to investigate similar work performed on walls when attempting to reduce their noise reflectivity.

Literature Review on Reflections from Walls

Much work has been done on the national and state levels regarding absorptive barriers, particularly by the FHWA's Volpe Center, Washington State DOT (WSDOT) and California DOT (Caltrans). Caltrans has been working in this area since 1978 and has recently completed a $3 million dollar project very similar to the TxDOT IH-30 project, using a combination of quieter, open-graded pavement and absorptive material retrofitted to an existing concrete barrier (Figure 2.3).

Figure 2.3: Caltrans retrofit project on US 101 (Menge & Barrett, 2010)

The combination of open-graded pavement and absorptive wall covering used by Caltrans is needed because even if a barrier is perfectly reflective, it can only add a 3 dBA increase in noise level. Not only is a barrier "theoretically limited to 3 dBA, but attempts to conclusively measure this reflective increase have never shown it to amount to more than 1 to 2 dBA, an increase that is not perceptible to the average human ear" (FHWA). The absorptive material retrofitted to a reflective barrier must achieve a 2 to 3 dBA noise reduction to be of perceptible benefit.

In view of the above, it was considered that an A + B specification would need to specify a minimum benefit (reduction) to be considered successful. If the contractor achieves a certain noise level reduction (NLR), measured as recommended by the consultant, then the bonus would be awarded. The amount of the bonus reflects the benefits to the community (reduction of noise), and to TxDOT in the form of decreased citizen complaints, lowered probability of lawsuits, and reduced cost of future research. The research team worked closely with TxDOT to establish the NLR limits that will become part of the specification.

Baseline Reflectivity Measurements

The maximum theoretical value for noise reflection from the wall is 3 dBA. Therefore, the maximum possible noise reduction achievable by applying noise-absorptive material to the wall is 3 dBA. However, that figure assumes a perfectly reflective barrier, which was not likely to be the case with the rough finish wall in place. Therefore, the researchers decided to directly measure the reflectivity of the wall. Not only would this step quantify how much reflected noise there is to reduce (and hence affect the specification), it also served as a baseline "before" measurement that could be compared to the performance after adding the absorptive material, thereby determining whether the bonus payment is awarded to the contractor.

Two methods were employed:

1. ***TNM Model***: The TNM model was run using traffic data derived from videotape, along with vehicle speeds, while simultaneously measuring noise levels in the neighborhood. Differences between predicted levels and measured levels would give a rough measurement of reflected noise from the barrier. TNM is not currently able to calculate reflections, but a hand calculation outside of TNM allows the estimation of the reflections, and its subsequent logarithmic addition to the results of the original TNM model without reflection provides a good estimate of the total noise (direct noise from the original model, plus reflected noise from hand calculation). From these calculations, the maximum benefit expected from the noise-absorptive treatment would be 2.8 dBA (for a wall with an absorption coefficient of 0.95).
2. ***Impulse Testing***: Creating a noise impulse and measuring the time response of the system (i.e., reverberation) to determine the reflected component of the noise. Although this test is classically performed with a very loud device such as a concussion mortar or gunshot, it was deemed unsafe during traffic. Instead, a recently developed, sophisticated method was employed using coded pseudorandom noise that can be played at a volume lower than the ambient traffic noise yet still separated out from the composite signal. The signal is continuous, broadband noise, commonly used in room acoustics testing, similar to traffic noise and other roadwork activities. The test is proprietary and was performed on 3 different days and at various locations along the roadway by an acoustic engineering consultant. Figure 2.4 shows the concept.

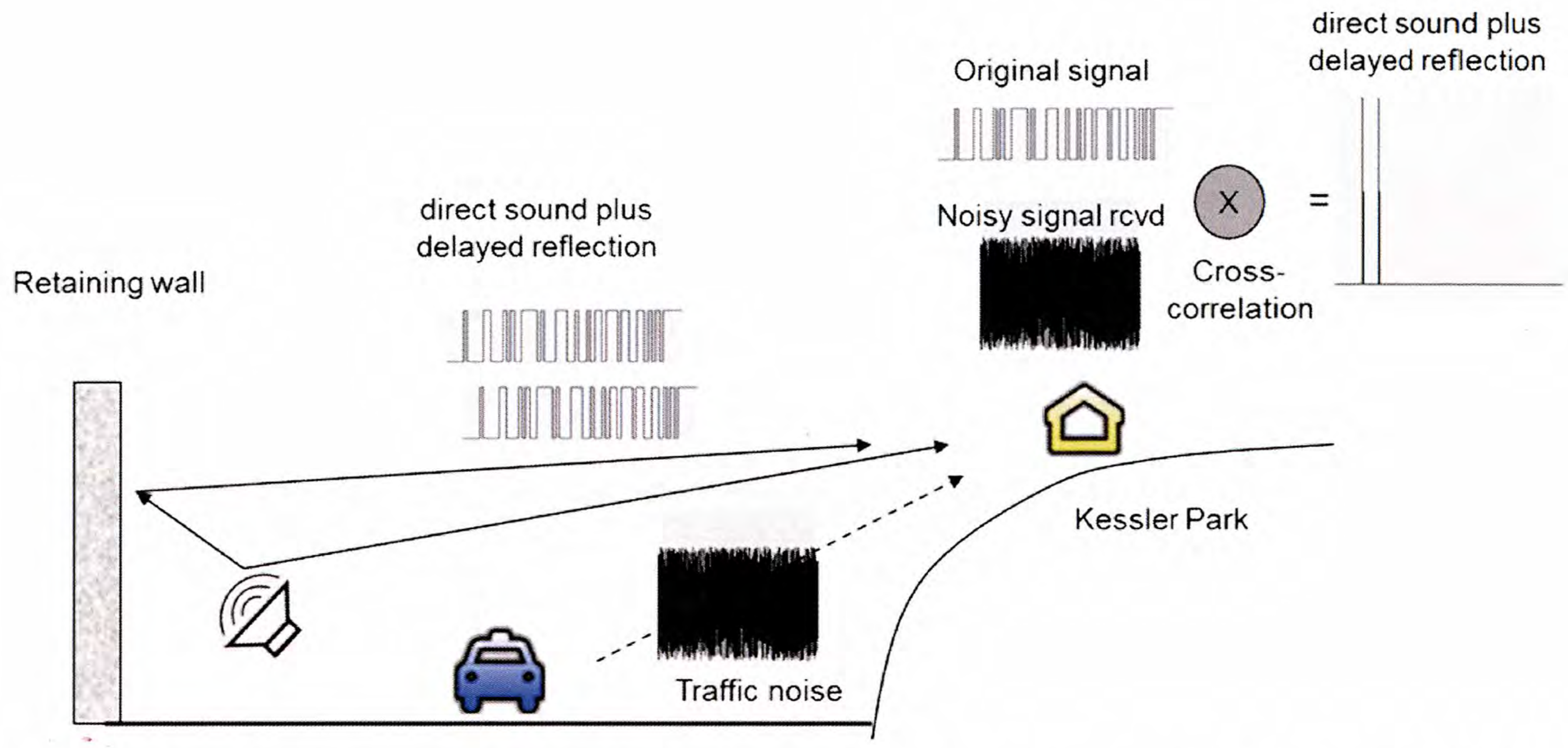

Figure 2.4: Measurement of reflected noise by Maximum Length Sequence Method

The test method consists of the following steps:

a) Play the test signal through a loudspeaker.
b) Receive noisy signal at neighborhood.
c) Detect copies of original signal in received signal by cross-correlation.
d) Uncorrelated noises are suppressed.

Work Performed

From November 30 to December 1, 2010, the project team traveled to Dallas to measure reflected noise by the two methods described above. The outside westbound lane of IH 30 was closed to provide working room and safety to the researchers, and an additional researcher was stationed in the Kessler neighborhood with a sound meter. Work was coordinated via cell phone so that all operations were synchronized, including videotaping traffic during the neighborhood noise tests. The consultant placed measurement microphones at various locations across the roadway and into the neighborhood to record the maximum length sequence (MLS) test data; the location that was finally selected for the procedure was the top of the Edgefield Avenue Bridge (Figure 2.5).

Figure 2.5: Measuring reflected noise from the Edgefield Avenue Bridge

Initial MLS results indicated an unexpected absorption of noise at some frequencies, but not at others (Figure 2.6). After some discussion between the consultant and the CTR researchers, it was determined that the PFC pavement surface between the MLS noise source and receiver microphones was selectively absorbing some frequencies through its well-documented propagation absorption (NCHRP 360, 5185-3) effect. A comparison of the MLS results (Figure 2.6) to the PFC absorption tests using cores in the impedance tube (Figure 2.7) shows a similarity of frequency ranges affected.

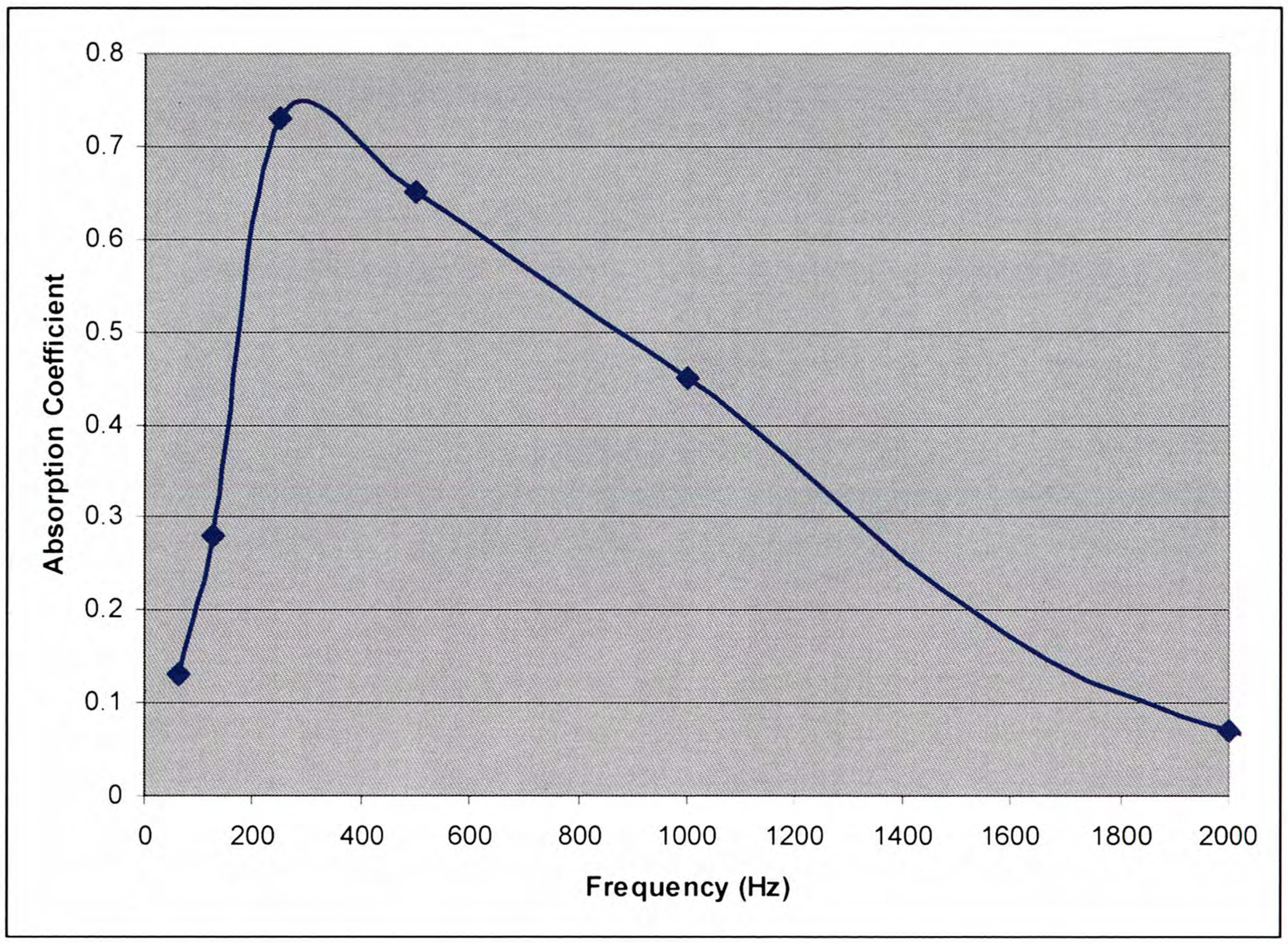

Figure 2.6: MLS absorption (possibly) due to propagation absorption

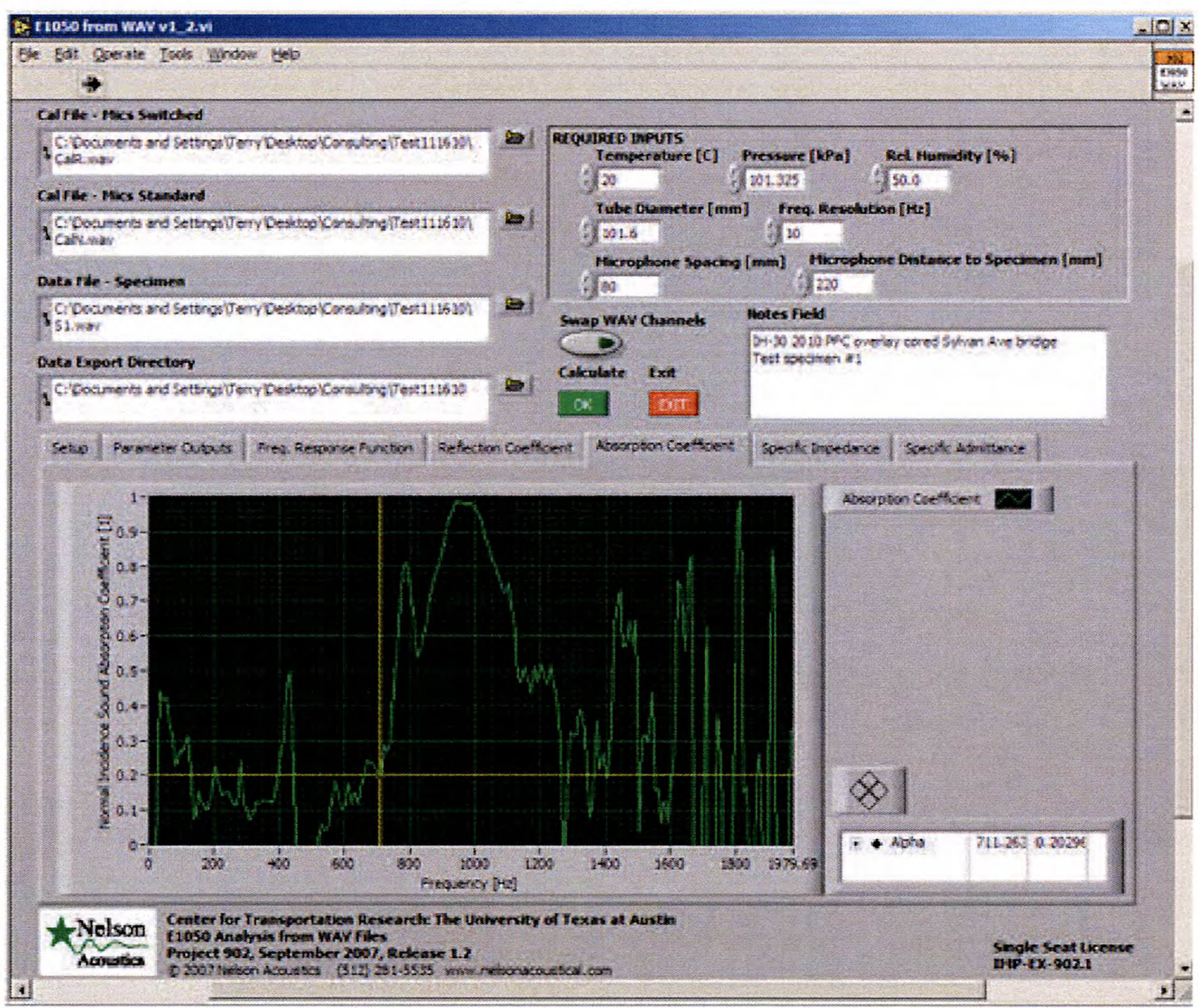

Figure 2.7: Impedance tube absorption for 2010 PFC

The CTR researchers returned to Dallas on December 9 to repeat the Kessler Park wayside measurements. The consultant team also returned to Dallas on December 21 and December 30 to further refine the test procedure and repeat their measurements. In the later measurements, the propagation effect from the PFC was reduced by laying down a plywood "stage" over the pavement to create a reflective area (Figure 2.8).

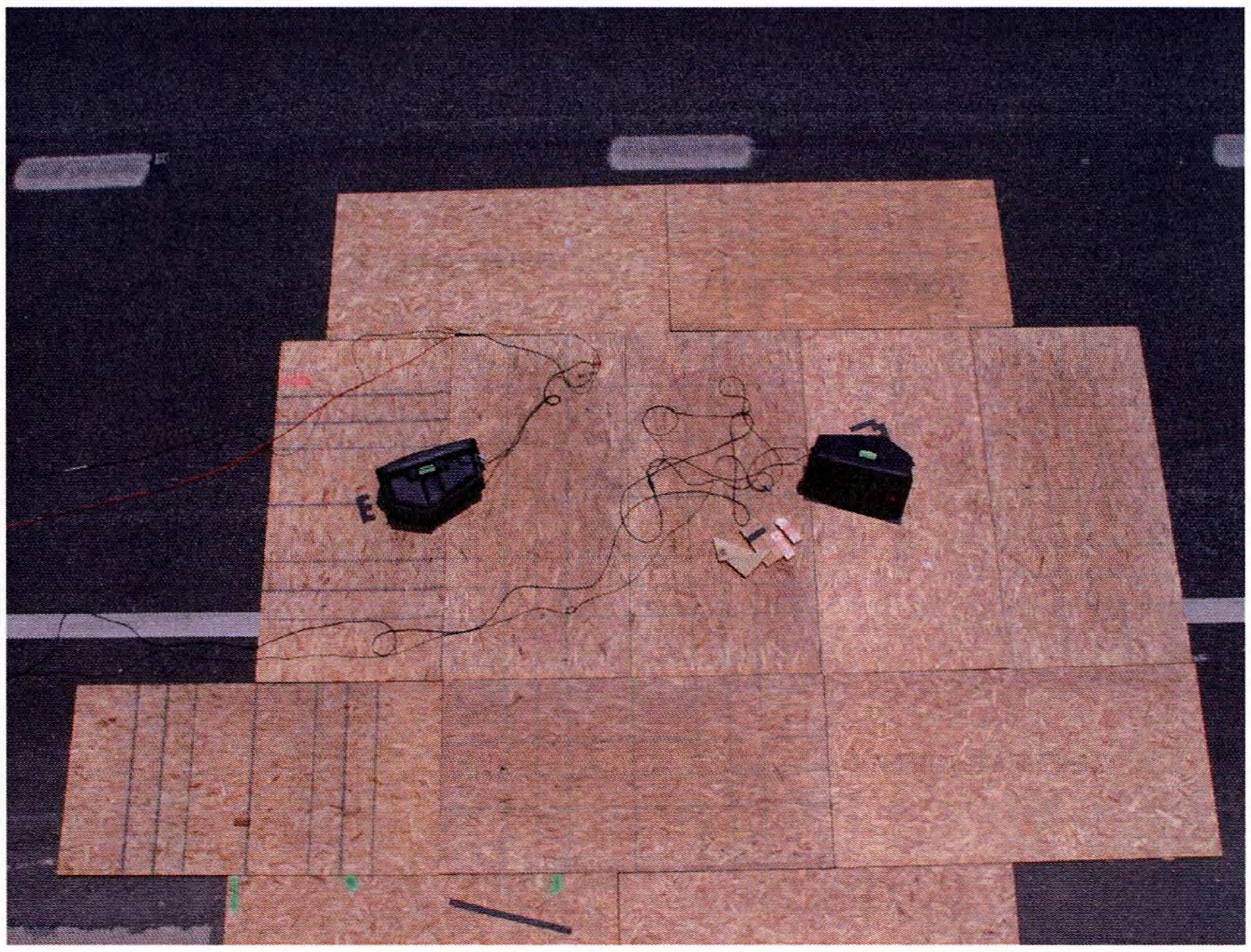

Figure 2.8: MLS test with speakers placed on plywood to reduce propagation absorption from PFC

MLS Test Results and Development of Specification

The findings for the initial test of the wall with the MLS method are listed in Table 2.1.

Table 2.1: Reflection and potential noise reduction

	250 Hz	500 Hz	1000 Hz	2000 Hz	A
Reflection Coefficient [1]	0.92	0.94	0.97	0.73	---
Max. SPL Reduction [dB]	2.7	2.8	2.9	1.9	---
Initial A-wtd. SPL [dB]	67.8	75.7	79.2	68.3	81.2
Minimum SPL [dB]	65.1	72.9	76.3	66.4	78.5

As shown in Table 2.1, the maximum reduction that can be achieved on this project would be 2.7 dBA for the 250 Hz frequency band, 2.8 dBA for 500 Hz, 2.9 dBA for 1 kHz, and 1.9 dBA for 2 kHz. These frequencies are the most audible to human hearing and most likely to be objectionable. The 1 and 2 kHz frequencies are the easiest to reduce using absorptive material, thus indicating a good outcome for applying absorptive material to the wall. A comparison of the A-weighted results in the right-hand column reveals that the retaining-wall reflection adds 81.2 – 78.5 = 2.7 dBA compared to a completely anechoic (non-reflective) wall.

The theoretical limit (for a perfect reflector) is 3.0 dBA. Thus, the findings are within the theoretical maximum, and they were supported by the second set of TNM runs that predicted a slightly higher value than the MLS findings. These findings supported setting a 2 dBA value or greater for the "B" value for the specification.

Due to the complexity of the MLS testing at this location, a discussion between the consultant and the researchers was held and the possibility was raised of using the impedance tube test to measure the wall reflectivity directly, either in situ (bringing the device to the project site and mounting it against various locations on the wall), or in the laboratory (several horizontal cores would need to be cut from the wall). The in situ method was tested by the researchers in February 2011 with positive results. Even though more testing is necessary, it would be a feasible, less expensive method of testing this and other reflective structures in the future.

Figure 2.9: Impedance tube in situ testing of IH-30 retaining wall

All of the research conducted supported an A + B spec with a bonus being awarded for achieving a 2 or more dBA noise reduction vs. the baseline measurements. The bonus measurements will be repeated at the same locations used for the baseline measurements to determine the NLR after the wall retrofitting is completed. After receiving CTR recommendations, TxDOT established two levels of bonuses, the first one being from 1.5 to 2.5 dBA in NLR, with the highest one set for 2.5 dBA or above.

2.3 Conclusion

On March 23, 2011, the Pre-Bid Conference for the noise-reduction wall was held in Dallas. The estimated cost for the noise-reduction material and installation is $1,538,108. The bonuses for the contractor were presented during the meeting, set according to Table 2.2.

Table 2.2: Incentive payments according to the NLR established in the specification

Noise Level Reduction (NLR) dBA	Payment Amount
NLR < 1.5 dBA	$0
1.5 dBA ≤ NLR < 2.5 dBA	$150,000
NLR ≥ 2.5 dBA	$450,000

By the end of April, TxDOT had selected a contractor to perform the work: Massana Construction, based in Atlanta, Georgia. Massana has hired Empire Acoustical Systems, based in Round Rock, to provide the noise-absorptive material for the covering of the wall.

On June 7 and 8, the acoustical contractor conducted the test to establish the noise reflectivity of the retaining wall on the north side of IH 30 before the absorptive material is placed, following the procedure described in previous paragraphs. After the test concluded and the results were processed, the baseline noise level for the test was determined as 81.08 dBA, considering the 250, 500, 1000, and 2000 Hz frequency band contributions. The same test methods and analysis procedures will be used to evaluate the wall after the application of sound absorbing materials, and the NLR value will be provided for consideration by TxDOT.

According to TxDOT's preliminary timeline, construction is expected to start around mid-September 2011.

Chapter 3. Statistical Analysis of TxCAP and Its Subsystems

3.1 Introduction

Task 11: Statistical Analysis of TxCAP and its Subsystems

The objective of this task was to conduct statistical analyses of the data used by TxDOT to develop TxCAP scores, and to recommend a sample size of the TxCAP system, including the PMIS, TxMAP, and TxTAP sub-systems, with reasonable estimates of the likely levels of variance in the data. Following is the technical memorandum submitted by the research team.

Statistical Analysis of TxCAP and Its Subsystems
Authors: Zhanmin Zhang and Abdus Qazi

3.1.1 Background

Transportation engineers face increasing challenges every day to ensure that the transportation infrastructure is maintained at its highest possible level with limited funds. In order to address this challenge, engineers need to develop monitoring programs that can be used to evaluate the maintenance process and needs in terms of performance and cost. A few highway agencies have developed systems to collect and analyze the condition of the highway infrastructure through inventory. Such systems can be broadly categorized as Maintenance Quality Assurance (MQA) programs for in-house maintenance (Gharaibeh et al. 2010). These systems also allow the agencies to utilize the benefits of Performance-Based Maintenance Contracts (PBMC) (Gharaibeh et al. 2010, de la Garza 2008). The highway system performance not only depends on the individual performance of pavements and bridges but also on the combined interactive "function" of the pavement component, traffic component (mainly traffic control devices), and roadside component. Each of these components or subsystems functions differently and has different maintenance requirements. To be able to evaluate the overall performance of the network, highway agencies need a system to comprehensively plan, measure, and manage the highway system. Such an assessment program/system must be able to organize infrastructure inventory, assess conditions, set minimum acceptable condition levels, and establish condition targets (NCHRP 608). Over the past few years, TxDOT has introduced a combination of systems that allows TxDOT to achieve this objective.

Texas has the largest state-maintained highway system in the United States with over 195,000 highway lane-miles (Peddibhotla 2010, TxDOT 1994). The highway system can be broadly classified into three distinct parts: the pavement system, the roadside system, and the traffic control system. TxDOT uses TxCAP and its three subsystems to measure and compare the overall road maintenance conditions among all 25 TxDOT Districts. The three subsystems include PMIS, which scores the condition of pavement; TxMAP, which evaluates many roadside conditions; and TxTAP, which evaluates the condition of traffic control devices and other traffic elements (TxDOT 2009). TxCAP combines information from PMIS, TxMAP, and TxTAP to get an overall picture of the condition of state roads. TxCAP and its subsystems should not only provide TxDOT officials a tool to evaluate the maintenance needs of the roadway network and the implications of different performance goals using the performance-based budget selection process, but also offer a means to clearly communicate to its key customers, including the public, the impact of policy and budget decisions on program service delivery.

3.1.2 Problem Definition

TxCAP provides a comprehensive assessment of the Interstate and Non-Interstate highway system. However, the scores for each of the subsystems are based on data of different sample sizes, accuracy, and levels of variations. This system raises concerns about whether the use of TxCAP is an effective and consistent means to measure the TxDOT roadway maintenance, or perhaps needs to be evaluated. One of the concerns is whether the difference between the scores of two districts is a true difference or a measurement error. In order to determine if the difference between any two scores is a true difference (statistically significant), statistical analyses of TxCAP and the data used to develop the TxCAP scores, i.e., each of the subsystems, have to be conducted.

3.1.3 Research Objectives

The main objective of this research is to conduct a statistical analysis on TxCAP and its subsystems. This research objective can be detailed as follows:

1) Determine if enough data is provided in the sample size and the patterns revealed through analysis of the data collected;
2) Determine the current level of statistical significance of the current TxCAP system by analyzing the current sample size and level of statistical significance of the subsystems (PMIS, TxMAP, and TxTAP).
3) Provide the recommended sample size of the TxCAP system including the subsystems with reasonable estimates of the likely levels of variance in the data from pre-existing data.

3.1.4 Literature Review: TxCAP and Its Subsystems

In order to maintain the asset items at a desirable level or standard, road administrators need to design a performance monitoring process. In fiscal year 2007, TxDOTss began revising the process by which the Department assesses the condition of the state's Interstate and Non-interstate highways. The process, which is known as TxCAP, combines data from PMIS, TxMAP, and TxTAP. As a result, TxCAP provides a more comprehensive assessment of the Interstate and Non-Interstate highway system (TxDOT 2009).

PMIS is an automated system for storing, retrieving, analyzing, and reporting pavement condition information such as distress, ride quality, deflection, and skid resistance data. It can be used to retrieve and analyze pavement information to compare maintenance and rehabilitation treatment alternatives, monitor current pavement condition, and estimate total pavement needs. The annual PMIS survey currently consists of three separate surveys: visual evaluation, ride quality, and skid resistance.

TxMAP evaluates the overall condition for the Interstate and Non-Interstate highway systems. Under TxMAP a visual inspection of 23 elements of the highway system is carried out in 3 different areas: pavement, roadsides, and traffic operations for each 1-mile segment in both directions (unless the segment is on a divided highway, in which case the segment is evaluated in

1 direction and so noted). Four full-time TxMAP employees perform the evaluations with assistance from district personnel. TxMAP inspections evaluate 10% of the interstate highway and 5% of all other highways in the state system.

TxTAP is a tool used by the department to evaluate the uniformity, quality, and consistency of traffic control devices on the state highway system. TxTAP evaluates traffic control devices across the state such as signs, work zones, railroad crossings, and other traffic elements. Evaluating every traffic control device is not feasible in terms of available resources; therefore, TxTAP scores are based on a relatively small sample of all traffic control devices. TxDOT's Traffic Operations Division conducts the annual evaluation in each of TxDOT's 25 field districts. Each district review consists of 20–30 randomly selected segments of the state highway system, 5–16 signalized intersections, 3–4 work zones, and 2–6 railroad crossings.

The development of TxCAP eliminates duplication of the three separate scoring systems and provides a simplified and concise scoring system. The ratings and descriptions of the numerical grading system are based on a five-point system. The 5-point system then is converted to a 100-point system by multiplying each rating by 20 (CTR 2010). The resulting score is then weighted to determine the overall score for each subsystem. Each subsystem's overall score is then weighted according to appropriate TxCAP value to obtain a total composite score for the entire roadway system (PBS&J 2009).

One of the most important areas in the performance monitoring process is inspections conducted in the field. Field inspections need to be carefully planned and monitored in order to ensure that the data collected is representative of the population being studied. The Virginia DOT developed their Maintenance Quality Evaluation (MQE) program to provide an evaluation of Virginia's Interstate, primary, and secondary highway systems. The MQE qualitatively assesses the level of maintenance for flexible and rigid pavements, stabilized roadways, roadway shoulders, drainage, traffic control and safety, roadside, and structures. One of the objectives of the MQE was to develop a formal process for assuring consistent levels of service statewide. Under this program, all 45 sub-elements (characteristics) of the 8 major maintenance elements had to be inspected. To create a feasible and valid representation of the entire roadway system, the MQE researchers adopted a random sampling procedure from the Florida DOT that evaluates each of the three highway systems separately. Initially, a pilot sample of each system was carried out to determine a representative "failure rate," from 50 randomly selected sites. "Failure rate" was defined as the percentage of sites that did not meet the desired level of service according to the Maintenance Condition Standards. These standards were developed separately by experienced highway engineers as part of this program. Using the failure rate, an estimate of centerline miles, a desired 95% confidence level, and a chosen precision rate of 4%, the sample size for the each highway system was obtained using this formula:

$$n = \frac{Z^2 \times N \times p(1-p)}{(A^2 \times N) + (Z^2 \times p(1-p))}$$

This formula would provide the sample size needed for a specific confidence level and a specific precision rate to arrive at a statistical conclusion of center-lane mileage for that particular highway system. The sampling section size was arbitrarily set to 0.1-mile of roadway. Each sample site was manually inspected by a team of two individuals. The team recorded if the actual condition met the desired standard or not. The MQE development process also included a validation process; 200 sample sites were surveyed by a task force team of 6 highly experienced maintenance field managers. The task force was also asked to assign weights to each of the characteristics. "What if" analyses were conducted on the survey results from the validation process to determine an overall numerical value for the site, which would show whether the roadway section was within maintenance policy. The task force determined that the maintenance level of service should be 80 on the Interstate and primary system and 75 on the secondary highway system (Kardian and Woodward 1990).

Researchers at Virginia Polytechnic Institute and State University have also developed a statistical sampling process (de la Garza et al 2008). In this study, the authors developed a three-stage, seven-step sampling procedure that discusses the characteristics of performance-based, road maintenance evaluations—namely, the issues pertaining to population, sample units, and performance targets. The authors stratified the population by urban and rural settings. Sample units have been defined as equal sections along the roadway to be randomly selected and observed. The authors also considered the effect of asset items within each sample unit. For example, a 0.1-mile road segment is a sample unit but it might contain assets like ditches, shoulder, and pipes that other samples may not contain. Thus, all sample units are not the same as they do not contain the same assets. The sampling mechanism used in this study is called "sampling proportional to size." This study considers a binary population scenario in which the measurement can take only values 0 or 1. A binary population is considered because an asset item within a sample unit either meets the performance criteria or not. The sampling procedure works well for a binary population where the individual asset items are not scored on a scale. This sampling process may not be applicable in the case of maintenance evaluations where each item is scored on a scale.

Many statistical methods are available for determining the sample size, such as the Bootstrap method, the Assume Normal-Pool Variance method, the Noether method, and the Risk-based method. Zhang et al. have conducted a detailed study on determining the sample size and the factors that affect it with respect to the testing of construction materials used by TxDOT (Zhang 2001). The materials analyzed in this study belong to the following areas: asphalt concrete, concrete for pavements, concrete for structures, subbase and base courses, and treated subbase and base courses. This study selected the Risk-based method for determining the optimal sample size as it is most commonly used and for its effectiveness and ease of understanding. In this method, the risk is determined by the probability of making a hypothesis testing error, i.e., both Type I and Type II error, and tolerable error (Zhang 2001, AASHTO 1996). The study derives and establishes the formula to determine the sample size in relation to hypothesis testing. It also discusses the relationship between the sample size and the other parameters involved. The required sample size depends on the following parameters: 1) variability of the characteristic being measured, 2) the risk that a state DOT is willing to take, 3) the risk that a contractor is willing to take, and 4) the margin of error that the involved parties are willing to accept. This study also includes some discussion on the cost of testing and on the trade-off between material testing costs and sample size, particularly cost due to failure. A detailed sensitivity analysis was also conducted to demonstrate the sensitivity of the sample size to each of the parameters. The study found that the adequate sample size obtained can be related to a level of risk for both parties involved. In this study the probability of making Type I error (α) was defined as the contractor's risk and the probability of making a Type II error (β) was defined as owner's/agency's risk. The analysis revealed that the sample size increases as the standard deviation of the property of the material being tested increases, and decreases as the tolerable error increases. The sample size also increases as the contractor's risk (α) and agency's risk (β) are lowered. The study further compares the current sample size used by TxDOT and determines how the risk of accepting poor materials by TxDOT can be defined. This process can be adopted and used to define the "risk" of making an incorrect judgment/conclusion for a hypothesis. Finally, the authors discuss the process of implementing the lessons learned and the possible areas of implementation (Zhang 2001).

3.2 Methodology

3.2.1 Determination of Sample Size

It is a generally recognized statistical rule that the accuracy of the estimated mean value of a population increases as the number of samples taken from the population increases (Zhang 2001). One important factor that affects the accuracy of the mean is the error that may occur due to insufficient sampling. This section discusses the methodology used to determine the minimum sample size and the factors that affect it. The sample size largely depends on the two errors associated with hypothesis testing. First, the two types of errors are defined, followed by the derivation of the formula for the minimum sample size. The methodology used for sample size calculation in this study was adopted from Zhang 2001, Devore 2004, and Walpole et al. 2011.

Type I Error

The Type I error is the most commonly considered error in hypothesis testing. This error, usually denoted as α, is the probability of rejecting a null hypothesis when it is actually true. In other words, it is the error of observing a difference when in truth there is none, thus indicating a test of poor specificity. A Type I error can be viewed as the error of excessive credulity.

Type II Error

The second error that may occur during hypothesis testing is the Type II error. Type II error, usually denoted as β, is the probability of failing to reject a null hypothesis when it is in fact not true. In other words, this is the error of failing to observe a difference when in truth there is a difference, thus indicating a test of poor sensitivity. Type II error can be viewed as the error of excessive skepticism.

In order to help avoid making a Type II error, statisticians have introduced the concept of power. The power of a statistical test, denoted as $(1 - \beta)$, is the probability that the test will reject the null hypothesis when the alternative hypothesis is true, i.e., the probability of not making a Type II error. Thus, the chance of making a Type II error decreases as the power increases.

Required Sample Size for Hypothesis Tests

A common problem facing statisticians is calculating the sample size required to yield a certain power for a test, for a predetermined Type I error (α). This error (α) is also known as producer's risk. A typical example for this is as follows:
Let $X_i, i = 1, 2, \ldots, n$ be independent observations taken from a normal distribution with unknown mean μ and known variance σ^2. For some smallest significant difference, $e > 0$, the following two hypotheses are constructed, a null hypothesis:

$$H_0: \mu = 0 \tag{3.1}$$

and an alternative hypothesis:

$$H_a: \mu \geq e \tag{3.2}$$

The smallest significant difference, e, is the smallest value recorded as a difference. In other words, if the difference between the two mean values is smaller than e then the two values are taken to be the same. Now, in order to (1) reject H_0 with a probability of at least $(1-\beta)$ when H_a is true, i.e., a power of $(1-\beta)$, and (2) reject H_0 with probability α when H_0 is true, α can be expressed as follows.

If z_α is the upper α percentage point of the standard normal distribution, then α can be expressed as

$$P\left(\bar{x} > \frac{z_\alpha\, \sigma}{\sqrt{n}} | H_0 \text{ true}\right) = \alpha \tag{3.3}$$

and so reject H_0 if the sample average $\bar{x}$ is more than $z_\alpha \sigma/\sqrt{n}$, which is a decision rule that satisfies criteria (2). It should be noted that this is a one-tailed test.

In order to satisfy criteria (1) when H_a is true, the following relationship is required:

$$P\left(\bar{x} > \frac{z_\alpha\, \sigma}{\sqrt{n}} | H_a \text{ true}\right) \geq 1 - \beta \tag{3.4}$$

Through careful manipulation, it can be shown that this occurs when

$$n \geq \left(\frac{\Phi^{-1}(1-\beta) + z_\alpha}{\frac{\mu^*}{\sigma}}\right)^2 \tag{3.5}$$

where Φ is the normal cumulative distribution function. Generally, two approaches can be adopted to calculate the sample size using the results above:

- control the Type I error only
- control both the Type I and Type II errors.

Controlling Type I Error

When only the Type I error is of concern, the following three steps should be carried out to calculate the desired sample size.

1) Specify the Tolerable Error.

The engineer must determine the level of precision needed. The desired precision is often expressed by probability in absolute terms, as

$$P(|\bar{y} - \bar{y}_{\mu}| \leq e) = 1 - \alpha \tag{3.6}$$

where:

$\bar{y}$ = Sample mean
$\bar{y}_{\mu}$ = Population mean
α = Type I error
e = Tolerable error or margin of error

The engineer must select a reasonable value for α and e. To achieve the desired relative precision, the precision may be expressed as

$$P\left(\left|\frac{\bar{y} - \bar{y}_{\mu}}{\bar{y}_{\mu}}\right| \leq e\right) = 1 - \alpha \tag{3.7}$$

2) Find an Equation Relating the Sample Size, *n*.

The simplest equation relating the precision and sample size comes from the confidence interval. To obtain absolute precision, the value of n must satisfy

$$e = \frac{Z_{\alpha/2}\sigma}{\sqrt{n}} \tag{3.8}$$

Solving for n,

$$n = \frac{\left(Z_{\alpha/2}\right)^2 \sigma^2}{e^2} \tag{3.9}$$

where:

n = Sample size
$Z_{\alpha/2}$ = The $(1 - \alpha/2)^{th}$ percentile of the standard normal distribution
σ = Standard deviation
e = Tolerable error.

3) Adjust the Sample Size, *n*.

The equations presented before, Equation (3.1) to Equation (3.9), are based on asymptotic theory (as the sample size goes to infinity). In the case under consideration the sample size is finite and, therefore, the sample size n should be adjusted for a sample size, n, that is not infinite. The adjusted sample size is given by Equation (3.10).

$$n_{\alpha} = \frac{n}{1 + n/N} \tag{3.10}$$

where:

n = Adjusted sample size

n = The sample size which ignores the finite population correction (FPC)

N = Population size.

Controlling Both Type I Error and Type II Error

When both the Type I and Type II error are concerned, the following steps should be taken to obtain the sample size.

1) Calculate Type II Error Probability.

Calculation of β can be very difficult for some statistical tests, but the Z test can be used to demonstrate both the calculation of β and the logic employed in selecting the sample size for a test.

For the test of $H_0: \mu = \mu_0$ against $H_a: \mu < \mu_0$, it is only possible to calculate Type II error probabilities for any given specific point in H_a. Suppose $\mu = \mu_0 - e$, then the power of this test can be expressed as:

$$1 - \beta = P(\bar{X} < a, \text{when } \mu = \mu_0 - e) \quad (3.11)$$

The probability of a Type II error, β, is

$$\beta = P(\bar{X} > a, \text{when } \mu_a = \mu_0 - e) \quad (3.12)$$

$$\beta = P\left(\frac{\bar{X} - (\mu_0 - e)}{\sigma/\sqrt{n}} > \frac{\bar{a} - (\mu_0 - e)}{\sigma/\sqrt{n}}, \text{when } \mu_a = \mu_0 - e\right) \quad (3.13)$$

In this equation $\frac{\bar{X} - (\mu_0 - e)}{\sigma/\sqrt{n}} = Z$ and, therefore, μ_a has an approximately standard normal distribution and the probability β can be determined by finding an area under a standard normal curve.

2) Find an Equation Relating the Sample Size, *n*.

Suppose the test is $H_0: \mu = \mu_0$ against $H_a: \mu < \mu_0$. If the desired values of α and β are specified, the sample size for controlling both Type I error and Type II error can be expressed as

$$n = \frac{(Z_\alpha + Z_\beta)^2 \sigma^2}{e^2} \quad (3.14)$$

where:

n = Sample size

α = Type I error

β = Type II error

Z_α = The $(1 - \alpha)^{th}$ percentile of the standard normal distribution

Z_β = The $(1 - \beta)^{th}$ percentile of the standard normal distribution

σ = Standard deviation

e = Tolerable error

It should be noted that Equation (3.14) gives the sample size for a one-tailed test.

Sample Size of Each Subsystem Given α, β, *and* e

From earlier discussions, it is observed that the sample size is a function of the Type I error (α), the Type II error (β), the tolerable error (e), and the standard deviation (σ). In fact, in Equation (3.14) the Type I and Type II error are incorporated as the confidence level ($1-\alpha$) and statistical power ($1-\beta$) respectively. The confidence level and power are used to determine Z_α and Z_β respectively. This indicates that the lower the Type I error, the higher will be the confidence level. Similarly, the smaller the Type II error, the greater will be the statistical power. From Equation (3.14) it can be observed that the higher the confidence level desired, the larger the required sample size. For a fixed value of α and holding other parameters constant, the smaller the Type II error (greater power), the larger the required sample size. The required sample size, n, is proportional to the variance (σ^2). Thus, for samples with large variability, a larger sample size is required to obtain a result, keeping other parameters fixed. The required sample size (n) is inversely proportional to the square of tolerable error (e), i.e., if the allowable error is to be kept small, a large sample size is needed and increases in the order of the square of e.

Comparison of Mean Values

In this section, the methodology for comparing performance scores across two districts or across two time periods is discussed. This comparison will determine whether the scores are significantly different from each other. The *t*–test will be used to compare the mean scores of TxCAP, and its subsystems: TxTAP, TxMAP, and PMIS. The results of the *t*-test can be utilized in two ways. The comparisons can be made either at a specific level of confidence to obtain the hypothesis results or the level of confidence can be determined at which the two scores are significantly different from each other.

Using t*-test*

The TxCAP score is a weighted average of the scores of its three components. The TxCAP score for each district is calculated from its components' scores using the following formula:

$$\text{TxCAP} = (0.5 \times \text{PMIS}) + (0.25 \times \text{TxMAP}) + (0.25 \times \text{TxTAP}) \qquad (3.15)$$

The PMIS, TxMAP, and TxTAP scores are calculated for each of the randomly selected survey sections within a district. Equation (3.15) is used to calculate the corresponding TxCAP score for each of the surveyed sections. The average of the section scores gives the average score for that district. The average scores of all the districts for the 3 years in the analysis period are provided in Appendix A.

The standard deviation of the mean TxCAP score is then calculated using the following formula:

$$s_{\text{TxCAP}} = \sqrt{(0.5^2 \times s_{\text{PMIS}}^2) + (0.25^2 \times s_{\text{TxMAP}}^2) + (0.25^2 \times s_{\text{TxTAP}}^2)} \qquad (3.16)$$

where:

s_{PMIS}^2 = The variance of the PMIS scores
s_{TxMAP}^2 = The variance of the TxMAP scores

s^2_{TxTAP}= The variance of the TxTAP scores.

In this study two sample comparisons were conducted. The scores for two districts are compared using the *t*-test. The test used in this study assumes that the two population variances are different and the sample sizes are also expected to be different. The *t*-statistic, for samples of different sizes and variance, can be calculated as follows:

$$t = \frac{\overline{X_1} - \overline{X_2}}{s_{\overline{X_1}-\overline{X_2}}} \qquad (3.17)$$

where:

$\overline{X_1}$ = The mean TxCAP score of district 1;
$\overline{X_2}$ = The mean TxCAP score of district 2 and

$$s_{\overline{X_1}-\overline{X_2}} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \qquad (3.18)$$

where:

$s_{\overline{X_1}-\overline{X_2}}$ = Combined Standard deviation
s^2= Unbiased estimator of the variance of each of the two samples
n = Sample size.

The corresponding degrees of freedom (D.F.) are calculated using:

$$D.F. = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\left[\left(\frac{s_1^2}{n_1}\right)^2/(n_1 - 1)\right] + \left[\left(\frac{s_2^2}{n_2}\right)^2/n_2 - 1\right]} \qquad (3.19)$$

Equations (3.20), (3.21), and (3.22) form the basis of the statistical tests to determine which pairs of district scores are significantly different from each other. Some details of the procedure followed are mentioned in the next section.

3.3 Case Study with TxDOT Data

3.3.1 Data Description

In order to evaluate the effectiveness and consistency of the current TxCAP system, a case study was carried out using a dataset containing data from all 25 districts spanning a period of 3 years: 2008, 2009, and 2010. The dataset consisted of scores of the elements under each of the three subsystems as well as the calculated PMIS, TxTAP, and TxMAP scores for each surveyed section within each district. The elements under each of the subsystems are detailed in Figure 3.1 (PBS&J 2009, CTR 2010). The TxCAP score for each section was calculated using Equation (3.15). The respective district scores were obtained by averaging the scores of the sections surveyed in that year. The average of the scores for all districts gave the mean score for the state.

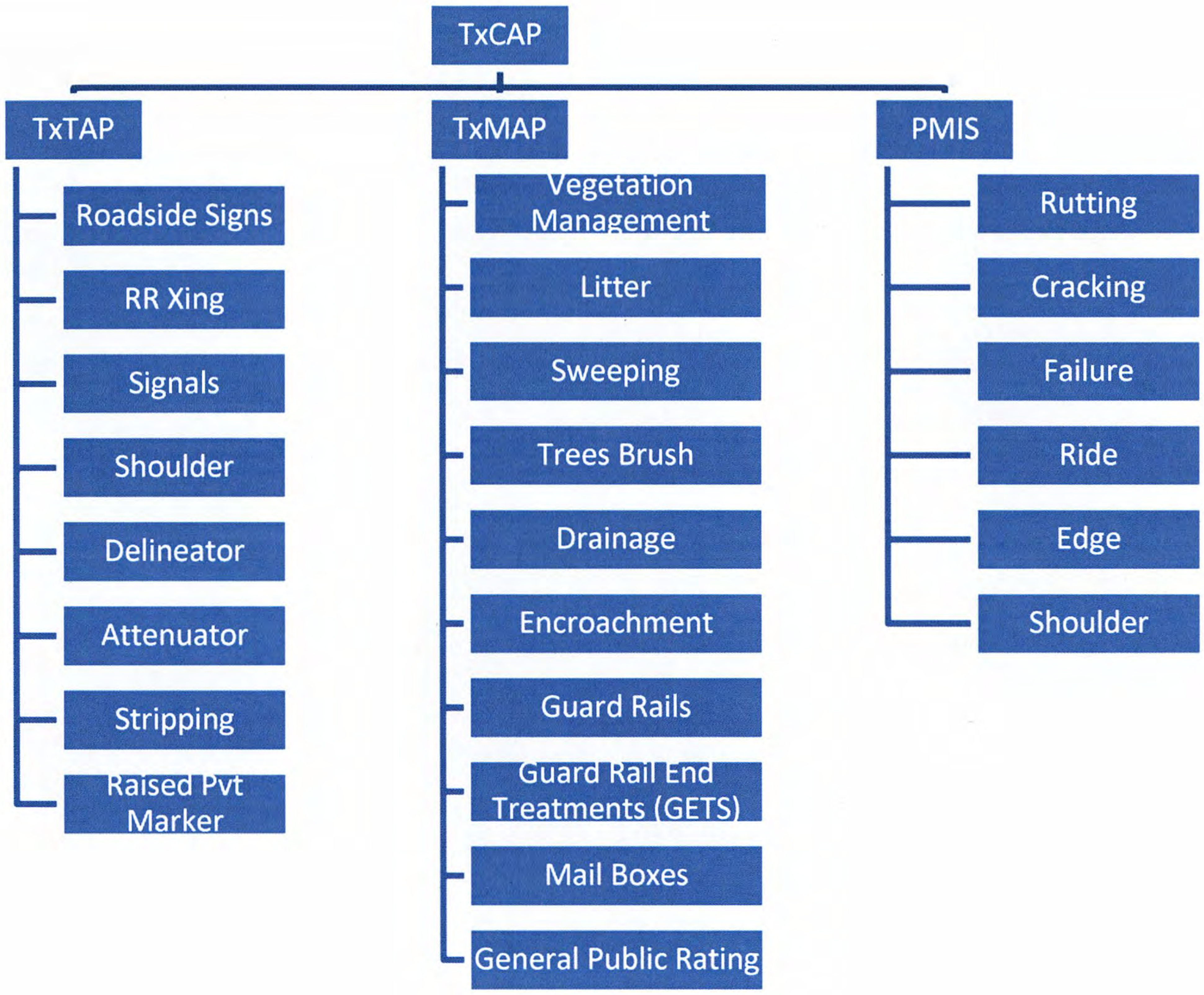

Figure 3.1: Elements of the subsystems in TxCAP

In order to obtain a preliminary idea about the sample data, the mean and the standard deviation of each sample (district) were calculated. An overview of the entire state over the 3 years is presented in this section. The mean and the standard deviation of the subsystem scores, for the entire state over the 3 years, are shown in Table 3.1. A more detailed summary of the scores, for the period under consideration, is provided in Tables A1 through A4 in Appendix A. A list of the districts ranked by each score is presented in Table A5. This table gives a qualitative idea about the performance of the districts relative to each other and the relative changes in performance over the 3 years under consideration.

Table 3.1: Overview of case study data

	PMIS		TxTAP		TxMAP		TxCAP	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
2008	77.80	11.111	79.48	12.243	81.24	9.004	79.13	8.869
2009	74.75	9.176	78.55	10.202	78.92	7.189	76.76	7.189
2010	76.52	8.874	80.10	10.170	79.93	6.844	78.26	6.908
Combined	76.34	9.838	79.37	10.919	80.02	7.763	77.86	7.981

3.3.2 Sample Size Calculation for Each Subsystem Score

Hypothesis testing and decision errors are crucial concepts in determining sample size. When testing hypotheses, there are two possible sources of errors: Type I error and Type II error. In many instances, only Type I error is considered. The probability of a Type I error is denoted by α and is also known as the level of significance. This case study aims to control both Type I and Type II errors when determining the required sample size.

Sample Size when Type I and Type II Error are Controlled

A risk-based statistical approach was used with the aim of conducting tests to achieve a certain standard of quality. The theoretical discussion and derivation of the formula have been presented in the previous chapter. In this chapter the objective is to identify significant differences. In other words, a two-tailed test needs to be conducted. Because both Type I and Type II errors should be controlled when determining the required sample size, the minimum sample size (considering a two-tailed test) was calculated using the following formula:

$$n = \frac{\left(Z_{\alpha/2} + Z_{\beta}\right)^2 \sigma^2}{e^2} \tag{3.20}$$

where:

n = Sample size of subsystem
α = Type I error
β = Type II error
$Z_{\alpha/2}$ = The $(1-\alpha/2)^{th}$ percentile of the standard normal distribution
Z_{β} = The $(1-\ \beta)^{th}$ percentile of the standard normal distribution
σ^2 = Variance of subsystem scores
e = Tolerable error.

An examination of the formula indicates that α, β, e, and σ^2 affect the sample size. The variance, σ^2, is estimated from the inventory data currently available. The sample sizes were calculated for different combinations of $\alpha, \beta,$ and e. Different sample sizes have correspondingly different risk levels (Zhang 2001). The risk level includes the α risk, β risk and the risk associated with e. Table 3.2 shows a portion of the sample size calculations as an example, presenting the sample size calculation for PMIS for different combinations of α and β for e = 0.5 only. Similar tables were created for each value of e chosen for PMIS. The complete set of tables, covering the different combinations of the parameters for the three subsystems, is provided in Tables C1 through C3 in Appendix C.

Table 3.2: Sample size for PMIS for *e* = 0.5

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	76.34	8380	6105	5039	3885
97	σ =	9.838	6852	4812	3871	2869
95	e =	0.5	6105	4190	3315	2393
90			5039	3315	2543	1745

Determination of Tolerable Error, e

The tolerable error is defined as the maximum difference at which the decision-maker is willing to conclude that two comparing scores are the same. Different values of the tolerable error have been mentioned in literature and are determined, in most cases, from experience or by expert judgment. This study also attempted to determine a suitable estimate of the tolerable error from the data available. Because no standards were available for the maximum difference at which the decision-maker is willing to conclude that the scores are same, an attempt was made to determine distribution of the differences between the scores. A histogram of the differences between the mean scores was developed for each subsystem. The histograms showing the distributions of these differences are presented in Figures B1 through B4 in Appendix B. The figures also show the mean value of the differences between the scores for each of the subsystems. The mean of the differences was used to obtain a reasonable estimate of the tolerable error (*e*). Based on these mean values, suitable values of the tolerable error were selected to calculate the required sample size. Table 3.3 summarizes the information presented in the histograms, i.e., the mean value of the differences, and also lists the tolerable error values used in the study. The calculation of the tolerable errors was based on 3 years of combined data.

Table 3.3: Estimated values of tolerable error

Subsystem	Mean value of absolute differences	Tolerable errors (*e*) used for calculation
TxTAP	3.61	0.5, 1, and 2
TxMAP	2.92	0.5, 1, and 2
PMIS	3.61	0.5, 1, and 2

3.3.3 Comparison of Scores

This section discusses the comparison of the performance scores to determine a statistically significant difference. The discussion includes the test assumptions, hypothesis, and the steps carried out. The *t*-test was conducted in a similar manner for each of the scores. Two approaches were used in analyzing the results. In the first approach, the comparison/hypothesis test was carried out for a predetermined level of confidence. In the second approach, the current level of confidence was calculated, which will be discussed later.

Assumptions for the t*-test*

The scores for TxCAP and its subsystems are mean values calculated for each district for a particular year. The *t*-test can be used for comparing means of two samples from the same population as well as for samples from two different populations. In this study, each district was considered as a separate population with a different size and different variance. This is recognized from the values of the district score variances, which are mentioned in Table A1, Table A2, and Table A3 in Appendix A. Considerable variation exists in the variances of the scores among the districts and, therefore, it is not reasonable to consider all the districts as one population with uniform variance.

Hypothesis for the t*-test*

The following null hypothesis has been constructed to determine whether the difference between the scores for any two districts is a true difference. The null hypothesis was defined such that the mean scores of any two districts are equal. In notation form, the null hypothesis for TxCAP can be stated as follows:

$$H_0: \bar{X}_{TxCAP,1} = \bar{X}_{TxCAP,2} \qquad (3.23)$$

and the alternative hypothesis as

$$H_a: \bar{X}_{TxCAP,1} \neq \bar{X}_{TxCAP,2} \qquad (3.24)$$

where:

$\bar{X}_{TxCAP,1}$ = is the mean TxCAP score for district 1
$\bar{X}_{TxCAP,2}$ = is the mean TxCAP score for district 2

Another equivalent representation of the hypothesis is as follows:

$$H_0: \left|\bar{X}_{TxCAP,1} - \bar{X}_{TxCAP,2}\right| = e \qquad (3.25)$$

and the alternative hypothesis as

$$H_a: \left|\bar{X}_{TxCAP,1} - \bar{X}_{TxCAP,2}\right| > e \qquad (3.26)$$

where:

e =Tolerable error.

The two possible outputs of the hypothesis test are either "reject H_0" or "fail to reject H_0." If the test results reject the null hypothesis then it can concluded that the scores are statistically different and there exists a true difference between the scores. If the *t*-test results fail to reject the null hypothesis, then it can be concluded that the scores are not statistically different. In such a case, the scores of the two districts may be the same or appear different due to variability in measurement (measurement error). The same null and alternate hypothesis was followed in the comparison of the PMIS, TxTAP, and TxMAP scores.

Obtaining results from the t*-test*

The first step in conducting the *t*-test was creating a 25×25 matrix of the score differences. A sample of this matrix is shown in Table D1 in Appendix D. This is a symmetric matrix and either the upper triangle or lower triangle can be used for inference. In the next step the combined standard deviation was determined for each of the 300 combinations of district-pairs from the variance of the score and the sample size of the corresponding districts using Equation (3.18), an example of which is shown in Table D2. Using the matrix of differences and the combined standard deviation, the *t*-statistics are computed and compared with the critical *t*-statistics for a particular significance level. In the first part of the study, a 5% significance level or 95% level of confidence was chosen in accordance with common practice. A *t*-statistic greater than the critical *t*-statistic indicated that the null hypothesis can be rejected, indicating that the mean scores of the two districts are significantly different. Table 3.4 shows a sample of the results of a two-tailed *t*-test at a 95% level of confidence for the TxCAP scores for 2010. The results of the *t*-test on all four systems for the four time periods of study are presented in the tables in Appendix E.

Table 3.4: *t*-test results for TxCAP for 2010 at 95% level of confidence

District		WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
	Mean	74.08	75.76	76.05	76.05	76.08	76.11	76.52	76.89	77.43	77.99	78.25	78.45	78.46	78.47	79.04	79.13	79.30	79.38	79.45	79.61	79.89	80.40	81.30	81.59	82.25
WFS	74.08		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	75.76	Yes		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	76.05	Yes	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	76.05	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	76.08	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	76.11	Yes	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	76.52	Yes	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	76.89	Yes	No	No	No	No	No	No		No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	77.43	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	77.99	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	78.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
LBB	78.45	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
AUS	78.46	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
LRD	78.47	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
YKM	79.04	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
AMA	79.13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
ATL	79.30	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
LFK	79.38	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes
CRP	79.45	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes
SJT	79.61	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes
SAT	79.89	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	Yes	Yes	Yes
BRY	80.40	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	Yes
ODA	81.30	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No
ELP	81.59	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No
BMT	82.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	

More information can be derived from these responses by clustering the "No" responses together into groups as shown in Table 3.4. In order to obtain this additional information, the districts must be sorted by the mean scores. In this study the districts were arranged in ascending order. The "No" responses can be clustered in multiple ways and no unique method for forming the groups was found. In addition, the groups were made as large as possible to keep the number of groups at a minimum. The results are discussed in more detail in the next section.

3.4 Determination of Level of Confidence

The method of comparison described in the previous section is limiting in the manner that the inferences can be made for a chosen level of confidence. The following approach relaxes this limitation. Using the *t*-statistic, an attempt was made to determine the probability that the two samples are likely to come from the same two underlying populations. This method has the flexibility of choosing any level of confidence for comparing the district scores, which eliminates the need to compare the *t*-statistics to different critical *t*-values corresponding to different levels of confidence. Table 3.5 shows the level of confidence at which the mean TxCAP scores are significantly different for the year 2010. In Table 3.5, the cells highlighted correspond to an 80% level of confidence. A more detailed discussion of the Level of Confidence tables is presented in the next section.

Table 3.5: Level of confidence for TxCAP scores for 2010

		WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
	Mean	74.08	75.76	76.05	76.05	76.08	76.11	76.52	76.89	77.43	77.99	78.25	78.45	78.46	78.47	79.04	79.13	79.30	79.38	79.45	79.61	79.89	80.40	81.30	81.59	82.25
WFS	74.08	0%	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	75.76	99%	0%	33%	32%	38%	37%	76%	91%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	76.05	99%	33%	0%	0%	4%	6%	48%	74%	88%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	76.05	99%	32%	0%	0%	4%	6%	47%	72%	87%	99%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	76.08	99%	38%	4%	4%	0%	3%	46%	73%	87%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	76.11	99%	37%	6%	6%	3%	0%	39%	66%	83%	98%	99%	100%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CHS	76.52	100%	76%	48%	47%	46%	39%	0%	40%	71%	97%	98%	100%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WAC	76.89	100%	91%	74%	72%	73%	66%	40%	0%	45%	88%	93%	98%	94%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	77.43	100%	95%	88%	87%	87%	83%	71%	45%	0%	49%	64%	78%	72%	73%	93%	95%	96%	97%	98%	99%	100%	100%	100%	100%	100%
BWD	77.99	100%	100%	99%	99%	99%	98%	97%	88%	49%	0%	29%	54%	45%	47%	87%	91%	93%	95%	96%	98%	100%	100%	100%	100%	100%
TYL	78.25	100%	100%	100%	99%	100%	99%	98%	93%	64%	29%	0%	23%	20%	21%	71%	77%	83%	86%	88%	94%	98%	100%	100%	100%	100%
LBB	78.45	100%	100%	100%	100%	100%	100%	100%	98%	78%	54%	23%	0%	1%	2%	63%	71%	78%	83%	86%	93%	98%	100%	100%	100%	100%
AUS	78.46	100%	100%	100%	99%	100%	99%	98%	94%	72%	45%	20%	1%	0%	1%	52%	59%	68%	73%	76%	85%	94%	98%	100%	100%	100%
LRD	78.47	100%	100%	100%	100%	100%	99%	99%	95%	73%	47%	21%	2%	1%	0%	52%	60%	69%	74%	77%	86%	94%	99%	100%	100%	100%
YKM	79.04	100%	100%	100%	100%	100%	100%	100%	100%	93%	87%	71%	63%	52%	52%	0%	10%	27%	35%	42%	58%	79%	94%	100%	100%	100%
AMA	79.13	100%	100%	100%	100%	100%	100%	100%	100%	95%	91%	77%	71%	59%	60%	10%	0%	18%	27%	34%	52%	75%	93%	100%	100%	100%
ATL	79.30	100%	100%	100%	100%	100%	100%	100%	100%	96%	93%	83%	78%	68%	69%	27%	18%	0%	9%	16%	34%	61%	87%	100%	99%	100%
LFK	79.38	100%	100%	100%	100%	100%	100%	100%	100%	97%	95%	86%	83%	73%	74%	35%	27%	9%	0%	7%	25%	54%	84%	99%	99%	100%
CRP	79.45	100%	100%	100%	100%	100%	100%	100%	100%	98%	96%	88%	86%	76%	77%	42%	34%	16%	7%	0%	18%	48%	81%	99%	99%	100%
SJT	79.61	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	94%	93%	85%	86%	58%	52%	34%	25%	18%	0%	34%	76%	99%	99%	100%
SAT	79.89	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	94%	94%	79%	75%	61%	54%	48%	34%	0%	57%	98%	97%	99%
BRY	80.40	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	99%	94%	93%	87%	84%	81%	76%	57%	0%	83%	85%	96%
ODA	81.30	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	98%	83%	0%	29%	72%
ELP	81.59	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	97%	85%	29%	0%	49%
BMT	82.25	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	96%	72%	49%	0%

3.5 Results

3.5.1 Sample Size of Each of the Subsystems

The sample size depends on different parameters and a different risk level is associated with each sample size. The risk level includes/combines the α risk, β risk, and the risk associated with e. A total of four different values (0.01, 0.05, 0.1, and 0.2) were selected for both α and β and three different values of tolerable error (0.5, 1.0, and 2.0). The sample sizes were calculated for each of these combinations of α, β, and e. The variations of the minimum sample size, for different parameters, of the subsystems PMIS, TxTAP, and TxMAP are presented in Table C1, C2, and C3, respectively, in Appendix C. These tables show the number of sample points that should be collected for each district each year to ensure the estimation accuracy at the specific risk level. In common practice, α and β are selected to be 0.05 and 0.05 respectively. Table 3.6 presents the recommended sample sizes for these configurations and Table 3.7 compares the recommendations with the current level of data collection over the past 3 years. It can be concluded that in some districts more samples need to be collected to ensure the same risk level for all subsystems. Based on Equation (3.14) and the standard deviation values in Table 3.1, TxTAP is expected to require the largest number of samples and TxMAP the least to ensure estimation accuracy at the same risk level. This expectation is verified by the results in Table 3.6. For the purpose of establishing a valid TxCAP, data for all three subsystems is required for all pavement sections under consideration (being sampled). Therefore, it is recommended that the number of data samples collected should match the largest minimum sample size (of the three subsystems) for a chosen risk level. Although PMIS data is collected for all state highways, insufficient data is collected for TxMAP and TxTAP (Zhang and Machemehl 2004).

Minimum sample sizes for all three subsystems with the combination of $\alpha = 0.05, \beta = 0.05, e = 2$ are obtained and shown as an example. Figure 3.2 illustrates the results. According to Figure 3.2, the largest minimum sample size is required for TxTAP and is 323 samples per district. In other words, in order to establish a valid TxCAP and compare the scores at this chosen risk level, 323 data points are required for all subsystems. Figure 3.2 clearly indicates where and how much sampling improvements are required. In addition, this figure can be utilized to compare the current sampling practice to any desired risk level.

Table 3.6: Comparison of current and required sample sizes

	2008			2009			2010			Sample size for $\alpha = \beta = 0.05$		
	Min	Max	Avg.	Min	Max	Avg.	Min	Max	Avg.	$e = 2$	$e = 1$	$e = 0.5$
PMIS	99	260	154	99	258	160	103	257	157	262	1047	4190
TxTAP										323	1290	5161
TxMAP										163	652	2609

Table 3.7: Number of districts meeting sample collection criteria

	Sample size for $\alpha = \beta = 0.05$ $e = 2$	Number of districts meeting this criteria		
		2008	2009	2010
PMIS	262	0	0	0
TxTAP	323	0	0	0
TxMAP	163	10	11	13

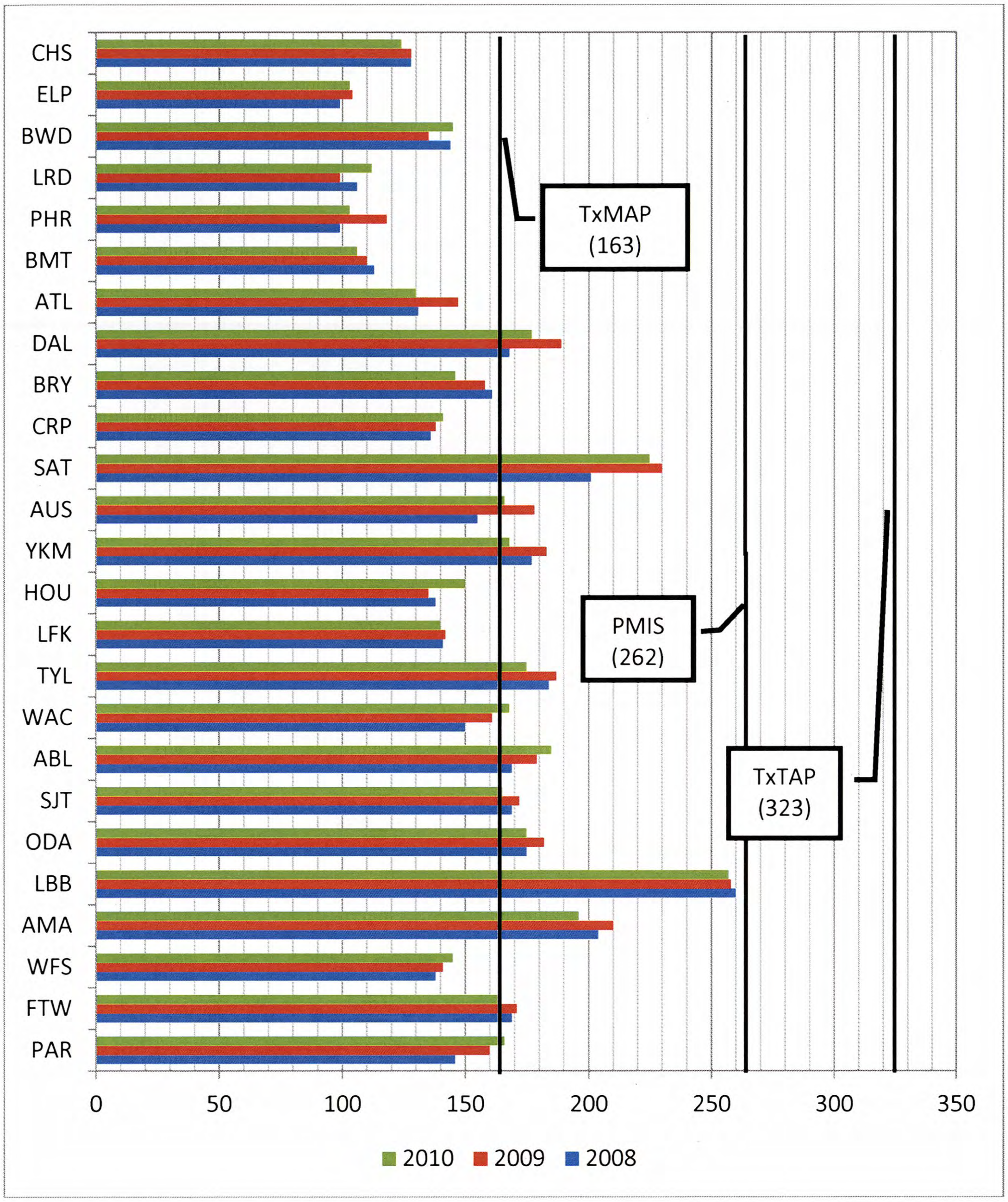

Figure 3.2: Current sample collection practice and recommended sample size

3.6 Possible Approaches for Increasing Sample Size

TxDOT will incur additional costs by increasing the number of samples collected. To avoid significant increase in cost, a number of possibilities are mentioned. This section discusses three different ways in which the sample sizes may be increased and the implications of these methods.

3.6.1 Increasing sample size by using ½-mile segments instead of 1-mile segments

The advantage of using ½-mile segments in lieu of the current 1-mile segments depends on the location and selection of the segments. Collecting data from ½-mile segments instead of the current practice of 1-mile segments means that each of the previous samples will be divided into two samples. This procedure will not be helpful because the samples are no longer random samples. The sampling process does not remain random because the location of every second sample is dependent on the location of the first (previous one). This can be further illustrated by considering the hypothetical network in Figure 3.3 and 3.4. In Figure 3.3, the red "marks" represent a randomly selected sample where each sample is a 1-mile section. In Figure 3.4, each of the samples of Figure 3.3 is divided into half-mile sections. The first sample (indicated by "a") will be considered randomly chosen but the second sample (indicated by "b") is dependent on the position of the first as it is half of a 1-mile section and therefore the sampling process no longer remains random. In other words, although this process doubles the sample size, the statistical significance of the data does not increase because the data is being collected from the same location twice. However, if all the ½-mile sections are randomly selected, then the statistical significance of the data would be increased. In this case, the number of samples would be doubled compared to the current practice and the data would have greater statistical significance.

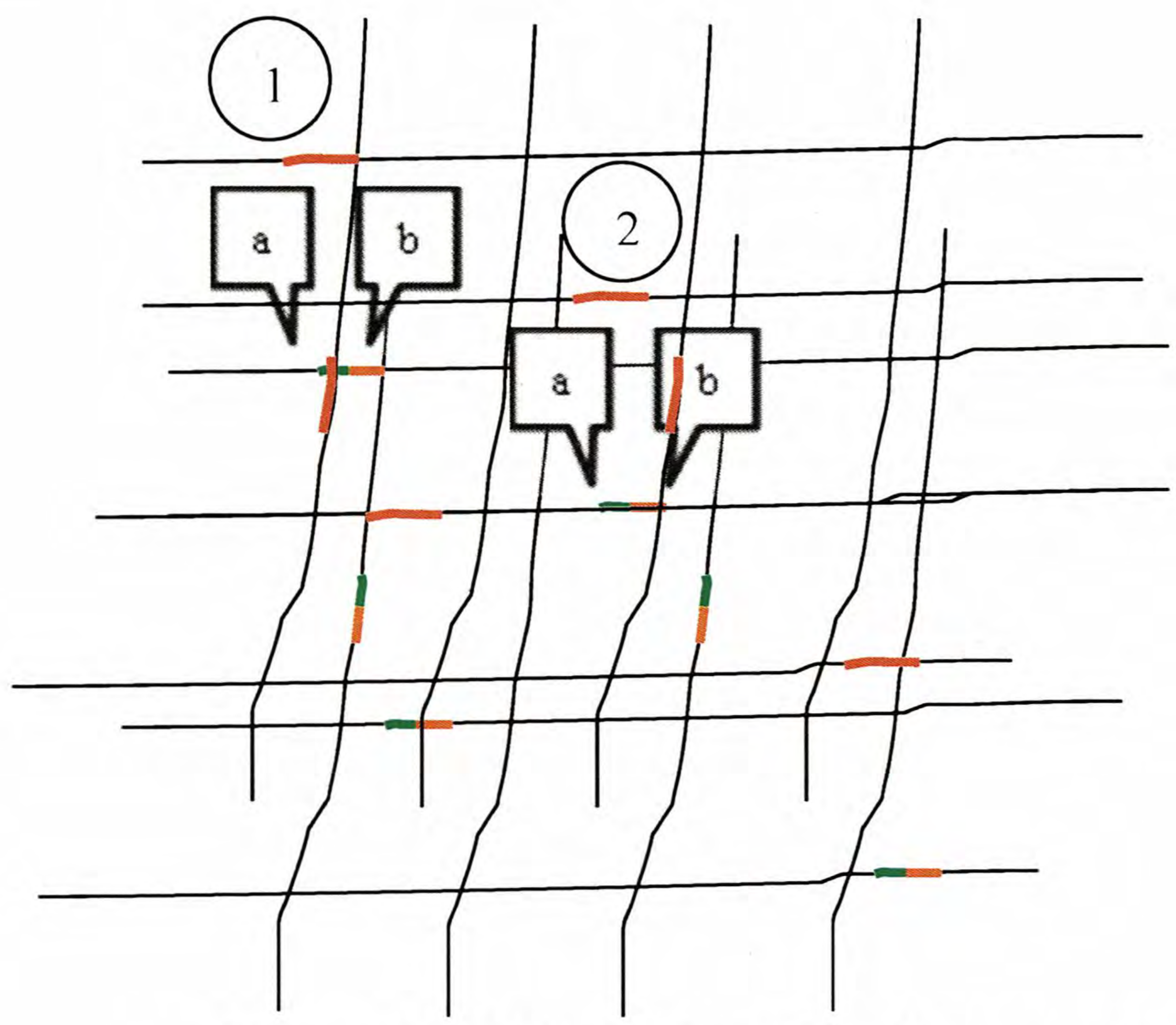

Figure 3.3: Illustration of random sample

3.6.2 Increasing the sample size to 10% of the population for TxMAP

Under this recommendation, it is suggested that 10% or 16,000 ½-mile sections be used as a sample. If 10% of the population is selected for sampling, then the sample size is 16,000 for the entire state. Therefore, the number of data points needed for each district is 640 each year. The current average sample size of TxMAP collected in each district is 157. The effect of increasing sample size from 157 to 640 can be explained by Table C3, which shows the required annual TxMAP sample size for each district. If α and β are set to 0.05 (or 5%), which is commonly used in practice, the difference between sample sizes of 157 and 640 lies in the improvement of tolerable error (e). With a sample size of 157 data points, inferences can be made for $e = 2$ whereas with 640 data points inferences can be made at $e = 1$. In other words, TxMAP score differences greater than 1 will be considered significantly different. Therefore, increasing sample size from 157 to 640 will enable decision-makers to compare TxMAP scores more precisely between different districts.

3.6.3 Average 2 years of samples (current year plus previous year)

In this proposition the sample size is being increased by combining the 2 years of data to make a larger sample. The advantage of using 2 years of data together depends on

- whether different districts are compared for the same time periods vs. different time periods for the same district, and
- the location of the data collected each year.

Comparison among different districts is one of the primary intentions of this research and will be discussed first. If different districts are being compared and the location of data collected (survey sites) are fixed (data is collected from the same site in both years), then using 2 years of data is not beneficial because the same data (from each location) is being repeated. Although the sample size doubles, this does not increase the statistical significance of the calculations. However, if the survey sites are random each year, then combining 2 years of data will lead to a larger sample, which will help "lower" the risk level. This can be illustrated by considering the following example. The number of samples for each subsystem must match the largest minimum sample size in order to develop a valid TxCAP system. Table 3.7 shows that TxTAP requires the largest sample size. Currently, the average annual sample size is 157 per district (for year 2010) corresponding to a risk level of $\alpha = 0.1, \beta = 0.2$, and $e = 2$ according to Table C2. Combining 2 years of data (2009 and 2010, for example) will increase the average sample size to 318 per district. This sample size corresponds to a risk level of $\alpha = 0.05, \beta = 0.05$, and $e = 2$. There is a significant reduction in the probability of making both Type I and Type II errors, although the tolerable error remains the same.

In order to make the analysis valid, comparisons must be conducted for time periods in blocks of 2 years. It must be ensured that there is no overlap in the time periods. This can be illustrated by considering samples from three time periods: A, B, and C. The sample "A" consists of year 2008 and 2009, "B" consists of years 2010 and 2011, and "C" consists of years 2009 and 2010. Comparison of sample "A" against sample "B" will yield significant results whereas comparison between sample "A" and sample "C" is not meaningful as the data for 2009 is being repeated in both samples. This remains valid irrespective of which subsystem is being considered.

On the other hand, when conducting analysis across time (years), the location is not significant. This comparison will indicate the performance of the infrastructure across time for that particular district and can also be used to check effects of improvements.

3.7 Results of *t*-test

Pair wise comparison of the mean TxCAP, PMIS, TxTAP, and TxMAP scores of the 25 districts were carried out using the *t*-test to determine which districts were statistically different. The results of the *t*-test are presented in the following tables. The tables in this section show the TxCAP, PMIS, TxTAP, and TxMAP comparison results only for the year 2010. The results of the analysis for 2008, 2009, and the 3 years combined (2008–2010) are presented in tabular form in Appendix E.

The results of the *t*-test for the null hypothesis (the scores of the two districts are equal) are shown in the following tables. A two-tailed test was carried out at a 95% level of confidence. The matrices show the comparison of each district with all other 24 districts. The output matrix is symmetric and either upper triangular or lower triangular matrix can be used. The matrix lists two possible responses: "Yes" and "No." The outcome "Yes" indicates that the difference between the scores is statistically significant and an outcome of "No" indicates that the difference is not statistically significant. The diagonal elements of the matrix have been left blank as they represent comparison of the district with itself. The districts have been sorted in ascending order by score so that similar responses can be clustered. After arranging the districts in ascending order, it is observed that the "No" responses are "grouped" along the diagonal. The "No" outcomes can be clustered into groups as shown in Table 3.8. A "No" output indicates that there is no difference between the two district scores, therefore, a group of "No" responses indicates that the scores of all districts within that group are not statistically different. In other words, within one group no true difference exists between the districts. Such groups can be named "Statistically Similar Performance Districts." Tables 3.8 through 3.11 show the *t*-test results at a 95% level of confidence for the year 2010 and Table 3.12 presents the corresponding groups of districts with similar condition for the year 2010. Tables 3.13 through 3.15 present the corresponding groups of districts with similar condition for the remaining analysis periods.

Table 3.8: Results of *t*-test for TxCAP for 2010 by groups

District		WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
	Mean	74.08	75.76	76.05	76.05	76.08	76.11	76.52	76.89	77.43	77.99	78.25	78.45	78.46	78.47	79.04	79.13	79.30	79.38	79.45	79.61	79.89	80.40	81.30	81.59	82.25
WFS	74.08		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	75.76	Yes		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	76.05	Yes	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	76.05	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	76.08	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	76.11	Yes	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	76.52	Yes	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	76.89	Yes	No	No	No	No	No	No		No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	77.43	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	77.99	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	78.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
LBB	78.45	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
AUS	78.46	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
LRD	78.47	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
YKM	79.04	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
AMA	79.13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
ATL	79.30	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
LFK	79.38	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes
CRP	79.45	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes
SJT	79.61	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes
SAT	79.89	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	Yes	Yes	Yes
BRY	80.40	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	Yes
ODA	81.30	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No
ELP	81.59	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No
BMT	82.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	

Table 3.9: Results of *t*-test for PMIS for 2010 by groups

District		WFS	DAL	FTW	WAC	BWD	ABL	TYL	HOU	PAR	LRD	AUS	AMA	LBB	ATL	YKM	CHS	SAT	PHR	CRP	SJT	BRY	LFK	ODA	ELP	BMT
	Mean	71.96	72.65	73.50	73.66	74.03	74.34	74.63	74.91	74.99	75.21	75.97	76.55	76.83	77.01	77.10	77.31	77.91	78.01	78.16	78.23	78.41	78.94	81.34	82.60	83.52
WFS	71.96		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	72.65	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	73.50	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	73.66	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	74.03	Yes	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	74.34	Yes	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	74.63	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	74.91	Yes	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	74.99	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	75.21	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	75.97	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AMA	76.55	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
LBB	76.83	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
ATL	77.01	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes
YKM	77.10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
CHS	77.31	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
SAT	77.91	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
PHR	78.01	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes
CRP	78.16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes
SJT	78.23	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes
BRY	78.41	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	Yes	Yes	Yes
LFK	78.94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		Yes	Yes	Yes
ODA	81.34	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No	No
ELP	82.60	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No
BMT	83.52	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	

Table 3.10: Results of *t*-test for TxTAP for 2010 by groups

District		CHS	WFS	HOU	PHR	ABL	PAR	FTW	LBB	CRP	AMA	ELP	DAL	AUS	LRD	BMT	WAC	YKM	SJT	ATL	LFK	ODA	BRY	BWD	SAT.	TYL
	Mean	71.06	74.88	75.53	76.17	76.49	76.57	78.96	79.00	79.35	80.14	80.21	80.38	81.03	81.18	81.43	81.85	81.85	82.11	82.12	82.19	82.65	82.86	82.93	83.77	84.27
CHS	71.06		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	74.88	Yes		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	75.53	Yes	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	76.17	Yes	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	76.49	Yes	No	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	76.57	Yes	No	No	No	No		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	78.96	Yes	Yes	Yes	Yes	Yes	Yes		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	79.00	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	79.35	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AMA	80.14	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
ELP	80.21	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
DAL	80.38	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
AUS	81.03	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No		No	No	No	No	No	No	No	No	No	No	Yes	Yes
LRD	81.18	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes
BMT	81.43	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes
WAC	81.85	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes
YKM	81.85	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes
SJT	82.11	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes
ATL	82.12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	No	No	Yes
LFK	82.19	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No		No	No	No	No	Yes
ODA	82.65	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No		No	No	No	No
BRY	82.86	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No	No		No	No	No
BWD	82.93	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No		No	No
SAT	83.77	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No
TYL	84.27	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	

Table 3.11: Results of *t*-test for TxMAP for 2010 by groups

District		WFS	PHR	PAR	ABL	LFK	HOU	FTW	CHS	WAC	DAL	SJT	TYL	ODA	YKM	SAT	BMT	LBB	ELP	AUS	ATL	BWD	CRP	BRY	LRD	AMA
	Mean	77.06	77.30	77.58	77.63	78.24	78.30	78.35	78.83	78.96	79.04	80.26	80.28	80.33	80.41	80.61	80.66	80.80	80.83	80.91	81.23	81.29	81.67	82.09	82.11	82.77
WFS	77.06		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	77.30	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	77.58	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	77.63	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	78.24	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	78.30	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	78.35	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	78.83	Yes	No	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	78.96	Yes	No	No	Yes	No	No	No	No		No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	79.04	Yes	No	No	Yes	No	No	No	No	No		No	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SJT	80.26	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
TYL	80.28	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
ODA	80.33	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
YKM	80.41	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes
SAT	80.61	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
BMT	80.66	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes
LBB	80.80	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	No	Yes
ELP	80.83	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes
AUS	80.91	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	Yes
ATL	81.23	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	No	Yes
BWD	81.29	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No		No	No	No	Yes
CRP	81.67	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No		No	No	No
BRY	82.09	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No		No	No
LRD	82.11	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No
AMA	82.77	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	

Table 3.12: Groups of statistically similar performance districts at 95% level of confidence for 2010

	TxCAP	PMIS	TxTAP	TxMAP
Group 1	WFS	WFS, DAL, FTW, WAC	CHS	WFS, PHR, PAR, ABL, LFK, HOU, FTW
Group 2	ABL, FTW, HOU, PAR, DAL, CHS, WAC	BWD, ABL, TYL, HOU, PAR, LRD	WFS, HOU, PHR, ABL, PAR	CHS, WAC, DAL
Group 3	PHR, BWD, TYL, LBB, AUS, LRD, YKM, AMA	AUS, AMA, LBB, ATL, YKM	FTW, LBB, CRP, AMA, ELP, DAL	SJT, TYL, ODA, YKM, SAT, BMT, LBB, ELP, AUS, ATL, BWD, CRP
Group 4	ATL, LFK, CRP, SJT, SAT, BRY	CHS, SAT, PHR, CRP, SJT, BRY, LFK	AUS, LRD, BMT, WAC, YKM, SJT, ATL, LFK, ODA, BRY, BWD	BRY, LRD, AMA
Group 5	ODA, ELP, BMT	ODA, ELP, BMT	SAT, TYL	---

Table 3.13: Groups of statistically similar performance districts at 95% level of confidence for 2009

	TxCAP	PMIS	TxTAP	TxMAP
Group 1	LFK	LFK, PAR, YKM	FTW, YKM, CRP, LFK, WFS, CHS	LFK, ATL
Group 2	YKM	ATL, WFS, TYL, FTW, AUS, BRY, SAT, CRP	PAR, LBB, HOU, PHR, ATL, ELP	WFS, FTW, YKM
Group 3	WFS, ATL, PAR, FTW	DAL, HOU, ABL, WAC, BWD	ABL, SAT, BWD, AUS, TYL, AMA, DAL, WAC, BMT, LRD	TYL, PAR, SAT, AUS, PHR
Group 4	TYL, AUS, CRP, SAT, HOU	AMA, LRD, SJT, CHS, ELP, BMT	ODA, BRY, SJT	BMT, CRP, DAL, AMA, CHS, ABL, HOU, LBB, WAC, LRD
Group 5	DAL, ABL, WAC, BWD, CHS, AMA, BRY, LRD	LBB	---	BWD, ELP
Group 6	LBB, BMT, ELP, PHR	PHR	---	BRY, SJT, ODA
Group 7	SJT	ODA	---	---
Group 8	ODA	---	---	---

Table 3.14: Groups of statistically similar performance districts at 95% level of confidence for 2008

	TxCAP	PMIS	TxTAP	TxMAP
Group 1	PAR, CRP, HOU	PAR, CRP, DAL	HOU	HOU, PAR
Group 2	DAL	LRD, LFK, AMA, LBB, FTW, AUS, PHR, HOU	CRP	CRP, PHR
Group 3	LRD, FTW, LFK, SAT, LBB, PHR, AUS, WFS	YKM, SAT, WAC, BMT, TYL, WFS	SAT	LFK, FTW, TYL, LRD, SAT, WFS, DAL, BWD
Group 4	WAC, YKM, BMT, AMA, BWD, TYL	BRY, BWD, CHS, ABL, SJT, ODA, ATL	DAL, PAR, BMT, LBB, FTW, AUS, BWD, WFS, CHS, ELP	WAC, AUS, LBB, YKM
Group 5	ELP	ELP	LRD, YKM, ATL, ABL, LFK, SJT, WAC, ODA	BRY, ODA, SJT, BMT
Group 6	---	---	AMA, PHR, BRY, TYL	AMA, ELP, CHS
Group 7	---	---	---	ABL, ATL

Table 3.15: Groups of statistically similar performance districts at 95% level of confidence for 2008–10 combined

	TxCAP	PMIS	TxTAP	TxMAP
Group 1	PAR	PAR, DAL	HOU, CHS	LFK, PAR, WFS, PAR, HOU
Group 2	LFK, FTW, WFS, YKM, CRP	FTW, WFS, CRP, LFK, AUS, TYL, YKM, WAC, LRD, HOU	CRP, WFS, PAR, FTW	FTW, TYL
Group 3	HOU, AUS, DAL, WAC, AMA, TYL, SAT, ATL	AMA, SAT, BWD, ABL, ATL, LBB	LBB, PHR, ABL, ELP	CRP, SAT, DAL, YKM, AUS, WAC
Group 4	LRD, LBB, BWD, BMT	BRY	DAL, SAT, YKM, AUS, BMT, LFK, BWD, ATL	ATL, LRD, BWD, BMT, LBB, ABL
Group 5	ABL, PHR, BRY, CHS, ELP	CHS, SJT, PHR, BMT	LRD, AMA, WAC	CHS, ODA, SJT, BRY, ELP
Group 6	SJT, ODA	ELP, ODA	SJT, ODA, TYL, BRY	---

3.7.2 Level of Confidence Tables

Another technique of comparing the scores is to look at the levels of confidence at which the scores are statistically different from each other. A two-tailed heteroskedastic *t*-test methodology was applied to determine the level of confidence. This is the probability that the difference between scores is statistically significant. The level of confidence for the four scores for the year 2010 are shown in Tables 3.16 through 3.19. The results of the test for years 2008, 2009, and the 3 years combined are presented in Appendix F. Table 3.16 shows the probabilities that the 2010 TxCAP score for two respective districts are different. The cells have been highlighted to correspond to an 80% level of confidence. In other words, values less than 80% indicate that those two districts are considered not statistically different. The highlighted cells show the districts that are statistically similar at an 80% confidence level. A clustering process similar to the one mentioned in the previous section can be conducted.

Table 3.16: Level of confidence analysis for TxCAP for 2010

		WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
	Mean	74.08	75.76	76.05	76.05	76.08	76.11	76.52	76.89	77.43	77.99	78.25	78.45	78.46	78.47	79.04	79.13	79.30	79.38	79.45	79.61	79.89	80.40	81.30	81.59	82.25
WFS	74.08	0%	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	75.76	99%	0%	33%	32%	38%	37%	76%	91%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	76.05	99%	33%	0%	0%	4%	6%	48%	74%	88%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	76.05	99%	32%	0%	0%	4%	6%	47%	72%	87%	99%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	76.08	99%	38%	4%	4%	0%	3%	46%	73%	87%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	76.11	99%	37%	6%	6%	3%	0%	39%	66%	83%	98%	99%	100%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CHS	76.52	100%	76%	48%	47%	46%	39%	0%	40%	71%	97%	98%	100%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WAC	76.89	100%	91%	74%	72%	73%	66%	40%	0%	45%	88%	93%	98%	94%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	77.43	100%	95%	88%	87%	87%	83%	71%	45%	0%	49%	64%	78%	72%	73%	93%	95%	96%	97%	98%	99%	100%	100%	100%	100%	100%
BWD	77.99	100%	100%	99%	99%	99%	98%	97%	88%	49%	0%	29%	54%	45%	47%	87%	91%	93%	95%	96%	98%	100%	100%	100%	100%	100%
TYL	78.25	100%	100%	100%	99%	100%	99%	98%	93%	64%	29%	0%	23%	20%	21%	71%	77%	83%	86%	88%	94%	98%	100%	100%	100%	100%
LBB	78.45	100%	100%	100%	100%	100%	100%	100%	98%	78%	54%	23%	0%	1%	2%	63%	71%	78%	83%	86%	93%	98%	100%	100%	100%	100%
AUS	78.46	100%	100%	100%	99%	100%	99%	98%	94%	72%	45%	20%	1%	0%	1%	52%	59%	68%	73%	76%	85%	94%	98%	100%	100%	100%
LRD	78.47	100%	100%	100%	100%	100%	99%	99%	95%	73%	47%	21%	2%	1%	0%	52%	60%	69%	74%	77%	86%	94%	99%	100%	100%	100%
YKM	79.04	100%	100%	100%	100%	100%	100%	100%	100%	93%	87%	71%	63%	52%	52%	0%	10%	27%	35%	42%	58%	79%	94%	100%	100%	100%
AMA	79.13	100%	100%	100%	100%	100%	100%	100%	100%	95%	91%	77%	71%	59%	60%	10%	0%	18%	27%	34%	52%	75%	93%	100%	100%	100%
ATL	79.30	100%	100%	100%	100%	100%	100%	100%	100%	96%	93%	83%	78%	68%	69%	27%	18%	0%	9%	16%	34%	61%	87%	100%	99%	100%
LFK	79.38	100%	100%	100%	100%	100%	100%	100%	100%	97%	95%	86%	83%	73%	74%	35%	27%	9%	0%	7%	25%	54%	84%	99%	99%	100%
CRP	79.45	100%	100%	100%	100%	100%	100%	100%	100%	98%	96%	88%	86%	76%	77%	42%	34%	16%	7%	0%	18%	48%	81%	99%	99%	100%
SJT	79.61	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	94%	93%	85%	86%	58%	52%	34%	25%	18%	0%	34%	76%	99%	99%	100%
SAT	79.89	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	94%	94%	79%	75%	61%	54%	48%	34%	0%	57%	98%	97%	99%
BRY	80.40	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	99%	94%	93%	87%	84%	81%	76%	57%	0%	83%	85%	96%
ODA	81.30	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	98%	83%	0%	29%	72%
ELP	81.59	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	97%	85%	29%	0%	49%
BMT	82.25	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	96%	72%	49%	0%

Table 3.17: Level of confidence analysis for PMIS for 2010

		WFS	DAL	FTW	WAC	BWD	ABL	TYL	HOU	PAR	LRD	AUS	AMA	LBB	ATL	YKM	CHS	SAT	PHR	CRP	SJT	BRY	LFK	ODA	ELP	BMT
		71.96	72.65	73.50	73.66	74.03	74.34	74.63	74.91	74.99	75.21	75.97	76.55	76.83	77.01	77.10	77.31	77.91	78.01	78.16	78.23	78.41	78.94	81.34	82.60	83.52
WFS	71.96	0%	49%	90%	93%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	72.65	49%	0%	59%	67%	84%	92%	93%	96%	98%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	73.50	90%	59%	0%	14%	46%	68%	75%	85%	90%	92%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WAC	73.66	93%	67%	14%	0%	33%	57%	67%	79%	86%	88%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
BWD	74.03	98%	84%	46%	33%	0%	31%	48%	66%	76%	79%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	74.34	99%	92%	68%	57%	31%	0%	25%	47%	58%	65%	91%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	74.63	99%	93%	75%	67%	48%	25%	0%	21%	30%	42%	78%	95%	98%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	74.91	100%	96%	85%	79%	66%	47%	21%	0%	7%	23%	68%	91%	96%	96%	97%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%
PAR	74.99	100%	98%	90%	86%	76%	58%	30%	7%	0%	18%	67%	93%	97%	97%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LRD	75.21	100%	98%	92%	88%	79%	65%	42%	23%	18%	0%	52%	84%	92%	92%	94%	97%	100%	99%	100%	100%	100%	100%	100%	100%	100%
AUS	75.97	100%	100%	98%	97%	95%	91%	78%	68%	67%	52%	0%	44%	62%	67%	73%	81%	95%	92%	97%	98%	98%	99%	100%	100%	100%
AMA	76.55	100%	100%	100%	100%	100%	99%	95%	91%	93%	84%	44%	0%	26%	38%	46%	61%	89%	83%	93%	95%	96%	99%	100%	100%	100%
LBB	76.83	100%	100%	100%	100%	100%	100%	98%	96%	97%	92%	62%	26%	0%	16%	25%	43%	82%	75%	89%	91%	93%	98%	100%	100%	100%
ATL	77.01	100%	100%	100%	100%	100%	100%	98%	96%	97%	92%	67%	38%	16%	0%	7%	24%	67%	62%	77%	80%	85%	94%	100%	100%	100%
YKM	77.10	100%	100%	100%	100%	100%	100%	99%	97%	98%	94%	73%	46%	25%	7%	0%	19%	65%	60%	76%	79%	84%	94%	100%	100%	100%
CHS	77.31	100%	100%	100%	100%	100%	100%	99%	99%	99%	97%	81%	61%	43%	24%	19%	0%	51%	48%	65%	70%	77%	90%	100%	100%	100%
SAT	77.91	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	95%	89%	82%	67%	65%	51%	0%	7%	23%	29%	43%	73%	100%	100%	100%
PHR	78.01	100%	100%	100%	100%	100%	100%	100%	99%	100%	99%	92%	83%	75%	62%	60%	48%	7%	0%	12%	16%	29%	59%	100%	100%	100%
CRP	78.16	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	93%	89%	77%	76%	65%	23%	12%	0%	6%	21%	58%	100%	100%	100%
SJT	78.23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	95%	91%	80%	79%	70%	29%	16%	6%	0%	16%	55%	100%	100%	100%
BRY	78.41	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	96%	93%	85%	84%	77%	43%	29%	21%	16%	0%	42%	100%	100%	100%
LFK	78.94	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	98%	94%	94%	90%	73%	59%	58%	55%	42%	0%	99%	100%	100%
ODA	81.34	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	0%	85%	94%
ELP	82.60	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	85%	0%	54%
BMT	83.52	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	54%	0%

Table 3.18: Level of confidence analysis for TxTAP 2010

		CHS	WFS	HOU	PHR	ABL	PAR	FTW	LBB	CRP	AMA	ELP	DAL	AUS	LRD	BMT	WAC	YKM	SJT	ATL	LFK	ODA	BRY	BWD	SAT	TYL
	Mean	71.06	74.88	75.53	76.17	76.49	76.57	78.96	79.00	79.35	80.14	80.21	80.38	81.03	81.18	81.43	81.85	81.85	82.11	82.12	82.19	82.65	82.86	82.93	83.77	84.27
CHS	71.06	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	74.88	100%	0%	41%	65%	87%	87%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	75.53	100%	41%	0%	36%	63%	64%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	76.17	100%	65%	36%	0%	20%	24%	97%	98%	97%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	76.49	100%	87%	63%	20%	0%	7%	99%	100%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	76.57	100%	87%	64%	24%	7%	0%	98%	99%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	78.96	100%	100%	100%	97%	99%	98%	0%	3%	26%	73%	63%	80%	94%	92%	95%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
LBB	79.00	100%	100%	100%	98%	100%	99%	3%	0%	25%	76%	64%	82%	96%	93%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	79.35	100%	100%	100%	97%	99%	98%	26%	25%	0%	50%	44%	60%	83%	82%	87%	96%	96%	98%	98%	99%	100%	100%	100%	100%	100%
AMA	80.14	100%	100%	100%	100%	100%	100%	73%	76%	50%	0%	4%	17%	58%	59%	69%	88%	89%	94%	93%	95%	99%	99%	99%	100%	100%
ELP	80.21	100%	100%	100%	99%	99%	99%	63%	64%	44%	4%	0%	9%	43%	47%	57%	75%	76%	83%	83%	85%	93%	94%	94%	99%	100%
DAL	80.38	100%	100%	100%	100%	100%	100%	80%	82%	60%	17%	9%	0%	43%	46%	58%	80%	81%	88%	88%	90%	97%	97%	97%	100%	100%
AUS	81.03	100%	100%	100%	100%	100%	100%	94%	96%	83%	58%	43%	43%	0%	9%	25%	53%	54%	68%	67%	72%	89%	91%	91%	100%	100%
LRD	81.18	100%	100%	100%	100%	100%	100%	92%	93%	82%	59%	47%	46%	9%	0%	14%	39%	40%	54%	54%	58%	78%	81%	82%	97%	99%
BMT	81.43	100%	100%	100%	100%	100%	100%	95%	96%	87%	69%	57%	58%	25%	14%	0%	25%	26%	41%	41%	46%	70%	74%	75%	96%	98%
WAC	81.85	100%	100%	100%	100%	100%	100%	99%	100%	96%	88%	75%	80%	53%	39%	25%	0%	0%	19%	19%	25%	57%	65%	66%	95%	98%
YKM	81.85	100%	100%	100%	100%	100%	100%	99%	100%	96%	89%	76%	81%	54%	40%	26%	0%	0%	19%	20%	25%	58%	66%	67%	96%	99%
SJT	82.11	100%	100%	100%	100%	100%	100%	100%	100%	98%	94%	83%	88%	68%	54%	41%	19%	19%	0%	1%	6%	43%	53%	55%	93%	98%
ATL	82.12	100%	100%	100%	100%	100%	100%	100%	100%	98%	93%	83%	88%	67%	54%	41%	19%	20%	1%	0%	5%	41%	51%	53%	92%	97%
LFK	82.19	100%	100%	100%	100%	100%	100%	100%	100%	99%	95%	85%	90%	72%	58%	46%	25%	25%	6%	5%	0%	37%	48%	51%	92%	97%
ODA	82.65	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	93%	97%	89%	78%	70%	57%	58%	43%	41%	37%	0%	18%	22%	84%	94%
BRY	82.86	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	94%	97%	91%	81%	74%	65%	66%	53%	51%	48%	18%	0%	5%	68%	85%
BWD	82.93	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	94%	97%	91%	82%	75%	66%	67%	55%	53%	51%	22%	5%	0%	61%	81%
SAT	83.77	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%	97%	96%	95%	96%	93%	92%	92%	84%	68%	61%	0%	46%
TYL	84.27	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	99%	98%	97%	97%	94%	85%	81%	46%	0%

Table 3.19: Level of confidence analysis for TxMAP 2010

		WFS	PHR	PAR	ABL	LFK	HOU	FTW	CHS	WAC	DAL	SJT	TYL	ODA	YKM	SAT	BMT	LBB	ELP	AUS	ATL	BWD	CRP	BRY	LRD	AMA
	Mean	77.06	77.30	77.58	77.63	78.24	78.30	78.35	78.83	78.96	79.04	80.26	80.28	80.33	80.41	80.61	80.66	80.80	80.83	80.91	81.23	81.29	81.67	82.09	82.11	82.77
WFS	77.06	0%	20%	48%	60%	88%	89%	90%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	77.30	20%	0%	22%	29%	68%	70%	72%	90%	92%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	77.58	48%	22%	0%	6%	60%	62%	65%	89%	93%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	77.63	60%	29%	6%	0%	65%	67%	70%	94%	96%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	78.24	88%	68%	60%	65%	0%	6%	11%	59%	68%	71%	100%	99%	100%	100%	100%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%
HOU	78.30	89%	70%	62%	67%	6%	0%	5%	52%	62%	66%	99%	99%	99%	100%	100%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%
FTW	78.35	90%	72%	65%	70%	11%	5%	0%	48%	58%	62%	99%	99%	99%	99%	100%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%
CHS	78.83	98%	90%	89%	94%	59%	52%	48%	0%	15%	23%	96%	96%	97%	98%	99%	95%	100%	97%	99%	100%	100%	100%	100%	100%	100%
WAC	78.96	99%	92%	93%	96%	68%	62%	58%	15%	0%	9%	93%	93%	95%	96%	99%	93%	100%	95%	99%	100%	100%	100%	100%	100%	100%
DAL	79.04	99%	93%	93%	96%	71%	66%	62%	23%	9%	0%	90%	90%	92%	94%	97%	90%	99%	93%	98%	99%	100%	100%	100%	100%	100%
SJT	80.26	100%	100%	100%	100%	100%	99%	99%	96%	93%	90%	0%	3%	8%	18%	41%	34%	61%	46%	60%	81%	83%	94%	99%	99%	100%
TYL	80.28	100%	100%	100%	100%	99%	99%	99%	96%	93%	90%	3%	0%	5%	14%	37%	31%	57%	43%	57%	79%	81%	93%	99%	98%	100%
ODA	80.33	100%	100%	100%	100%	100%	99%	99%	97%	95%	92%	8%	5%	0%	10%	34%	28%	54%	41%	55%	78%	80%	93%	99%	98%	100%
YKM	80.41	100%	100%	100%	100%	100%	100%	99%	98%	96%	94%	18%	14%	10%	0%	24%	21%	46%	34%	48%	73%	76%	91%	99%	98%	100%
SAT	80.61	100%	100%	100%	100%	100%	100%	100%	99%	99%	97%	41%	37%	34%	24%	0%	5%	25%	19%	32%	63%	66%	87%	98%	96%	100%
BMT	80.66	100%	100%	100%	100%	99%	98%	98%	95%	93%	90%	34%	31%	28%	21%	5%	0%	12%	11%	19%	44%	48%	70%	88%	86%	98%
LBB	80.80	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	61%	57%	54%	46%	25%	12%	0%	3%	12%	47%	52%	80%	97%	94%	100%
ELP	80.83	100%	100%	100%	100%	99%	99%	99%	97%	95%	93%	46%	43%	41%	34%	19%	11%	3%	0%	7%	32%	36%	62%	83%	81%	96%
AUS	80.91	100%	100%	100%	100%	100%	100%	100%	99%	99%	98%	60%	57%	55%	48%	32%	19%	12%	7%	0%	30%	35%	65%	88%	85%	99%
ATL	81.23	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	81%	79%	78%	73%	63%	44%	47%	32%	30%	0%	6%	43%	78%	73%	97%
BWD	81.29	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	83%	81%	80%	76%	66%	48%	52%	36%	35%	6%	0%	37%	73%	69%	96%
CRP	81.67	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	93%	93%	91%	87%	70%	80%	62%	65%	43%	37%	0%	44%	42%	87%
BRY	82.09	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	98%	88%	97%	83%	88%	78%	73%	44%	0%	2%	71%
LRD	82.11	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	98%	96%	86%	94%	81%	85%	73%	69%	42%	2%	0%	63%
AMA	82.77	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	96%	99%	97%	96%	87%	71%	63%	0%

3.8 Conclusions

The primary goal of this research was to determine whether TxCAP is an efficient and consistent means to assess conditions of TxDOT highways. The statistical analyses were carried out in 2 steps on a dataset covering all 25 districts spanning 3 years. This section presents the conclusions drawn from analyses conducted in this research.

The conclusions drawn from this research are as follows:

- TxDOT uses TxCAP to provide a comprehensive assessment of Texas's highways by combining data from its subsystems: PMIS, TxTAP, and TxMAP. This comprehensive system eliminates duplication of the three separate scoring systems and provides a simplified and concise scoring system for the entire Texas roadway infrastructure.
- A literature review was conducted to identify research on the state of the art for data collection procedures and methodologies. It was found that a few studies have been developed on statistical sampling procedures for a binary population using the sampling mechanism of sampling proportional to size.
- Because the data used in this study is not a binary population and the effort is designed to identify differences between mean scores, the minimum sample size was determined using a risk-based method to achieve a certain standard of quality. The sample size depends on the data variability, the chosen values of Type I error (α), Type II error (β), and tolerable error (e).
- A range of values for the tolerable error was estimated from the current dataset. A histogram of the differences of the scores was created and the mean was used to

estimate the tolerable error. Three different tolerable errors (0.5, 1.0, and 2.0) were used to calculate the minimum sample size.

- Analysis of the existing data shows that the three subsystems have different variances, and therefore the minimum sample size for the three subsystems should be different to ensure the same risk level. Currently, the same number of data points (survey sites) are collected for all three subsystems and this practice must be changed in order to ensure estimation at the same risk level. The highest number of data points is needed for the TxTAP subsystem, followed by PMIS, which is followed by TxMAP.
- The sample size calculation yielded various minimum sample sizes for the different combinations of confidence level $(1-\alpha)$, power $(1-\beta)$, and the tolerable error (e). The tables presented in this study show the minimum number of data points that should be collected by each district per year because comparisons are carried on an annual basis.
- In order to develop a valid TxCAP system, data for all three subsystems is required for all sections being sampled. Therefore, it is recommended that the number of data samples collected, for all subsystems, should match the largest minimum sample size (of the three subsystems) for a chosen risk level.
- This study also looked into two ways of increasing the data sampling process without significant cost increase:
    - One is to take data from ½-mile segments instead of the current 1-mile segments, i.e., by dividing the current sample into two samples. This method does not increase the statistical significance of the data as the data becomes non-random, which violates the key assumption for the sampling process. The statistical significance can be increased only if all ½-mile sections are randomly selected.
    - Another option is to aggregate the data for 2 years to create a larger sample. This process will definitely increase the sample size but care must be taken to ensure the time periods for comparison do not overlap.
- Statistical difference between the scores was determined by a two-sample comparison using the *t*-test. In this study, each district was assumed to form a population, i.e., a total of 25 populations. Each population was considered to have a different size and variance.
- A two-tailed *t*-test was carried out to test the null hypothesis at a 95% level of confidence. The null hypothesis in this study was that the mean scores of two districts are equal. The results of the *t*-test were presented as matrices; each cell contains "Yes" or "No" responses. The matrices show the comparison of each district with the remaining 24 districts.
- Because each "No" response indicates that the scores of the two respective districts are statistically not different, a group of "No" responses indicates that the scores of all districts within that group are not statistically different.

- In addition to the *t*-test results, the level of confidence was also calculated. The results are presented as matrices for each score for each year. These matrices give the probability that scores, of any two districts, are different.

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Chapter 4. TxDOT FTEs for PE and CE, and PS&E Backlogging

4.1 Introduction

Task 12: Assessment of TxDOT FTEs for Project Development and Construction, and PS&E Backlog Analysis

The objective of this task was to examine FTE staffing needs for TxDOT project development and construction, and analyze needs for "backlogging" plans, specifications, and estimates (PS&E), i.e., preparing construction plans in advance and keeping them "on the shelf" for possible construction funding in the future.

TxDOT has experienced a decline in funding available for traditional highway construction projects, from approximately $6 billion in FY 2006, to a projected figure of less than $3 billion per year in the future. However, there is uncertainty regarding national and state funding, with the possibility of rapid infusions such as state bond issues (Proposition 12, Proposition 14) and federal stimulus funds (from the American Recovery and Reinvestment Act [ARRA]). As a result, TxDOT needs a strategy for staffing its project development and construction functions based on anticipated funding levels. In addition, it needs a strategy to determine and maintain a "reasonable" amount of backlogged PS&E plans, and associated staffing levels for developing these.

The scope of this task includes reviews of previous studies on project staffing, collection and analysis of data including P6 records on TxDOT PS&E productivity, and development of recommendations. For the backlog analysis, CTR examined the risks of expending funds to refresh shelved plans versus the benefits of having plans ready if funding suddenly becomes available.

4.2 Task 12A. Construction Staffing

Following are the subtasks in Task 12A:

1. Acquire information on TxDOT construction engineering (CE) needs, historical productivity, and influencing factors (e.g., type of project, scope, region, season, etc.).
2. Develop models for estimating CE needs for TxDOT's 2011–2013 portfolio of work, and make projections for future years.
3. Submit initial models by September 30, 2010. Continue refining models with additional data from TxDOT and peer states as it becomes available, and provide quarterly updates.

Technical Memorandum 1
Primary Author: Nabeel Khwaja
Date: October 2010

This technical memo and the attached PowerPoint slides provide an update on various cost models related to CE costs incurred on TxDOT roadway construction projects.

4.2.1 Construction Engineering Costs

CE costs for this analysis consist of expenses incurred during the construction phase of a project primarily related to managing a construction project after contract award. The main components of TxDOT CE costs are the following:

- Project supervision
- Inspection of work in progress and project records
- Job control (includes testing)
- Construction surveys (post-letting)
- Design verification, changes and alterations
- Preparation of as-built plans
- Other charges (could be credits for donated services or items)

CE costs as a percentage of construction costs generally exhibit an inverse relationship with the construction costs, i.e., as the cost of constructing a project increases, the percentage CE costs decreases. This is best exhibited by the relationship shown in Figures 4.1, 4.2, and 4.3. Figures 4.1 and 4.2 reflect engineering charges and construction costs from TxDOT's Financial Information Management System (FIMS); Figure 4.3 shows charts from the American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice.

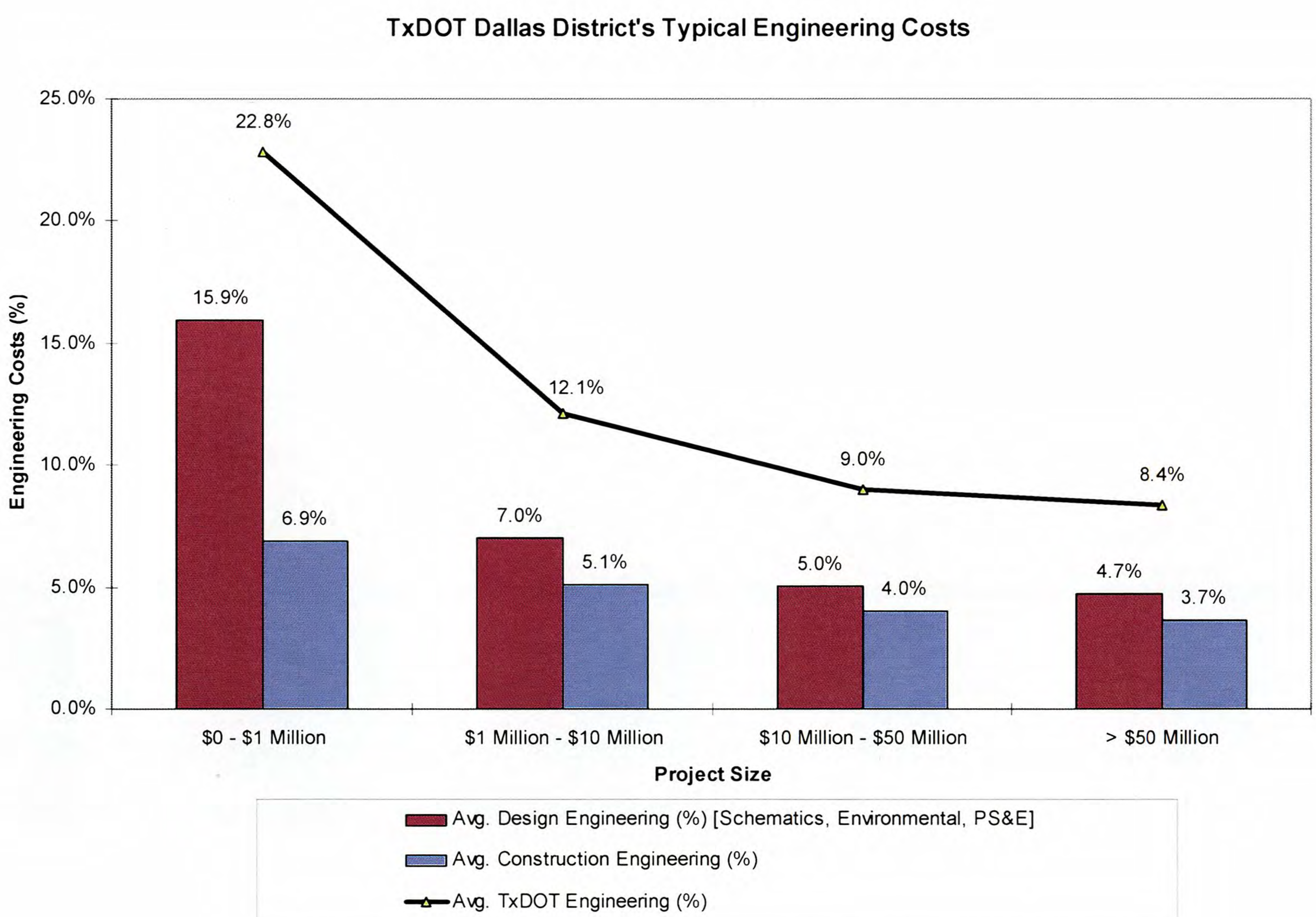


Figure 4.1: Dallas District engineering costs from FIMS

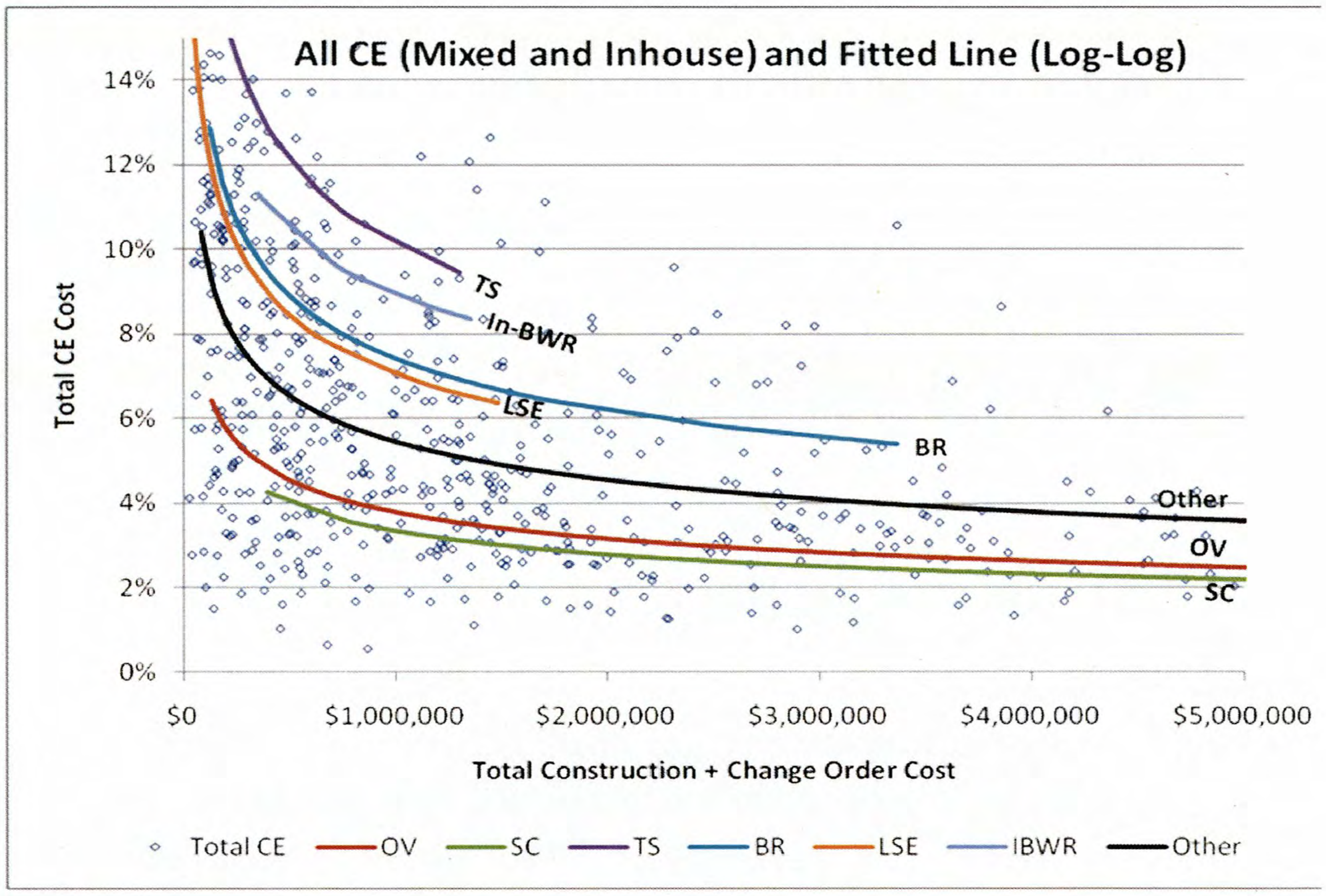
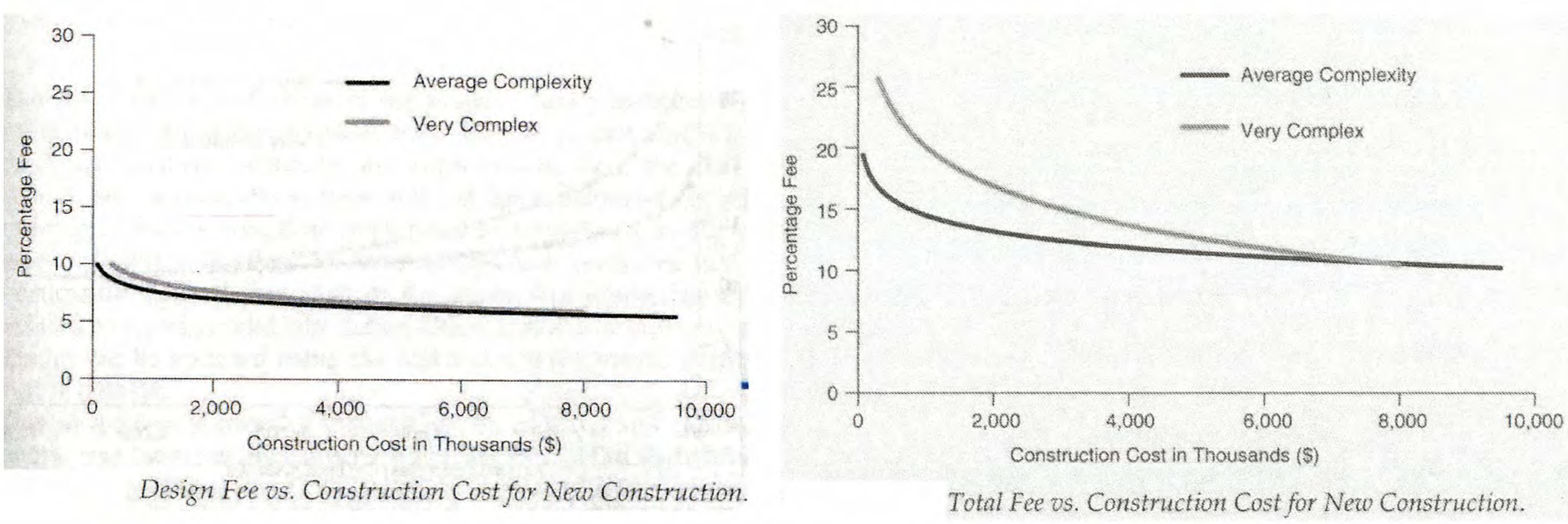


Figure 4.2: Construction engineering costs for TxDOT projects (Source: Persad & Singh, "An Analysis of TxDOT's In-house and Consultant Preliminary Engineering and Construction Engineering Costs")



(a) (b)

The ASCE published these charts on *engineering fees* in its publication "How to Work Effectively with Consulting Engineers. Getting the Best Project at the Right Price" (ASCE Manuals and Reports on Engineering Practice No. 45. ASCE 2002). Engineering fees are shown as a percentage of construction costs. The *Design Fee* in Figure 4.3(a) covers "preliminary and final design services." The *Total Fee* in Figure 4.3(b) covers "investigations, studies, preliminary design, final design, construction services, and all other services." These graphs were created by fitting logarithmic curves to data collected confidentially from respondents to a 2000 ASCE survey of consulting

Figure 4.3: PE and total engineering costs for new construction (Source: ASCE, 2002)

The ASCE charts provides the same inverse relationship between the design fee and total fees paid to consultants as a percentage of construction costs. The total fee covers investigations, studies, preliminary design, final design, construction services, and all other services. This confirms that TxDOT's percentage CE costs follow the same trend as the national trend from the ASCE practice manual.

TxDOT's statewide CE costs have historically ranged at around 5%. FIMS data compiled from all completed projects in FY 2007 showed an average CE cost of 4.76%. Similar data for all completed projects in FY 2010 shows a CE cost of 4.57%.

4.2.2 TXDOT'S Construction Workload Staffing Model

In addition to the cost models, CTR has reviewed the TxDOT construction workforce staffing model (CWSM). This model maintained by the Construction Division of TxDOT is used for estimating construction workforce required to inspect, supervise, and manage all active and upcoming construction projects. This technical memo summarizes the strengths and deficiencies of the current model.

The CWSM estimates the staffing numbers in three different categories:

1. Number of inspectors required to inspect the projects.
2. Number of managers needed to manage the construction staff at the Area Office level.
3. The support staff needed to ensure compliant record-keeping and materials testing at Area Office and District laboratories; District Director of Construction and his/her staff.

4.2.3 CWSM Inspector Counts

The CWSM estimates inspector counts using productivity assumptions in terms of dollar value of construction work that can be inspected per month per inspector. The base value for this is $250,000 per inspector per month. This base productivity number was calculated using data from 2008 and is adjusted using TxDOT's Highway Cost Index (HCI) when estimating inspector counts using construction costs for future projects. The CWSM refines the inspector counts by eliminating over-estimation for Seal Coat (SC), Overlay (OV), and Bridge Rehabilitation (BR) projects. This is needed because SC and OV projects can consist of many smaller jobs that, if modeled using the standard productivity approach, would yield an over-estimation. Similarly, inspector needs for the BR projects are calculated using a modified approach, whereby a $5M BR project is assigned a single inspector and anything above that is assigned two inspectors during the life of the project.

In addition to directly inspecting and managing projects, TxDOT has oversight on projects where federal transportation funds are utilized. However, entities other than TxDOT are responsible for managing and inspecting construction work. For these projects, CWSM estimates the inspector requirements using a factor that yields a productivity of $2.5M per inspector per month. A similar approach was used to calculate inspector needs for projects that use non-traditional methods of project delivery, i.e., Comprehensive Development Agreements, Design-Build projects, and others. The current version of the model does not contain data for these types of projects.

4.2.4 Calculated and Actual Contract Duration

One key variable missing in TxDOT's Design and Construction Information System (DCIS) is "construction or contract duration" for projects that will be let in the future. This is a critical variable for calculating construction staffing needs, because construction projects span several months—or, in the case of large projects, several years. The CWSM overcomes this by using a duration model that converts construction costs into months of contract time or construction duration. Although it would be preferable to have actual contract durations for all projects, in the absence of such, the calculated duration estimates are the next available option. These, however, may not match the actual durations and, therefore, affect the overall staffing counts.

CWSM first calculates the number of inspectors needed to inspect the projects in the field based on the productivity assumptions or project types mentioned above. After calculating those numbers, the CWSM calculates the support staff and managers needed. Manager numbers are calculated using a ratio of 14 inspectors per manager (defined as an Area Engineer, Assistant Area Engineer, or Project Manager). Support staff calculations are based on the overall construction volume. Figures 4.4 and 4.5 illustrate outputs from CWSM.

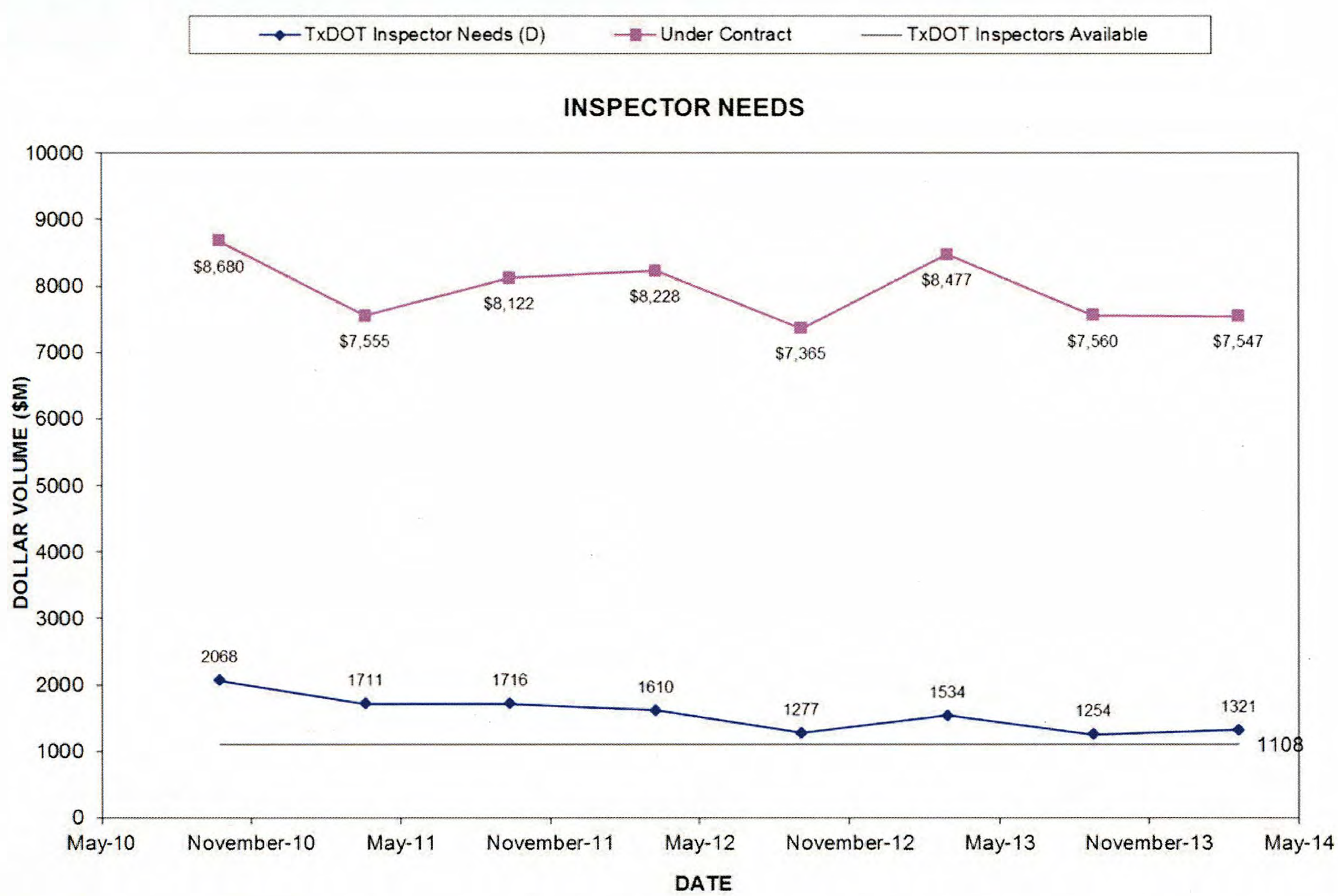


Figure 4.4: CWSM calculation of TxDOT inspector needs based on dollar volume under construction (Source: Ken Barnett, CST)

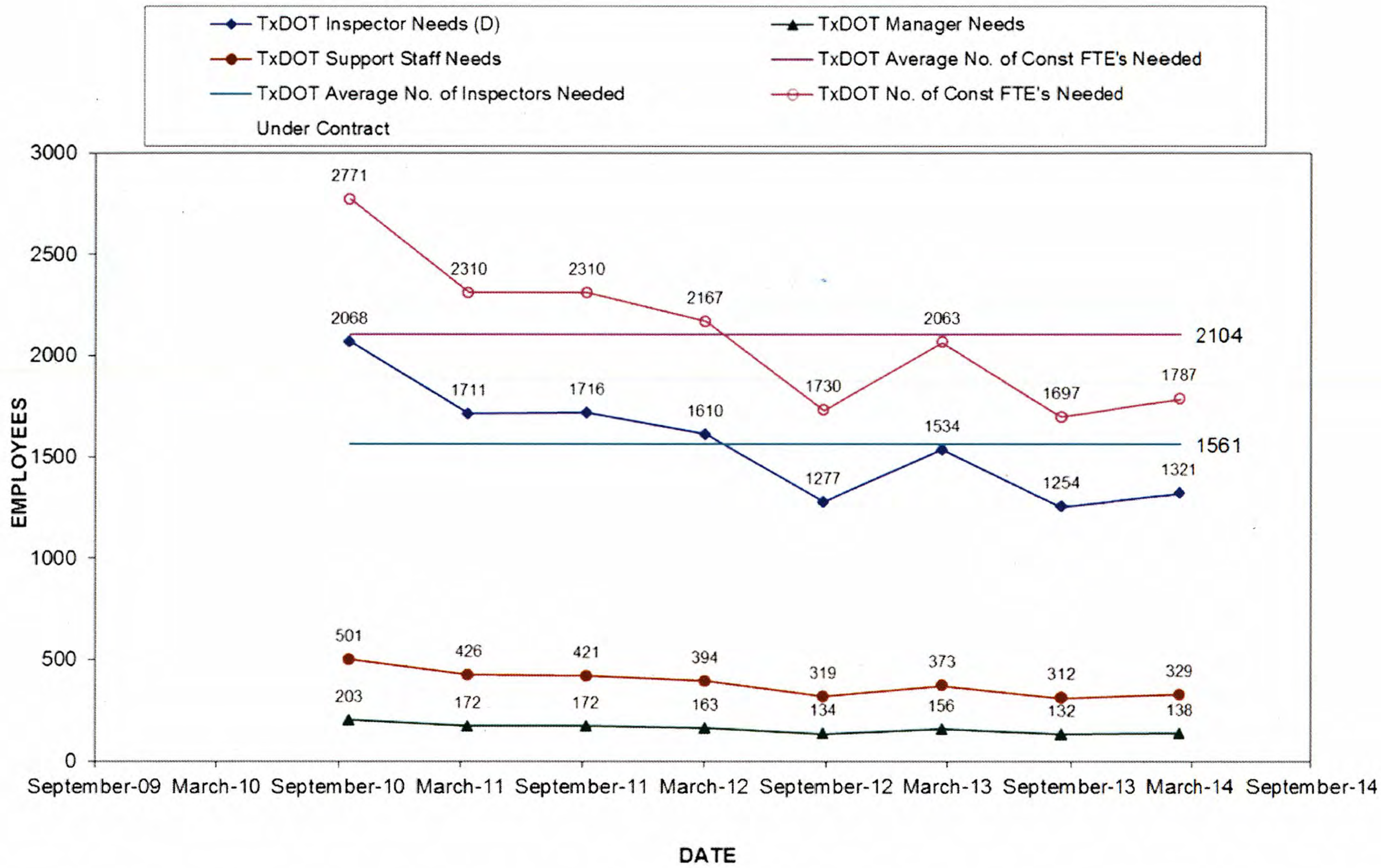


Figure 4.5: CWSM calculation of total construction staffing needs based on same construction volume as Figure 4.4 (Source: Ken Barnett, CST)

4.2.5 CWSM Limitations

In order to test the model limitations, a hypothetical project mix scenario was tested as shown in Figure 4.6. As can be seen, the two scenarios have an approximately equal amount of construction volume; however, the calculated inspector needs are far apart (eight for the first scenario and three for the second scenario) because the model rounds up calculated numbers below one. Any number greater than one is not rounded up. This may yield an over-estimation for an office with a series of small projects and under-estimation for an office with several large projects.

Construction Co	Duration	Average Monthly Estimate	Calculated Inspecto	Awarded Inspecto	Inspector Months
$ 850,000	10	$ 84,720	$ 0.44	1.00	10
$ 1,100,000	12	$ 92,729	$ 0.48	1.00	12
$ 1,400,000	14	$ 103,139	$ 0.53	1.00	14
$ 1,600,000	15	$ 110,182	$ 0.57	1.00	15
$ 1,900,000	16	$ 120,705	$ 0.62	1.00	16
$ 2,200,000	17	$ 131,099	$ 0.68	1.00	17
$ 2,600,000	18	$ 144,713	$ 0.75	1.00	18
$ 3,350,000	20	$ 169,490	$ 0.87	1.00	20
$ 15,000,000				**8.00**	**120**

Construction Co	Duration	Average Monthly Estimate	Calculated Inspecto	Awarded Inspecto	Inspector Months
$ 4,950,000	23	$ 219,652	$ 1.13	1.13	25
$ 9,950,000	27	$ 361,949	$ 1.86	1.86	51
$ 14,900,000				**3.00**	**77**

Figure 4.6: CWSM limitation—two equal construction volumes with different numbers of projects yields different inspector needs

The model currently uses a 5% inflation factor for adjusting inspection productivity. Because the DCIS uses a 4% inflation adjustment factor, it may be preferable to use the same in the CWSM to ensure consistency. TxDOT has been working on refining its 4-year work plan. The CWSM was populated with future project data prior to the finalization of the 4-year work plan. Therefore, it's quite possible that the model may not incorporate all projects that are part of the 4-year work plan now. It is highly recommended that the CWSM is updated with the latest data from the 4-year work plan to see if an adjustment is needed.

4.3 Task 12B. Project Development Staffing

Technical Memo 2
Primary Author: Khali Persad
November 2010

4.3.1 Introduction

This memorandum provides an update on various models for estimating Project Development Engineering (referred to as PE) costs incurred on TxDOT projects and approaches to estimating PE staffing.

4.3.2 Project Development Engineering Costs

PE costs are the costs incurred in developing project data and preparing construction plans. PE costs as a percentage of project construction costs generally exhibit an inverse relationship to project construction costs. This relationship is widely used by consultants for estimating PE costs and staffing, as recommended by the 2002 ASCE Manuals and Reports on Engineering Practice (ASCE, 2002). Figure 4.7 shows the ASCE chart.

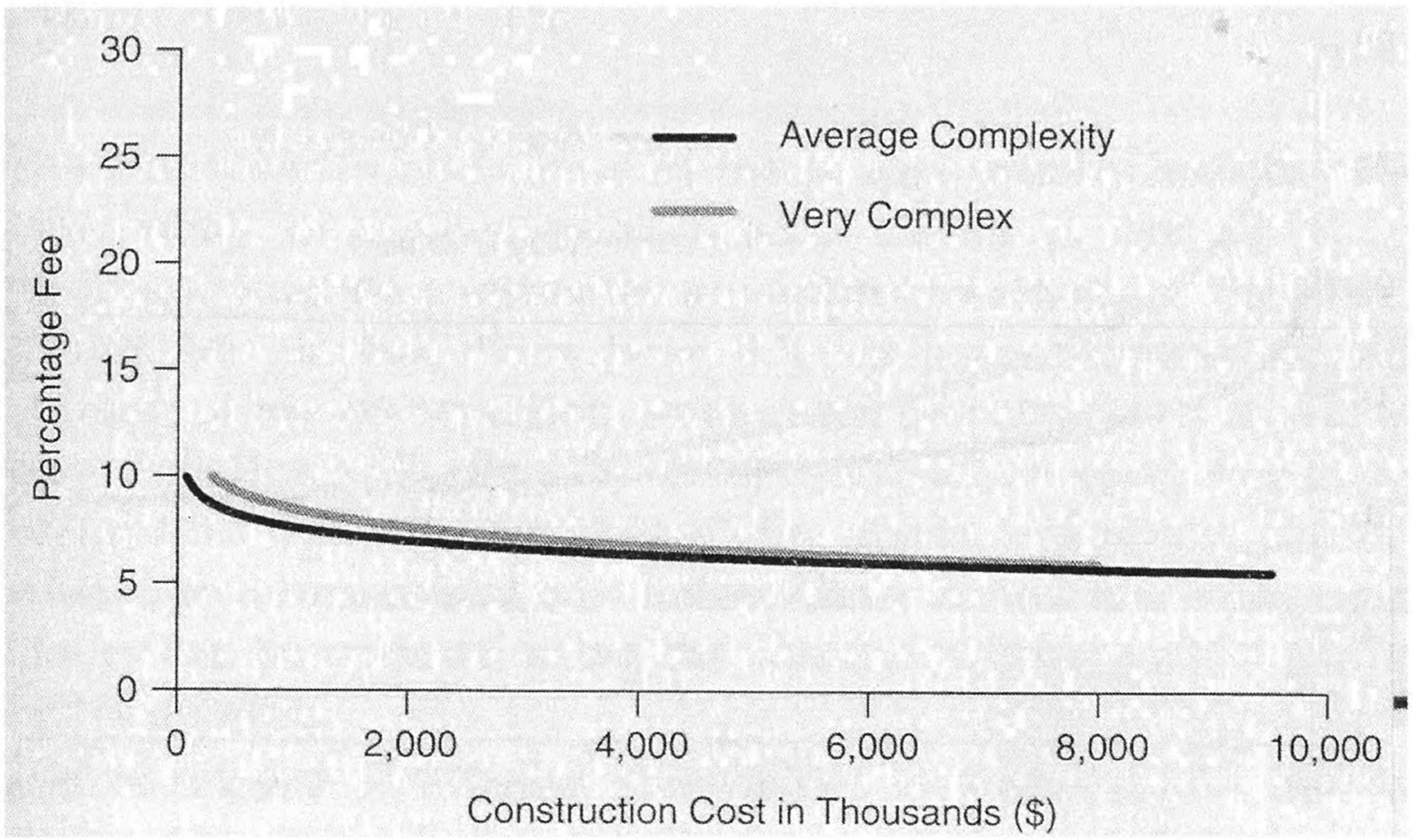


Figure 4.7: ASCE chart for PE cost estimation (ASCE, 2002)

The percentage PE fee can be estimated for a given project size and complexity using the ASCE chart. For example, a $10 million project would have a recommended fee of about 5%, or $500,000, while a $1 million project would have a fee of about 7–8%, or $70–80,000, depending on complexity. The fee would include investigations, studies, preliminary design, final design, and PS&E preparation.

4.3.3 TxDOT PE Costs

PE costs are tracked by TxDOT as "Function Code 100 series" in TxDOT's FIMS, as summarized in Table 4.1.

Table 4.1: TxDOT PE cost codes

Function Code	Function Description
102	Feasibility Studies
110	Route and Design Studies
120	Social, Economic and Environmental Studies and Public Involvement
126	Donated Items or Services
130	Right-of-Way Data (State or Contract Provided)
145	Managing Contracted or Donated Advance PE Services. Also includes all costs to acquire the consultant contract(s) and services Applicable to advance PE, Function Codes 102 - 150. Advance PE are activities in Function Codes 102 through 150.
146	Rework by TxDOT of complete consultant plans on advance PE projects. Advance PE are activities in function codes 102 through 150.
150	Field Surveying and Photogrammetry
160	Roadway Design Controls (Computations and Drafting)
161	Drainage
162	Signing, Pavement Markings, Signalization (Permanent)
163	Miscellaneous (Roadway)
164	Managing Contracted or donated PS&E PE Services. Also includes all costs to acquire the Consultants Contract(s) and Services applicable to PS & E, Function Codes 160 - 190. PS&E PE are activities in function code 160 through 190.
165	Traffic Management Systems (Permanent)
166	Rework By TxDOT Of Completed Consultant Plans on PS&E projects. PS&E PE are activities in function codes 160 through 190. Rework Segment 76 FCs 160-190 for metric conversion. For reworking existing PS&E to metric units on projects already into plan preparation.
169	Donated Items or Services
170	Bridge Design
180	District Design Review and Processing
181	Austin Office Processing (State Prepared PS&E)
182	Austin Office Processing (Consultant Prepared PS&E)
190	Other Pre-letting date Charges, Not Otherwise Classified.
191	Toll Feasibility Studies
192	Comprehensive Development Agreement Procurement
193	Toll Collection Planning

During the pre-construction phase TxDOT projects are designated by Control-Section-Job numbers (CSJ). Multiple CSJs may be packaged as a Construction CSJ (CCSJ). In a study conducted in 2009, Persad and Singh (2009) analyzed PE costs on 1,473 CCSJs (about 14,000 CSJs bundled) that went to letting in fiscal years 2006 and 2007 (i.e., with letting dates September 2005 through August 2007).

The objective of that study was to compare in-house PE costs to consultant PE costs, and it was found that the average recorded PE costs of a CCSJ conducted entirely with in-house forces is 1.29% of construction cost (including change orders), while those with consultant involvement (termed "mixed" because there were no fully consultant-staffed projects in the data) have 6.20% average recorded PE costs. Table 4.2 is a summary of the projects studied.

The Project Type abbreviations are standard TxDOT project types, as shown in Table 4.3. This analysis showed that fully in-house projects are generally smaller in construction cost and have lower PE costs than projects with consultant involvement.

A statistical analysis found that TxDOT's PE costs follow a similar inverse relationship as in the ASCE chart. Figure 4.8 shows the percentage PE plotted versus construction cost for all the projects studied, and the statistically fitted lines.

Table 4.2: Construction cost and percentage PE by project type for 2006–07 TxDOT projects

Projects		**Observed Ranges**		**Observed Medians**	
Type	**No.**	**Construction Cost**	**% PE**	**Constr. Cost**	**% PE**
In-house BR	10	$123k-$1.748m	18.0–3.3%	$472k	7.7%
Mixed BR	136	$182k-$144.041m	29.7–2.5%	$1.133m	15.1%
In-house BWR	5	$276k-$1.849m	9.3–2.7%	$384k	7.5%
Mixed BWR	30	$372k-$76.821m	19.7–2.8%	$2.308m	10.1%
Mixed CNF	7	$22.089m-$99.785m	3.0–1.7%	$38.311m	2.5%
In-house INC	1	-	-	$18.555m	0.7%
Mixed INC	26	$2.411m-$69.908m	11.7–3.4%	$23.971m	5.0%
In-house LSE	72	$40k-$2.826m	12.4–0.8%	$250k	3.8%
Mixed LSE	4	$134k-$1.126m	11.1–5.1%	$208k	9.5%
In-house MSC	144	$49k-$14.492m	25.2–0.1%	$455k	3.2%
Mixed MSC	124	$60k-$74.904m	35.8–2.6%	$1.508m	10.9%
Mixed NLF	1	-	-	$67.467m	2.0%
In-house OV	116	$160k-$11.275m	3.8–0.2%	$2.022m	0.7%
Mixed OV	20	$134k-$9.789m	20.0–4.1%	$3.136m	6.3%
In-house SC	74	$396k-$18.483m	1.4–0.2%	$4.790m	0.4%
Mixed SC	5	$1.092m-$8.045m	0.9–0.4%	$6.984m	0.4%
In-house UPG	5	$718k-$8.331m	6.0–1.2%	$5.700m	1.6%
Mixed UPG	5	$3.489m-$62.416m	10.4–3.6%	$14.774m	6.1%
In-house WF	1	-	-	$394k	9.6%
Mixed WF	13	$4.144m-$176.140m	10.6–2.7%	$59.365m	4.0%
In-house WNF	3	$2.395m-$8.023m	0.6–0.3%	$2.704m	0.5%
Mixed WNF	59	$1.552m-$82.910m	10.8–2.5%	$13.668m	4.8%
Other In-house	285	$29k-$22.425m	27.6–0.4%	$776m	2.7%
Other Mixed	327	$58k-$154.257m	27.2–1.5%	$3.390m	6.1%
All In-house	**716**	**$29k- $22m**	**27.6–0.1%**	**$1.4m**	**1.29%**
All Mixed	**757**	**$58k- $176m**	**35.8–0.4%**	**$3.7m**	**6.20%**

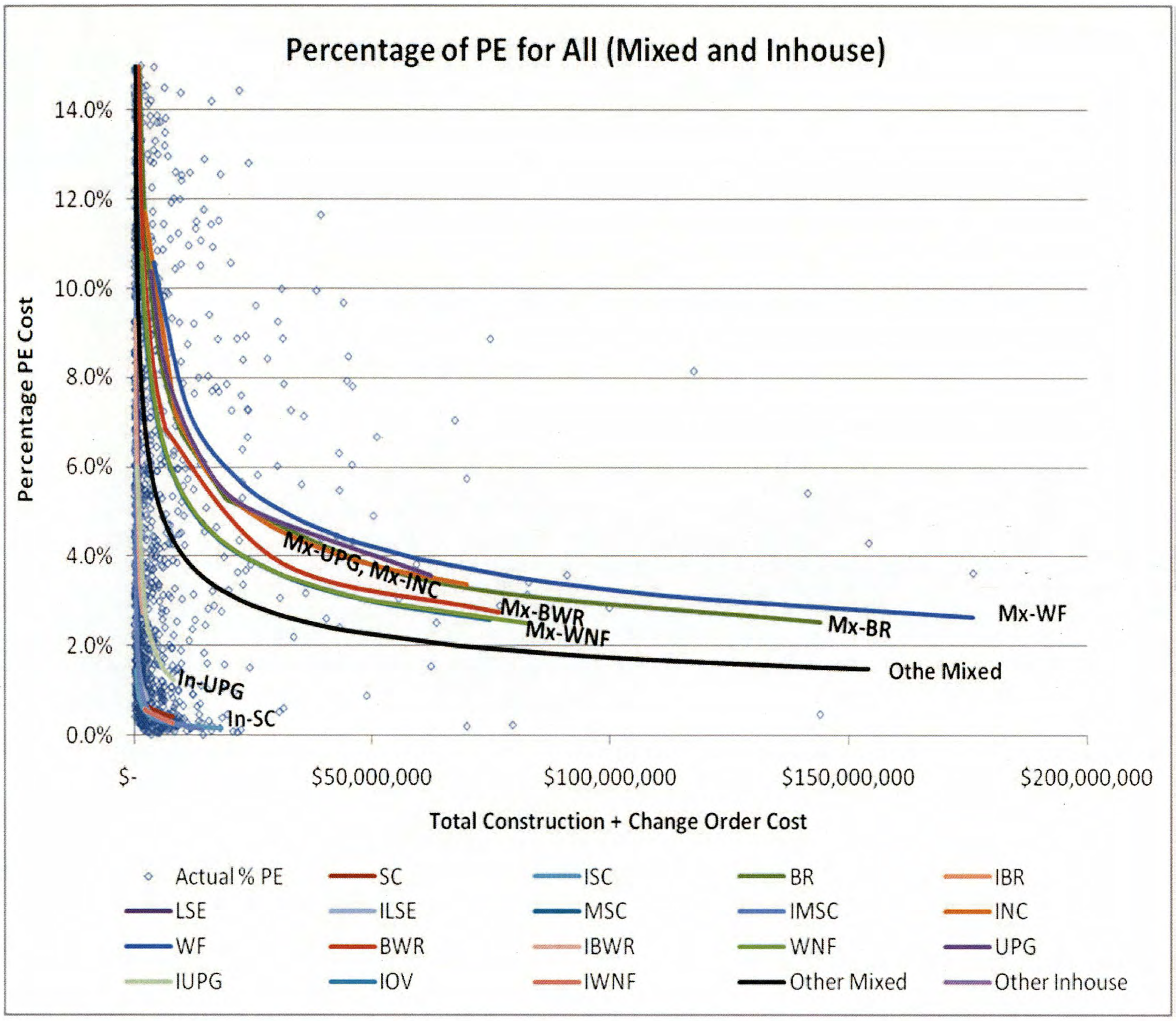


Figure 4.8: Percentage PE costs for mixed (Mx) and in-house (I) TxDOT projects let in FY 2006–07

Because the in-house projects are dwarfed by the mixed projects in this graph, a zoomed plot for projects less than $20 million is shown as Figure 4.9. These` graphs confirm that the TxDOT PE percentage decreases with increasing project construction cost, leveling off at around 2% for mixed projects exceeding $200 million, and less than 1% for fully in-house PE.

That study also found that project types can be ranked in terms of PE complexity as follows:

1. WF: Widen Freeway (including NLF—New Location Freeway and CNF—Convert Non-Freeway to Freeway)
2. UPG: Upgrade Freeway to Standards
3. INC: Interchange
4. BR: Bridge Replacement
5. BWR: Bridge Widen/Rehab

6. WNF: Widen Non-Freeway
7. MSC: Miscellaneous Construction
8. Other Project Types Not Listed
9. Landscape
10. Overlays
11. Sealcoats

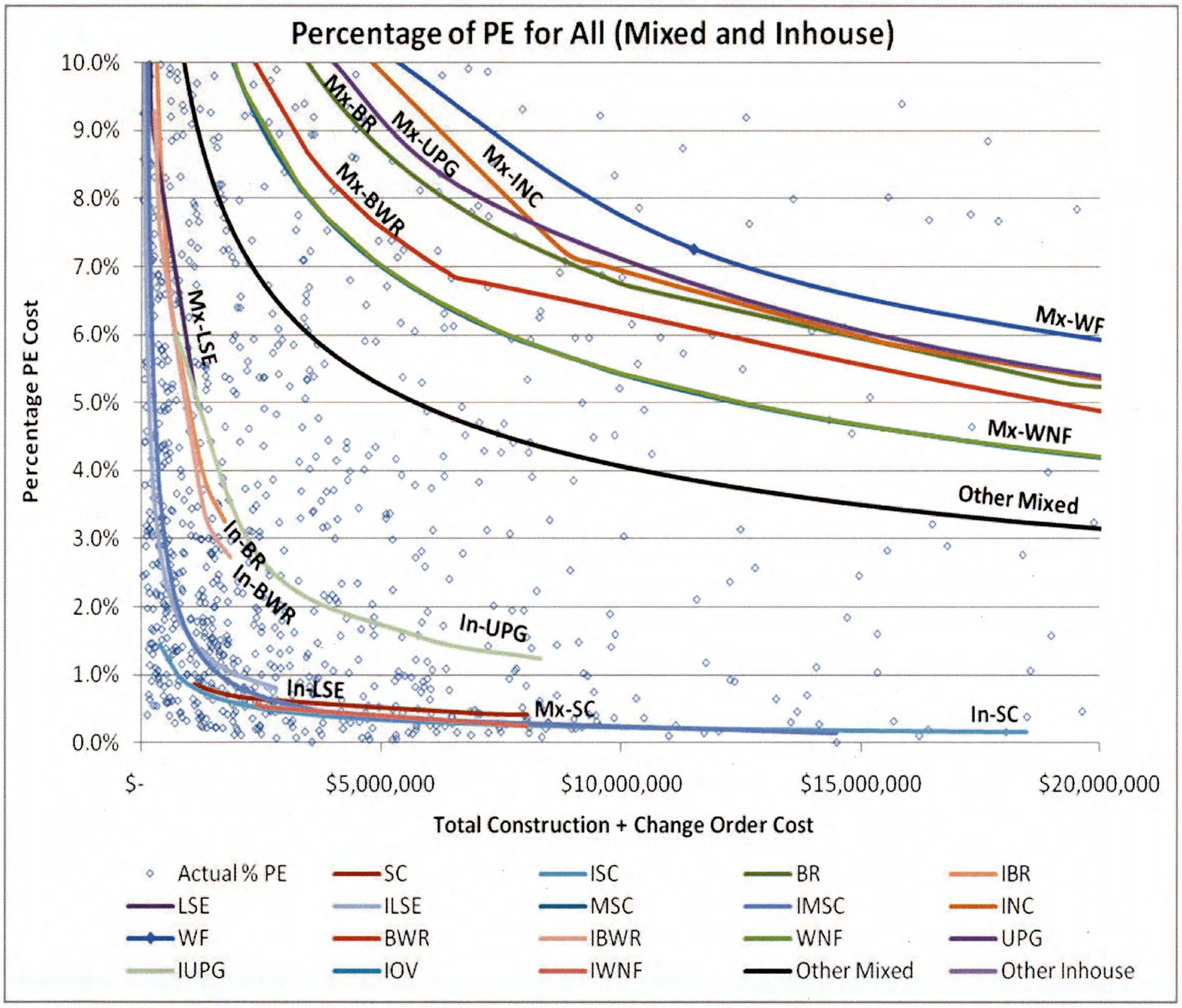


Figure 4.9: Percentage PE costs for mixed (Mx) and in-house (I) TxDOT projects let in FY 2006–07—zoomed plot

The fitted model for estimating TxDOT PE cost is a log-linear relationship of the form:

$$\textbf{Log}_{10}\textbf{PE Cost} = \textbf{(InterceptConstant)} + \textbf{Log}_{10}\textbf{Construction Cost*(SlopeConstant)}$$

The model has an adjusted R^2 of 0.749 at 0.049 F-significance, with a standard error of 0.375 on the estimate of Log_{10}PE Cost. Table 4.3 gives the constants for the respective project types for in-house and mixed projects.

Table 4.3: Coefficients for PE costs for in-house and mixed projects

Provider	Project Type	Intercept Constant	Slope Constant
In-house	Bridge Replacement (BR)	2.313	0.356
	Bridge Widen/Rehab (BWR)	2.313	0.356
	Interchange (INC)	2.313	0.356
	Landscape/Scenic Enhance (LSE)	2.313	0.356
	Miscellaneous Constr.(MSC)	3.604	0.078
	Overlay (OV)	1.929	0.356
	Seal Coat (SC)	2.313	0.442
	Upgrade Freeway to Stds. (UPG)	2.313	0.356
	Widen Freeway (WF)	2.313	0.356
	Widen Non-Freeway (WNF)	1.736	0.356
	Other Project Types	2.313	0.356
Mixed	Bridge Replacement (BR)	1.413	0.631
	Bridge Widen/Rehab (BWR)	1.351	0.631
	Convert Non- Freeway to Freeway (CNF)	1.193	0.631
	Interchange (INC)	1.423	0.631
	Landscape/Scenic Enhance (LSE)	0.937	0.631
	Miscellaneous Constr.(MSC)	1.317	0.631
	New Location Freeway (NLF)	1.193	0.631
	Overlay (OV)	1.193	0.631
	Seal Coat (SC)	0.163	0.631
	Upgrade Freeway to Stds. (UPG)	1.430	0.631
	Widen Freeway (WF)	1.466	0.631
	Widen Non-Freeway (WNF)	1.318	0.631
	Other Project Types	1.193	0.631

When district differences were analyzed, it was found that most districts have fairly similar relationships in terms of in-house PE cost-project size. However, after adjustments for project type and size, there were large differences across districts in the costs of mixed projects, with Laredo, San Antonio, and El Paso being higher than average, and Childress, Amarillo, and Yoakum being lower than average.

The study concluded that project type and construction cost are predictors of PE costs. Projects with consultant involvement are typically larger in scope and more complex, and have higher PE cost. Therefore, when calculating PE costs across a program, it is important to take into account project type, size, and PE provider instead of using a fixed PE percentage.

Some shortcomings were identified with the data and analysis above. One significant shortcoming is that the PE costs analyzed were only those recorded for the CSJs that were bundled into each CCSJ. The accuracy of those charges cannot be checked. PE costs for project development prior to assignment of CSJs (e.g., during corridor planning) were not captured. Similarly, PE costs for CSJs that did not go to letting were not captured. Moreover, there are charges made by PE and management staff to "overhead" or "administration" that are not allocated to CSJs. Consequently, the PE costs recorded for CCSJs let in the 2-year period could be lower than the actual costs incurred by TxDOT. Actual TxDOT PE costs over a 2-year period are not a direct comparison because the development life of the projects could have been over 10+ years.

4.3.4 Nationwide PE Costs

Most state DOTs have higher average PE costs than TxDOT. Table 4.4 shows a summary of a survey conducted by TxDOT in 2008 of PE percentages for several states over the period 2005–07.

However, as was noted earlier, average percentage PE can be a misleading number. If a state is doing many small projects, it is likely to have a higher percentage than a state with larger projects. The only reasonable way to estimate PE costs is at the project level, using project size, complexity, and PE provider as variables. PE costs can then be aggregated across a district or state program.

Table 4.4: State DOT PE percentage costs 2005–07 (Source: TxDOT Survey 2008)

	2005			2006			2007		
	Consultant Projects %	In-House Projects %	All Projects %	Consultant Projects %	In-House Projects %	All Projects %	Consultant Projects %	In-House Projects %	All Projects %
Arkansas		5-8%			5-8%			5-8%	
California			15.70%			13.90%			16.00%
Indiana			4-5%						
Kentucky			21.00%			21.00%			21.00%
Maine			11.20%			7.29%			9.60%
Massachusetts			6-8%			6-8%			6-8%
Missouri			5.26%			5.26%			
Montana			22.00%			20.00%			16.00%
Nevada	10.80%	6.50%							
New Hampshire	10-15%	5-10%	8-10%	10-15%	5-10%	8-10%	10-15%	5-10%	8-10%
New Jersey	11-22%			11-22%			13-23%		
New Mexico	6-12%			6-12%			6-12%		
North Carolina			5.40%			4.60%			4.90%
Ohio	8.62%	5.46%	7.90%	8.62%	5.46%	7.90%	8.62%	5.46%	7.90%
Pennsylvania							14-16%		
South Dakota		3.30%			3.00%			4.69%	
Tennessee			6.87%			6.79%			5.82%
Texas	8.62%	3.43%	7.01%	9.30%	3.22%	6.31%	8.65%	3.18%	5.55%
Utah			11.80%			12.80%			11.03%
Virginia	10-15%			10-15%			10-15%		
Wisconsin	7.50%			5.06%			7.48%		
Wyoming			10.00%						

4.3.5 PE Staffing Models

To estimate PE staffing needs, most state DOTs use the simplistic percentage of construction volume method, typically estimating PE cost as 10–15% of construction cost. These percentages may be adjusted on individual projects based on project type, size, and provider, with % PE ranging from 6 to 20%. The Wisconsin DOT increases PE costs by up to 2.8 times according to project size and number of consultants involved (WSDOT, 2009).

TxDOT has used some rules of thumb. For example, a general estimate is that one FTE can produce $5 million construction plans per year. Some adjustments are considered for project type and provider. For example, for bridge projects, the estimate is $2.5 million construction per year per FTE, while for seal coats, it is $7.5 million construction per year per FTE. Consultants, who typically work on Funding Categories 2 and 3 (mobility) plans, are estimated to produce $6.5 million construction per year per FTE.

Some states use more detailed methods for estimating staff. The Ohio DOT looks at the number of plan sheets to be prepared. The Florida DOT provided this research team with a spreadsheet that can be used to estimate PE staffing at the work task level (FDOT, 2010). However, the spreadsheet has 34 primary tasks and hundreds of sub-tasks (Figure 4.10 is the introductory tab), and preparing such an estimate appears to be tedious and ultimately no better than simpler methods.

INTRODUCTION		**SIGNALIZATION**	
	Introduction		Signalization Guidelines
	Disclaimer	21.	Signalization Analysis
	Project Information	22.	Signalization Plans
	Summary	**LIGHTING**	
PROJECT GENERAL TASKS			Lighting Guidelines
3.	Project Common and Project General Tasks	23.	Lighting Analysis
ROADWAY ANALYSIS		24.	Lighting Plans
	Roadway Guidelines	**LANDSCAPE ARCHITECTURE**	
4.	Roadway Analysis		Landscape Guidelines
5.	Roadway Plans	25.	Landscape Architecture Analysis
DRAINAGE ANALYSIS		26.	Landscape Architecture Plans
6.	Drainage Analysis	**SURVEY**	
UTILITIES			Survey Guidelines
	Utilities Guidelines	27.	Survey
7.	Utilities	**PHOTOGRAMMETRY**	
ENVIRONMENTAL PERMITS			Photogrammetry Guidelines
	Environmental Permits Guidelines	28.	Photogrammetry
8.	Environmental Permits, Compliance and Clearances	**MAPPING**	
STRUCTURES		29.	Mapping
	Structures Guidelines	**GEOTECHNICAL**	
9.	Summary and Miscellaneous Tasks & Drawings		Geotechnical Guidelines
10.	Bridge Development Report	30.	Geotechnical
11.	Temporary Bridge	**ARCHITECTURE**	
12.	Short Span Concrete Bridge		Architecture Guidelines
13.	Medium Span Concrete Bridge	31.	Architecture Development
14.	Structural Steel Bridge	**NOISE BARRIERS**	
15.	Segmental Concrete Bridge	32.	Noise Barriers Impact Design Assessment in the Design Phase
16	Movable Span	**INTELLIGENT TRANSPORTATION SYSTEMS (ITS)**	
17.	Retaining Walls		ITS Guidelines
18.	Miscellaneous	33.	ITS Analysis
SIGNING & PAVEMENT MARKINGS		34.	ITS Plans
	Signing & Pavement Markings Guidelines		
19.	Signing & Pavement Markings Analysis		
20.	Signing & Pavement Markings Plans		

Figure 4.10: Front tab of Florida DOT PE staffing estimate spreadsheet

4.3.6 Summary and Next Steps

The research team examined a number of models for estimating PE costs and staffing for DOT projects, and the results are summarized in this technical memorandum. The team will continue to search for applicable and useful models, and provide updates as additional findings become available.

In the next step, the team proposes to validate the Persad-Singh models with more recent TxDOT project data. The team would like to investigate actual hours recorded on projects in the recently launched Primavera P6 Project Management system to see if they will provide better insights than FIMS data.

The team has identified some challenges in converting PE costs to PE staffing:

1. Salary and overhead rates are needed to estimate FTEs.
2. Productivity factors may be needed to convert estimated FTEs to recommended staffing.
3. Administrative ratios will be needed to estimate management and support staff needs.

4.3.7 References

1. American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice. 2002.

2. Persad and Singh. TxDOT Research Report 0-6581-1, 2009.

3. TxDOT Survey 2008. TxDOT PE Costs Task Force, 2008.

4. WSDOT 2009. "Cost Estimating Manual for WSDOT Projects." Washington State Department of Transportation, Olympia, WA. 2009.

5. FDOT 2010. "Standard Scope & Staff Hour Estimation Guidelines." <http://www.dot.state.fl.us/projectmanagementoffice/Scope/default.shtm>. Accessed October 2010.

4.3.8 PE Analysis—June 17, 2011 Update

On April 20, 2011, data was obtained from the Finance Division (FIN) on all CSJs let in FY 2008–10, i.e., with letting dates between September 2007 and August 2010, a total of 3,172 CSJs packaged and let as 2,430 CCSJs.

4.3.9 Data Checks

Table 4.5 is a summary of the number of CCSJs of each DCIS project type.

Table 4.5: Project types for 2008–10 TxDOT lettings

Project Class	No. of CSJs	Project Class	No. of CSJs
BR	420	RES	69
BWR	88	ROW	51
CNF	5	SC	350
INC	33	SFT	542
LSE	80	TS	69
MSC	487	UGN	8
NLF	6	UPG	21
NNF	47	UTL	16
OV	378	WF	22
RER	276	WNF	118

Noteworthy is that 487 projects are classified as MSC—Miscellaneous Construction. For each CSJ, the data included the hours and dollars charged (overhead included) to PE, i.e., function codes 102–193. Total PE cost for these projects was $487.3 million, for 3,819,279 manhours. Figure 4.11 shows the distribution of hours to complete a CCSJ, with the most frequent observations (1,349 CCSJs) being in the 100–1,000 hours range.

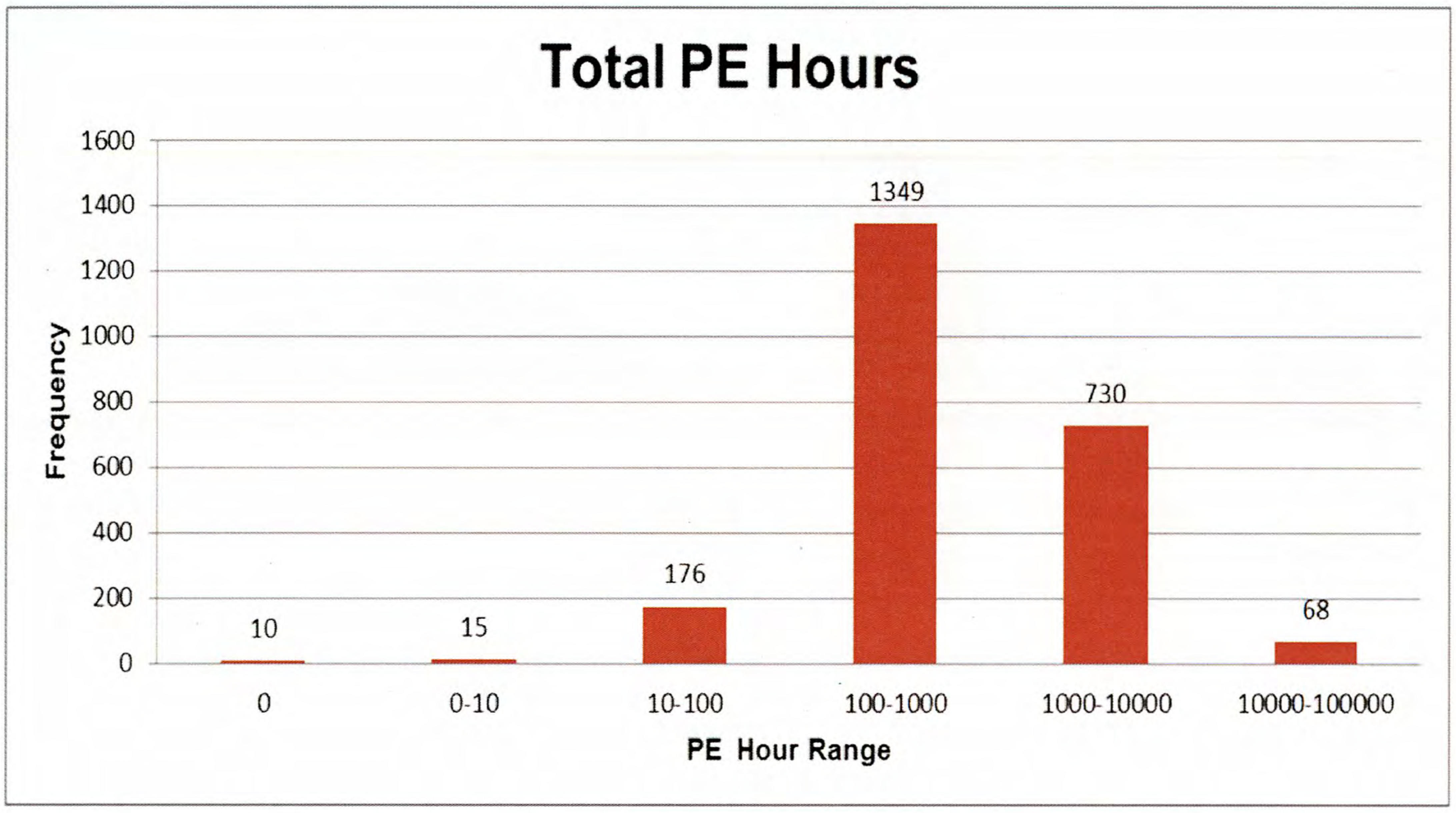


Figure 4.11: Distribution of hours to complete a CCSJ

Of note is that 10 CCSJs had 0 hours, and 15 were found with 10 or fewer hours. At the other extreme, 68 CCSJs had 10,000 or more hours. The largest, a Widen Freeway (WF) in Harris County, had 79,436 hours, and two WFs in Montgomery County had 44,937 hours and 41,191 hours respectively.

Figure 4.12 shows the distribution of cost per hour at the CSJ level. Average cost per PE hour was $127.58. At the upper end are a New-Location Non-Freeway (NNF) in Guadalupe County that came out at $65,340/hour, a NNF in Bell County for $55,817/hour, and a Bridge Replacement (BR) in Taylor County for $22,260/hour. These figures suggest that the hours and/or costs were not properly recorded.

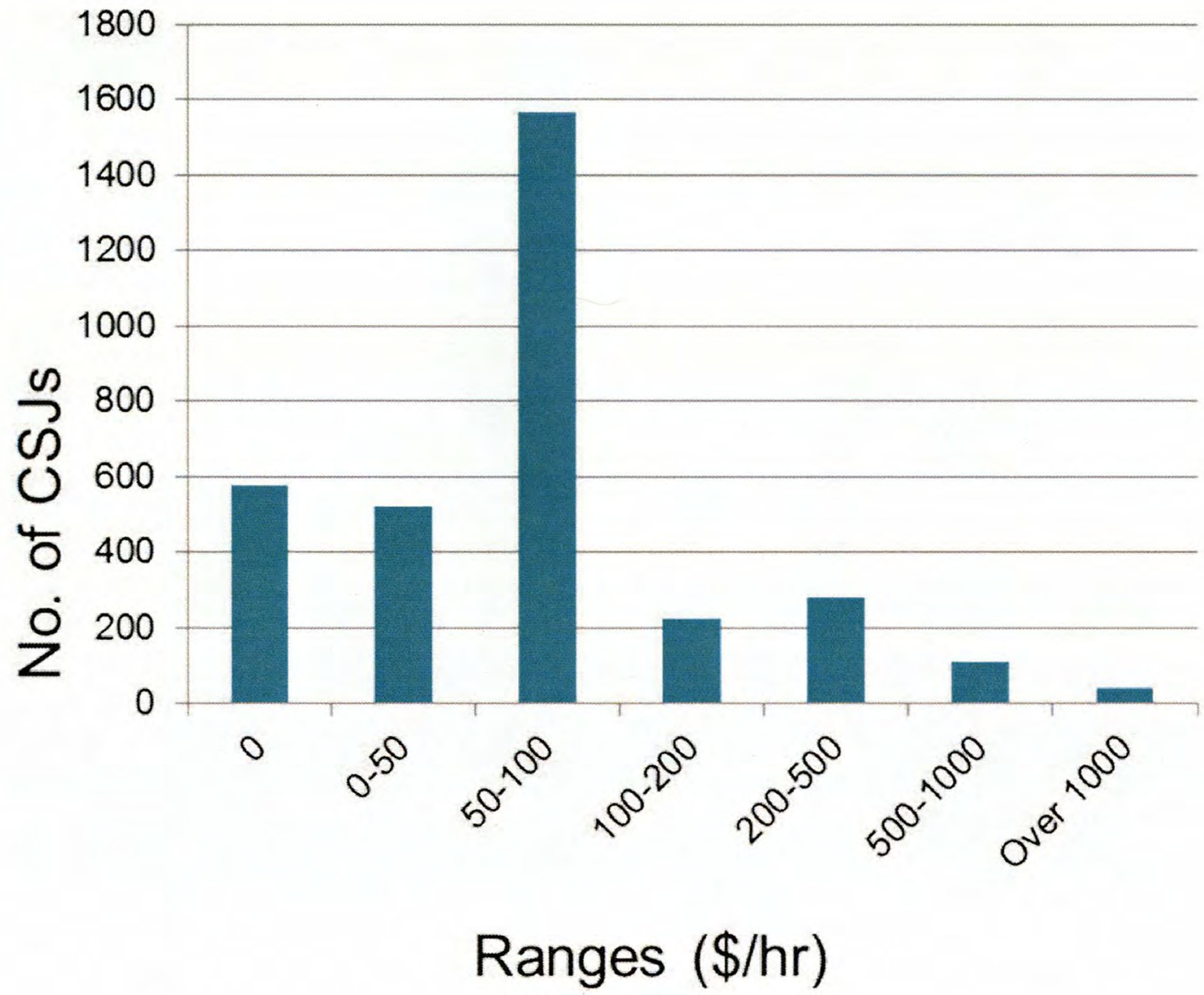


Figure 4.12: Distribution of PE cost/hour at CSJ level

Of concern is that almost 600 CSJs have zero costs per hour. This group of projects clearly has charges missing, affecting the ability to model PE needs. Additionally, there appears to be one statistical mode in the \$50–100 per hour range (almost 1,600 CSJs) and another in the \$200–500 per hour range (almost 300), perhaps corresponding to two different cost regimes. Future analyses will explore this aspect further.

4.3.10 PE Cost Model

To estimate future staffing needs, it is necessary to estimate both PE cost and PE hours at the project level. Even though projects are developed in the districts at the CSJ level, in many cases a group of CSJs are developed concurrently and packaged as a single CCSJ for construction. Therefore, effort was focused on analyzing the data at the CCSJ level. Of the 2,430 CCSJs for which data was obtained, 90 had zero charges, and these were removed from further analysis.

With data from 2,340 CCSJs, a model of the following form was proposed for each project type:

PE Cost (or Hours) = F{Construction Cost, Location}

Or, for all project types:

PE Cost (or Hours) = F{Construction Cost, Location, Project Type}

The data distributions were observed to be non-normal (as is the case with many phenomena), so in order to satisfy conditions for statistical analysis, a log transform was done:

$$\textbf{Log}_{10}\textbf{PE Cost (or Hours)} = \textbf{(Constant A)} + \textbf{B* Log}_{10}\textbf{Construction Cost} + \textbf{Project Type Factor} + \textbf{Location Factor}$$

PE cost and Construction Cost are continuous variables, while Project Type and Locations are Binary (e.g., BR is present [=1] or absent [=0], etc., and Location is Metro [Y=1, N=0], Urban or Rural). Stepwise regression was carried in the SPSS Statistical Package, whereby variables were entered in order of significance, and removed if no longer significant. Table 4.6 gives the result.

Table 4.6: SPSS statistical PE cost model for 2,340 FY 2008–10 CCSJs

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
15	.737[o]	.544	**.541**	.46973

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
15	(Constant)	1.612	.126		12.788	.000
	Const_Costs	.563	.019	.504	30.328	.000
	OV	-.901	.041	-.451	-22.194	.000
	SC	-1.059	.054	-.331	-19.748	.000
	BR	.158	.041	.080	3.840	.000
	WNF	.170	.056	.050	3.031	.002
	Metro	.103	.032	.048	3.230	.001
	LSE	-.548	.066	-.137	-8.342	.000
	RES	-.518	.068	-.118	-7.566	.000
	RER	-.354	.043	-.158	-8.243	.000
	SFT	-.324	.041	-.169	-7.832	.000
	MSC	-.232	.041	-.126	-5.720	.000
	TS	-.302	.069	-.072	-4.384	.000
	Rural	-.056	.022	-.040	-2.584	.010

The model can also be read as:
Log (PE Cost) = 1.612 + 0.563 Log (Constr. Cost) + 0.158 BR + 0.17 WNF – 0.548 LSE – 0.518 RES – 0.354 RER – 0.324 SFT – 0.232 MSC – 0.301 TS - 0.901 OV - 1.059 SC + 0.103 Metro – 0.056 Rural

The project types not listed are the pool group. Thus, the pool is "Other project type, in an Urban County." The numbers for Metro and Rural indicate that Metro projects are 10^0.103 = 27% more costly, and Rural projects are 10^-0.056 = 88% of the cost of Urban projects. A positive coefficient for a specific project type indicates that that type is more costly than the pool, while a negative coefficient indicates it is less costly. Thus, BR and WNF are more costly than the pool, while SC and OV are among the least costly.

The model adjusted R-squared is 0.541, indicating that PE cost is only partially reflected by construction cost, project type, and location. Other factors also play a part, but data is not available to investigate these. The standard error is 0.470, meaning that for 68% confidence in estimate (one standard deviation on each side of mean), the natural PE cost estimate is multiplied or divided by 10^0.47 = 2.95.

Another model was developed for PE Hours, as shown in Table 4.7.

Table 4.7: SPSS statistical PE hours model for 2,340 FY 2008–10 CCSJs

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
10	.658[j]	.433	**.431**	.43050

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
10	(Constant)	.071	.100		.716	.474
	Const_Costs	.459	.016	.501	28.319	.000
	OV	-.471	.028	-.283	-16.659	.000
	SC	-.611	.043	-.232	-14.066	.000
	WNF	.327	.047	.117	6.882	.000
	BR	.154	.027	.096	5.640	.000
	RES	-.211	.058	-.059	-3.677	.000
	LSE	-.214	.054	-.065	-3.988	.000
	NNF	.230	.070	.053	3.307	.001
	INC	.260	.083	.051	3.125	.002
	SFT	-.063	.027	-.040	-2.310	.021

This model can be read as:

Log (PE Hours) = 0.071 + 0.459 Log (Constr. Cost) + 0.154 BR + 0.327 WNF + 0.230 NNF + 0.260 INC– 0.214 LSE – 0.211 RES – 0.063 SFT - 0.471 OV – 0.611 SC

The project types not listed are the pool variable, different in this case from the PE Cost model. Note that the location variable was not found significant, meaning that project PE hours are similar in all locations, but costs differ. As before, a positive coefficient for a specific project type indicates that that type requires more hours than the pool, while a negative coefficient indicates it requires less.

This model is more compact than the PE Cost model, but it has a lower adjusted R-squared of 0.431, indicating that the independent variables predict PE Cost better than they predict PE Hours. However, the standard error is also lower, indicating that there is better confidence in the Hours estimate. The relevant coefficients for each project type are summarized in Table 4.8.

Table 4.8: FY 2008–10 PE cost and PE hours model for each project type

Project Type	Log (PE Cost)		Log (PE Hours)	
	Intercept	Slope	Intercept	Slope
Bridge Replacement (BR)	1.770	0.563	0.225	0.459
Interchange (INC)	1.612	0.563	0.331	0.459
Landscape/Scenic Enhance (LSE)	1.112	0.563	-0.143	0.459
Miscellaneous Construction (MSC)	1.380	0.563	0.071	0.459
New Location Non-Freeway (NNF)	1.612	0.563	0.301	0.459
Overlay (OV)	0.709	0.563	-0.400	0.459
Rehabilitate Existing Road (RER)	1.258	0.563	0.071	0.459
Restoration (RES)	1.094	0.563	-0.140	0.459
Seal Coat (SC)	0.553	0.563	-0.540	0.459
Safety Treatment (SFT)	1.288	0.563	0.008	0.459
Traffic Signalization (TS)	1.311	0.563	0.071	0.459
Widen Non-Freeway (WNF)	1.782	0.563	0.398	0.459
Other Project Types, including BWR, CNF, NLF, UPG, UGN and WF	1.612	0.563	0.071	0.459

Figure 4.13 illustrates some of the model trend lines. The model is inherently limited to the conditions on which the data are based. It captures performance on projects let in FY 2008–10, many of which could have been in development several years prior to that date. It must be noted that the 3 years' lettings had a total of 3,819,279 hours recorded, equivalent to about 650 FTEs. These figures are actual hours and costs plus overhead charged to CSJs that went to letting, and so would not include non-overhead management, support, and compliance functions that do not charge to CSJs, or other non-CSJ time charges. Nor do they include charges to CSJs that did not go to letting (backlog, etc.).

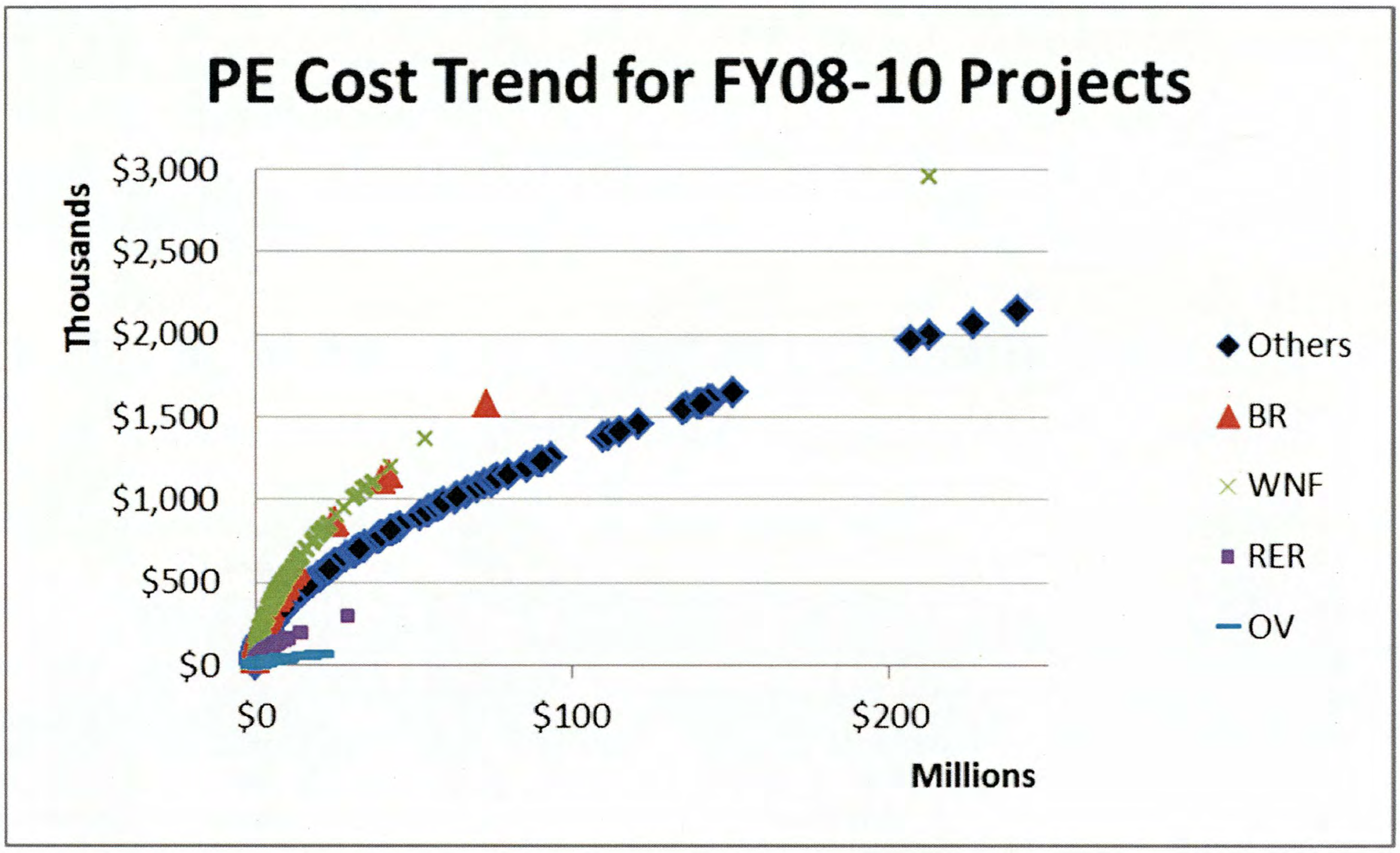


Figure 4.13: FY 2008–10 trend lines of PE cost versus construction cost for some projects types

Also of interest is the slope difference between the models for PE Cost and PE Hours. For example, using the model for "Other Projects."

Log (PE Cost) - Log (PE Hours) = 1.541 +0.104*Log (Project Construction Cost)

Or: **PE Cost/Hours = 34.75*(Project Construction Cost)$^{0.104}$**

This indicates that, as project size increases, the PE hourly rate increases. For example, for a $100,000 project, the hourly rate is estimated at $115.08, and for a $10 million project, the rate is estimated at $185.78. This finding bears out the observation in Section 4.4.1 that there may be two different cost models. Larger projects have higher hourly costs; therefore, to convert PE costs to PE hours, one cannot divide by a standard hourly rate.

4.3.11 Interaction Analysis

A previous analysis of FY 2006–07 data revealed some interaction between project type and construction cost, i.e., the model for some project types had different trend line slopes. A similar analysis was done for the FY 2008–10 data. The results are given in Table 4.9.

Compared to Table 4.8, the models are different, as shown in Table 4.10.

Table 4.9: SPSS statistical PE cost model for FY 2008–10 CCSJs with interaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
18	.741(r)	.550	.546	.46710

Coefficients(a)

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t B	Sig. Std. Error
18	(Constant)	1.084	.131		8.265	.000
	LogCC	.541	.042	.484	12.978	.000
	LogCC_OV	-.143	.006	-.444	-22.510	.000
	LogCC_SC	-.163	.008	-.337	-20.094	.000
	BR	1.153	.333	.589	3.466	.001
	WNF	.148	.057	.043	2.615	.009
	Metro	.750	.268	.351	2.796	.005
	LogCC_LSE	-.091	.012	-.126	-7.868	.000
	RES	-.508	.068	-.116	-7.493	.000
	RER	-.348	.042	-.156	-8.247	.000
	LogCC_SFT	-.049	.007	-.150	-7.287	.000
	LogCC_MSC	-.033	.007	-.105	-5.023	.000
	LogCC_TS	-.320	.115	-.417	-2.784	.005
	LogCC_BR	-.160	.054	-.495	-2.944	.003
	LogCC_Urban	.105	.044	.468	2.409	.016
	TS	1.504	.636	.356	2.365	.018
	LogCC_Rural	.096	.044	.421	2.210	.027

Table 4.10: FY 2008–10 PE cost model for each project type

Project Type	PE Cost Intercept	PE Cost Slope
Bridge Replacement (BR)	2.237	0.381
Landscape/Scenic Enhance (LSE)	1.084	0.452
Miscellaneous Construction (MSC)	1.084	0.508
Overlay (OV)	1.084	0.398
Rehabilitate Existing Road (RER)	0.736	0.541
Restoration (RES)	0.504	0.541
Seal Coat (SC)	1.084	0.378
Safety Treatment (SFT)	1.084	0.492
Traffic Signalization (TS)	2.588	0.221
Widen Non-Freeway (WNF)	1.232	0.541
Other Project Types, including BWR, CNF, INC, NLF, NNF, UPG, UGN, and WF	1.084	0. 541
Metro, add	0.750	
Urban, add		0.105
Rural, add		0.096

This model indicates different trend line intercepts and slopes for some project types. For example, overlays, sealcoats, and traffic signals have flatter lines—their costs do not increase as much as other project types when project size increases. After accounting for project type differences, metro projects have a higher intercept of 0.75, but urban and rural projects have higher slopes of 0.105 and 0.096 respectively. Thus, smaller metro projects have higher PE costs than same-sized urban and rural projects. However, for projects larger than about $30 million, urban and rural have higher PE costs than metro. The models are displayed in Figure 4.14.

This model has a slightly better adjusted R-square (54.6%) than the model presented in Section 4.3.10 (54.1%). It also has a slightly lower standard error (0.4671 versus 0.4697). However, these differences are so small that either model could be used. The simpler model without interaction is preferred.

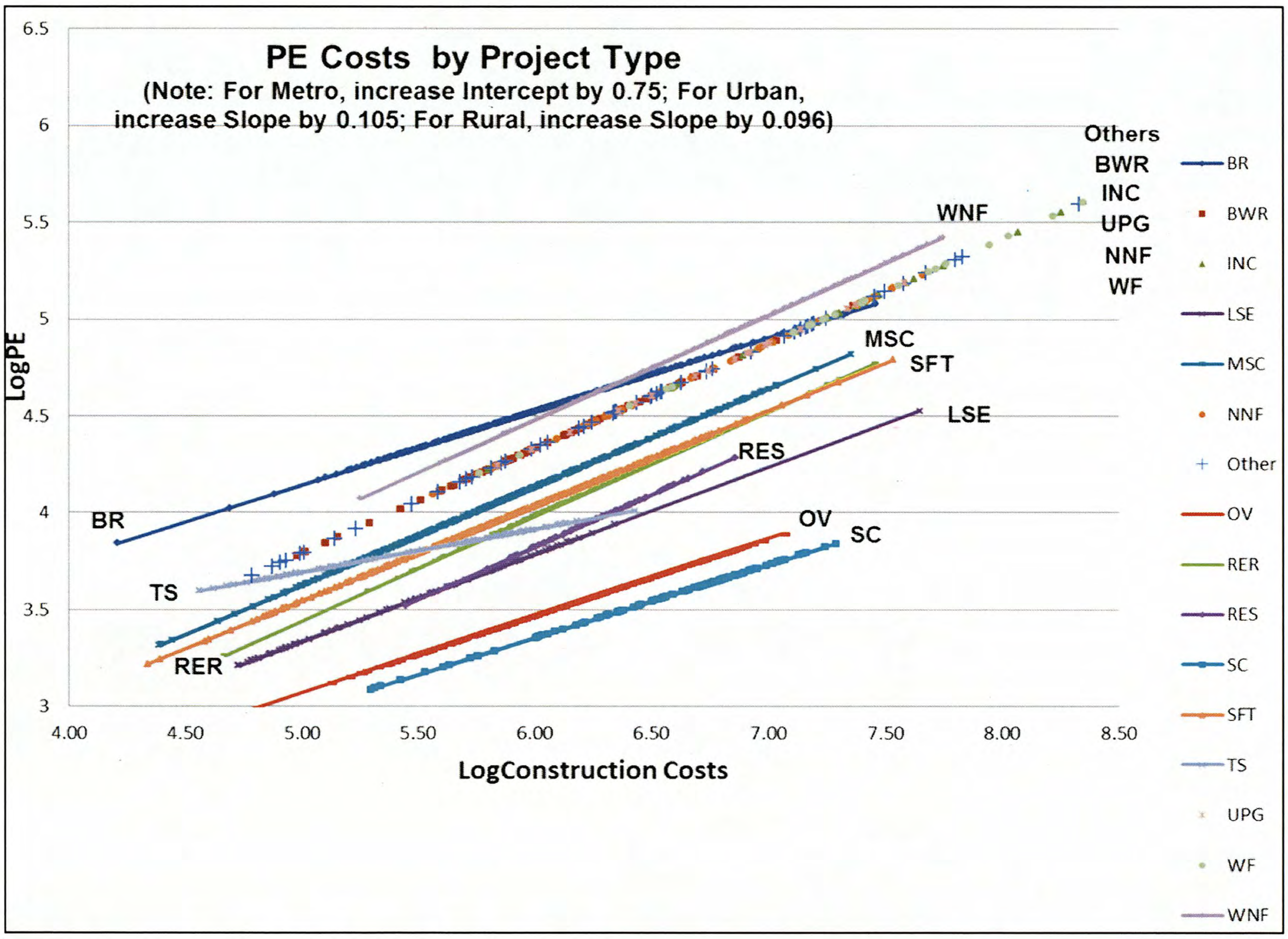


Figure 4.14: FY 2008–10 trend lines of PE cost versus construction cost when project type-construction cost interaction considered

4.3.12 Application of PE Cost Model for 4-year Work Plan

The PE cost model presented in Section 4.3.10 was used to develop a preliminary estimate of district PE staffing needs.

4.3.13 Draft 4-year Work Plan

The approach used in this research to estimate district PE staffing is to use past performance to develop models for estimating PE costs and PE hours at the project level. Then these models can be applied to any program of projects to estimate future costs and hours, which can then be translated into FTEs.

At the beginning of this task, TxDOT had a task force working on developing a 4-year program of lettings for the districts. A preliminary version was provided to this research team in late 2010. It is a list of CSJs by district, with data on project type, estimated construction cost, and estimated letting date. Figure 4.15 is a snapshot of that data.

DISTRICT	CSJ	HWY	COUNTY	AWARD AMT	DCIS WORK TYPE	LET DATE	PE Completion Date
Waco	0996-02-015	FM 638	Limestone	$194,040	SC	Oct-2013	Jul-2013
Dallas	1016-02-017	FM 1138	Collin	$2,242,156	SFT	Oct-2013	Jul-2013
Paris	1465-01-013	FM 1530	Delta	$120,000	SC	Oct-2013	Jul-2013
Waco	1565-01-019	FM 1670	Bell	$337,630	SC	Oct-2013	Jul-2013
Abilene	1654-01-017	FM 1661	Jones	$1,793,912	RER	Oct-2013	Jul-2013
Abilene	1654-03-007	FM 1661	Haskell	$820,618	RER	Oct-2013	Jul-2013
Waco	1661-02-017	FM 67	Hill	$64,105	SC	Oct-2013	Jul-2013
Waco	2133-01-010	FM 485	Bell	$287,191	SC	Oct-2013	Jul-2013
Paris	2193-01-008	FM 2324	Rains	$231,440	SC	Oct-2013	Jul-2013
Waco	2395-01-013	FM 2491	McLennan	$438,533	SC	Oct-2013	Jul-2013
Waco	2604-01-007	FM 2604	Hill	$127,290	SC	Oct-2013	Jul-2013
Paris	2945-01-008	FM 409	Fannin	$308,000	SC	Oct-2013	Jul-2013
Paris	3121-01-009	FM 3019	Hopkins	$52,000	SC	Oct-2013	Jul-2013
Paris	3144-03-008	FM 3105	Hopkins	$156,000	SC	Oct-2013	Jul-2013
Waco	3459-01-023	FM 3371	Limestone	$323,469	SC	Oct-2013	Jul-2013

Figure 4.15: Snapshot of TxDOT 4-year work plan (draft as of late 2010)

It was observed that the projects petered out in 2013, meaning that the draft work plan was missing projects for 2014. The monthly lettings as projected by that draft are shown in Figure 4.16.

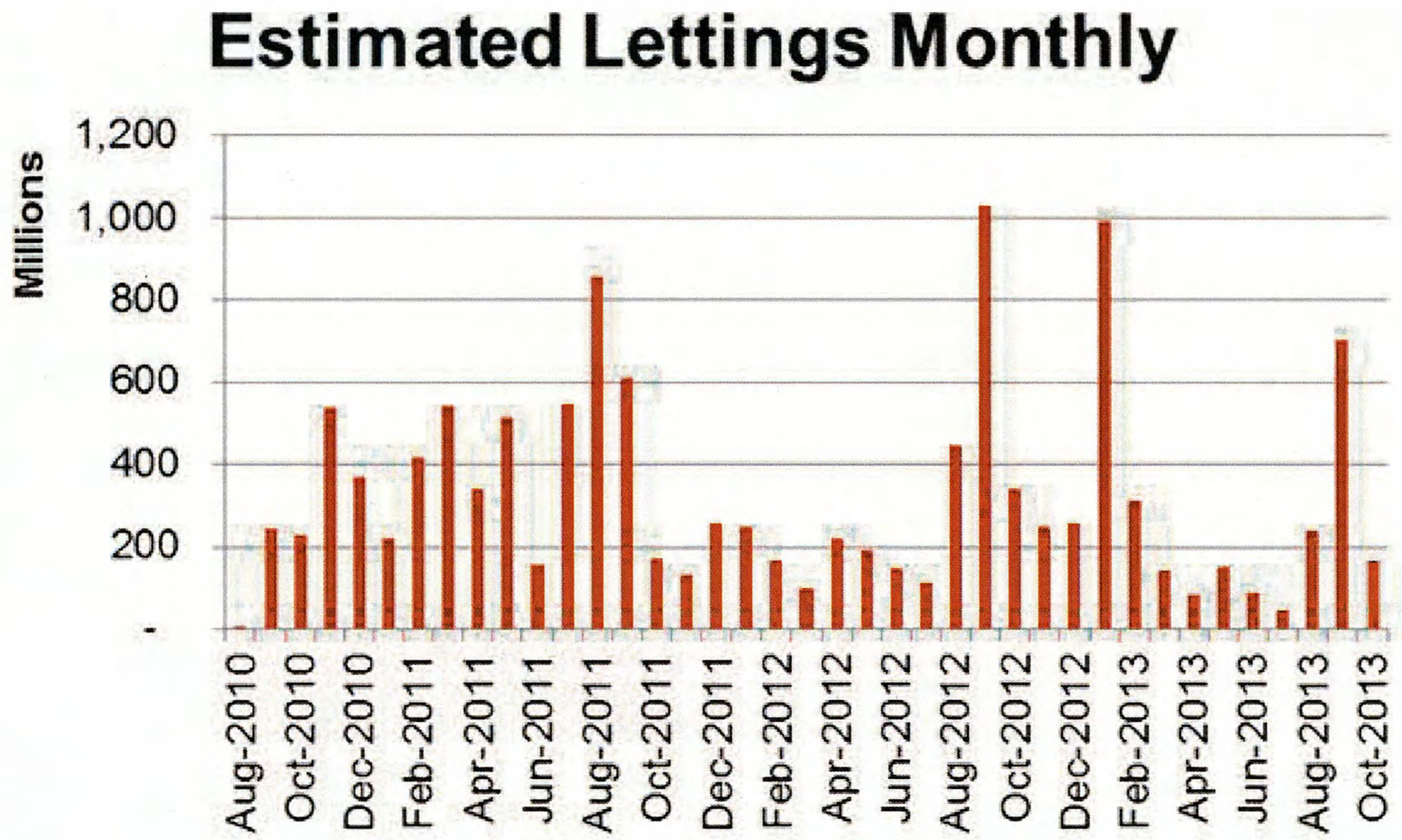


Figure 4.16: Estimated monthly lettings, TxDOT 4-year work plan (draft as of late 2010)

The total construction volume for the period August 2010 through October 2013 is $12,595,251,875. As is normal, there are spikes in summer lettings and troughs in winter lettings, except for one large letting in January 2013.

4.3.14 Estimate of PE Effort for Draft 4-year Work Plan

The PE cost model was applied to this list of projects to estimate district PE expenditure for the draft work plan. A total PE cost for each CSJ was calculated. Next, an assumption had to be made as to when that PE effort is expended. In general, districts are required to submit projects to Austin for review 3 months before letting, so as Figure 4.15 shows, the PE completion date was estimated as 3 months before the let date.

The period over which PE effort is expended depends on the complexity of the project and the urgency of getting it to letting. TxDOT does not have a model for calculating PE duration, although the new P6 program can calculate the Critical Path Method (CPM) time. Realistically, one cannot use the CPM time for every project because CPM assumes that resources are unlimited for the project in question.

Therefore, for this analysis, a simplification was tested to see how the results might vary—the duration of all projects was fixed at a constant. The PE cost was spread evenly over the duration (again, a simplification, but a reasonable one, because expenditure follows a bell curve that, when added over multiple projects with different finish dates, results in a leveling effect). Figure 4.17 shows the results for a fixed duration of 12 months. Different durations gave slightly different profiles, but the peaks and valleys did not vary a lot.

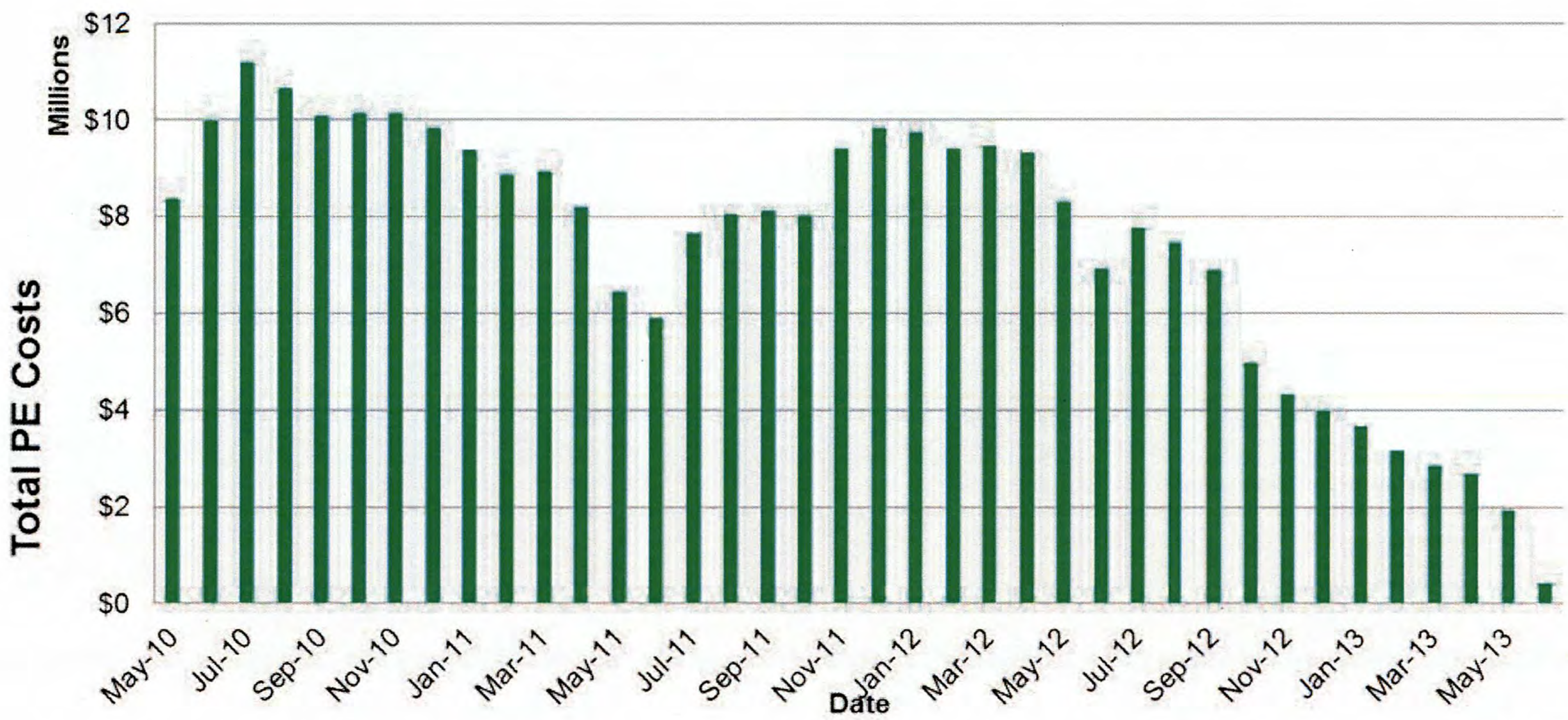


Figure 4.17: Estimated PE expenditures, TxDOT 4-year work plan (draft as of late 2010)

Clearly, the fade-out that begins around October 2012 is due to the lack of defined projects in 2013. A revised version of the 4-year Plan is due in October–November 2012, and should fill out that gap. These results show that the future peak in PE effort is around $10 million per month in the period November 2011 to April 2012. The shoulder appears to be about $8 million per month.

4.3.15 Limitations of this estimate

This estimate is based on district performance in FY 2008–10. Variances in past and future productivity due to staff experience, retirements, consultant usage, etc. are not included. It also does not include functions such as management that may not charge to CSJs, nor can it account for time spent on projects that are not let (e.g., planning projects, shelved projects, etc.) Being a projection of PE costs, it must be adjusted for inflation.

PE cost must be translated to FTEs using some conversion factor. In the 3 years of lettings studied, 3,819,279 hours were recorded. At 2,080 hours per FTE per year, this number is equivalent to just under 700 FTEs. However, there were more FTEs than that figure working on PS&E in the districts in the study period. More data is needed on time spent on non-letting activities in order to provide an estimate of adequate staffing.

Finally, as noted, the 4-year work plan is incomplete past October 2013. A revised version due in October–November 2011 will fill that gap. However, it must also be recognized that large and complex projects take several years to develop, so PE effort for lettings 2–3 years from now is already at its peak. Even though it was found that, in the aggregate, an average project duration of 12 months is reasonable, at the smaller scale of design offices, longer projects and peaking would have more severe effects on the demand for staffing.

4.3.16 District questionnaire

To address the need to convert PE effort into staffing numbers, and the lack of data on non-letting activities, a questionnaire was developed. Three key questions were asked of the districts:

1. How many staff did you have in FY 2008–10 in each of the following categories: Advanced Planning (AP), PS&E Production (PSP), PS&E Support (PSS), Consultant Management (CM), Toll/CDA projects (Toll), and Other Administration (ADM)?
2. What percentage of time did each of those functions spend on projects that didn't go to letting?
3. For a hypothetical annual program of work (ranging from $10 million to $1 billion), how many staff in each of those functions would be needed?

The questionnaire was sent out on August 5, 2011, and twenty districts responded by late August. The numbers will be evaluated to develop some benchmarks for district performance and staffing needs.

4.3.17 Conclusion and continuing work

Because the revised 4-year work plan is due in October–November 2011, the TxDOT panel decided to extend this task into FY 2012. Additional work will be undertaken in the following areas:

1. Collect and analyze additional data, including P6 records on TxDOT PS&E productivity.
2. Develop a model to predict staffing based on overall program dollars and funding category dollars.
3. Develop a model to estimate consultant work volume in relation to consultant costs.
4. Integrate the Texas State University study on in-house and consultant costs into the model to calculate in-house and consultant needs.
5. Develop models for estimating ADM (administration), AP (advance planning), PSP (PS&E production), and PSS (PS&E support) staffing.
6. Submit initial models by November 30, 2011.
7. Refine models for estimating PE needs and apply to TxDOT's Project Development Plan (PDP) 2012 list of projects when it becomes available from TxDOT. Expected in October or November 2012.
8. Estimate PE staffing needs for the Version 2 of the Proposition 12 list of projects when it is finalized and approved by the commission.
9. Provide estimates and refinements as PDP projects are defined for future years.
10. Submit final models by June 30, 2012.
11. Upon the PD's request, conduct a survey of comparable DOTs to identify the methodology used by them for estimating PE staffing during times of uncertain funding. Identify best practices and methods used for determining staffing levels and report findings to the panel.

4.4 Task 12C. Backlog Analysis

Backlog is the term TxDOT uses to describe project plans that are developed even when no funds have been identified for construction.

4.4.1 Reasons for Developing Backlog

There are at least three reasons why backlog projects are necessary:

1. In case new funds suddenly come available, e.g., ARRA funds in 2009.
2. To backfill when some expected projects are not ready for letting.
3. To backfill if bids come in lower than expected, as has been the case in 2009–2011.

However, each of these scenarios has considerations associated with them, as illustrated in Figure 4.18. When projects are delayed, in many cases local agencies other than TxDOT, such as MPOs, have a say in the substitutions, and there may be other restrictions as well, e.g., the replacement may have to be a project from the same funding category. In the case of lower than expected bids, similar restrictions apply as for delayed projects, but again, the operative issue is that it is unexpected. When it happens close to the end of a fiscal year, funding may not roll into the next year.

Reason	Considerations
1. New funding	• Restrictions on use. • Lead time to prepare plans
2. Backfill for delayed projects	• Role of MPOs and others in selecting backfill projects. • Need for lists by funding category.
3. Changes in prices	• Predictable?

Figure 4.18: Reasons for backlogging

New funding may have restrictions on use. For example, ARRA required that the projects be "shovel-ready," meaning TxDOT did not have enough lead time to develop complex projects, and instead had to use the money immediately, primarily on pavement-type projects. Figure 4.19 illustrates TxDOT's annual letting volumes since 2009 and the unexpected funds (those other than Fund 6). There are multiple scenarios for additional funding in the future, but these are highly unpredictable. For example, the 2011 Texas Legislature recently approved Proposition 12,Version 2 (Prop 12 V2), with $3 billion in funding to be available over the next few years.

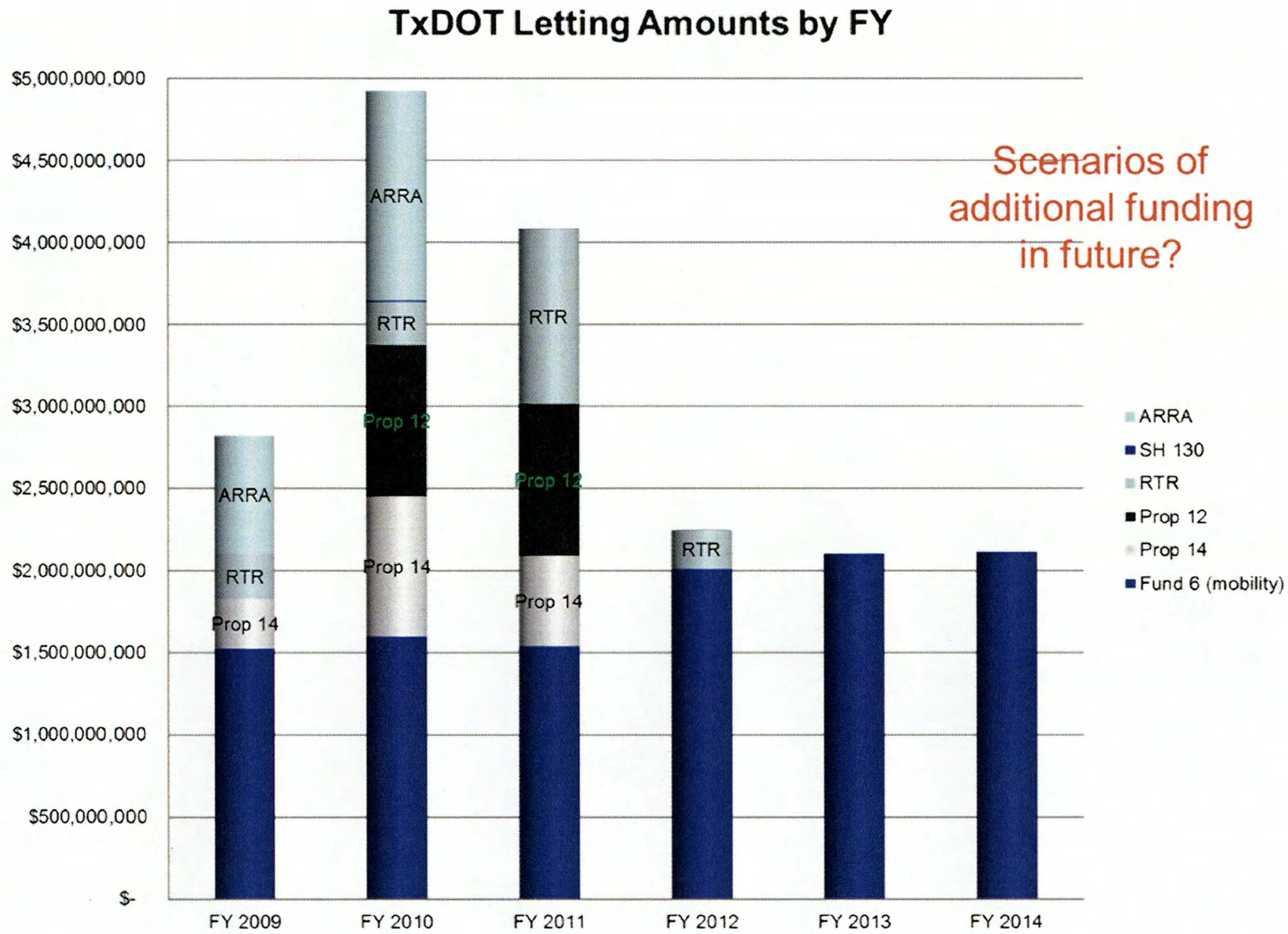


Figure 4.19: TxDOT letting volumes since 2009 and funding sources

Backlog management is contingency management. Figure 4.20 illustrates the questions associated with each type of backlogging contingency. A one-time shot of extra funding requires an equivalent backlog, while a new funding regime requires a ramp-up to a new steady state.

1. Extra funding	One-time or annual?
2. Backfill for delayed projects	Short- or long-term delay?
3. Changes in prices	Predictable?

Figure 4.20: Three types of contingencies for backlogging

4.4.2 Amount of Backlog

The amount of backlog that should be carried by TxDOT is uncertain. As Figure 4.21 illustrates, there are risks as well as rewards associated with the volume of backlog.

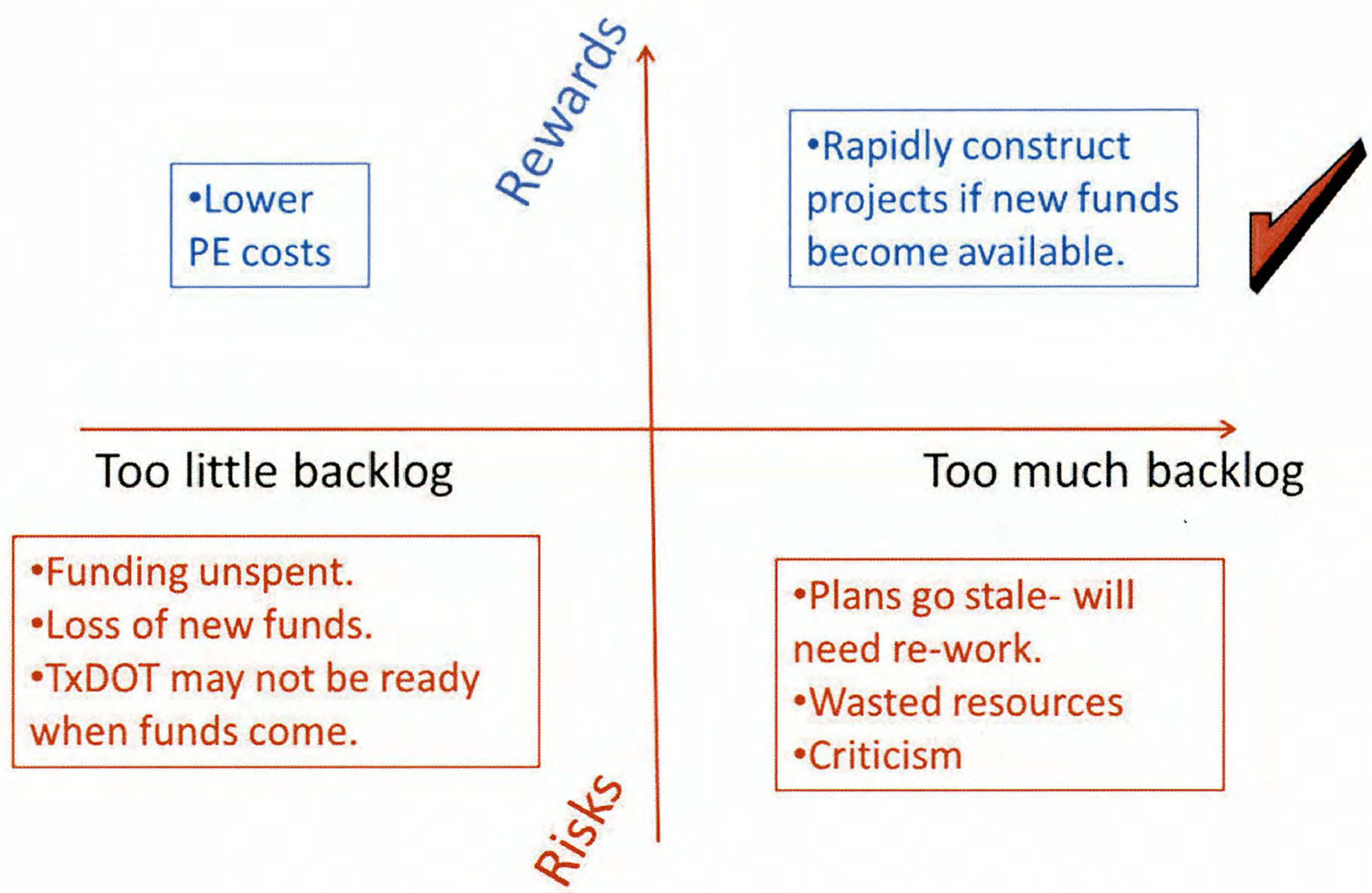


Figure 4.21: Backlogging—risks and rewards

The risks associated with having an insufficient amount of projects on the shelf were quite apparent in the ARRA case. The funds would have remained unspent or gone to another state, incurring criticism of TxDOT. In the case of the recent Prop 12 V2, if TxDOT cannot use the funds promptly, it will lose credibility and risk losing legislative goodwill. Ultimately, the risk is that TxDOT would be seen as not ready even though it has repeatedly made the case that inadequate funding is causing the state to fall behind in meeting transportation needs. In the case of delayed projects and leftover funds, TxDOT risks losing those funds. On the other hand, the reward for not having enough backlog is that the PE costs for those projects would not have been incurred. Overall, having too little backlog carries greater risks than rewards.

The rewards of having too much backlog lie in the ability to rapidly let and construct projects as soon as funds come available, a primary goal of TxDOT. Conversely, too much backlog means that plans may sit on the shelf a long time and go stale, requiring extensive rework. TxDOT would suffer criticism for wasting those resources and/or making work for its engineers. All in all, the balance is tilted in favor of having more backlog rather than less, but the actual quantity still needs to be determined.

To estimate the quantity of backlog, three levels of analysis are possible: at the program level (e.g., a percentage over the expected program funding), at the funding category level (e.g., a percentage over the amount in each funding category), or at the project level (a list of projects in addition to those already funded). Each approach has its own complications, as illustrated in Figure 4.22.

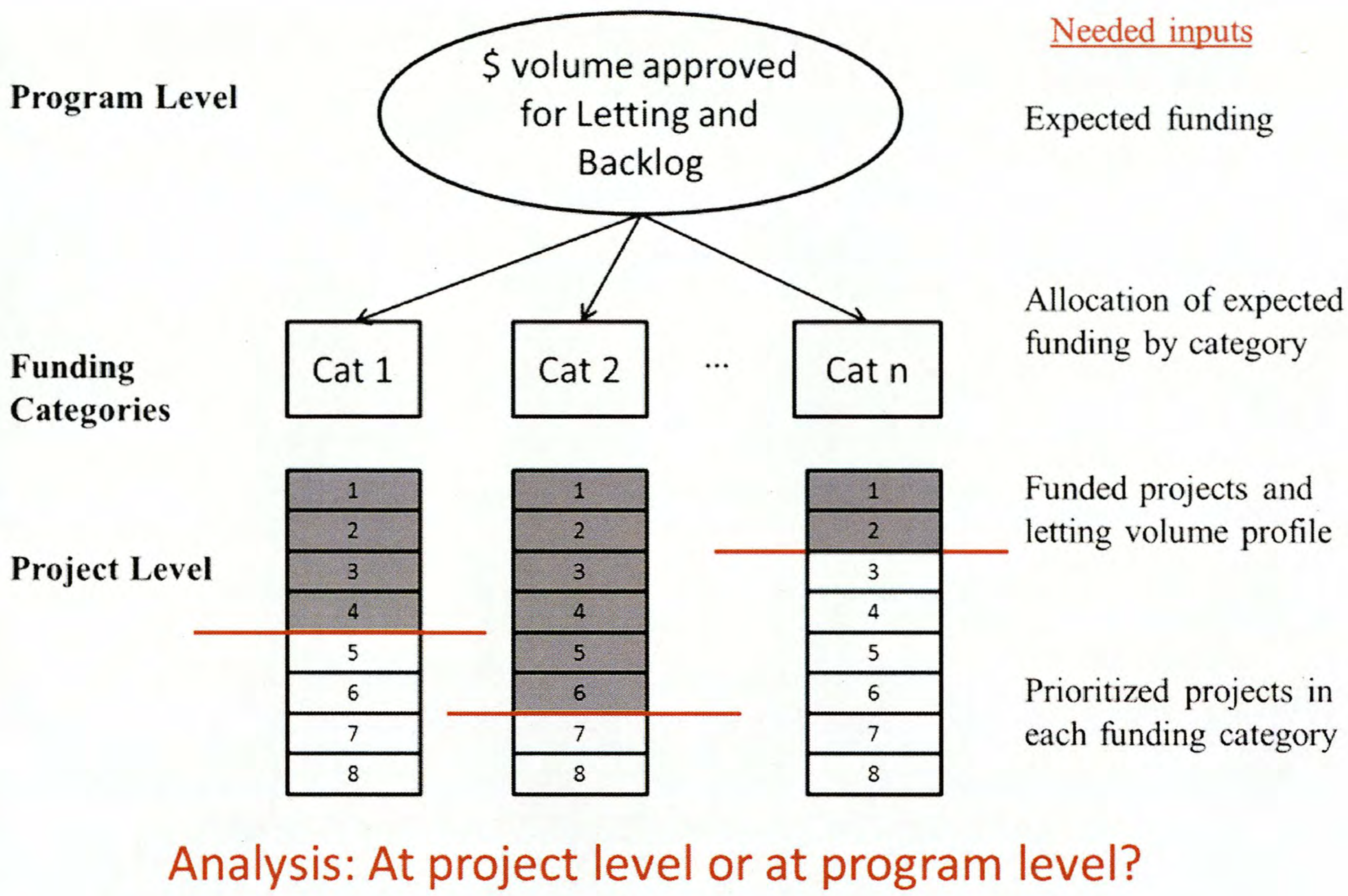
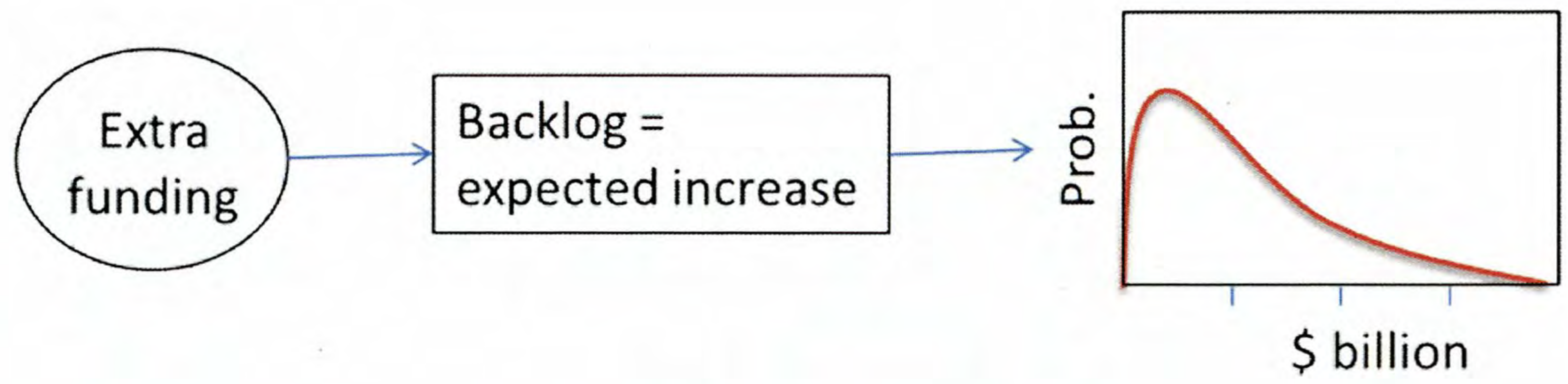


Figure 4.22: Three conceptual approaches to estimating backlog

At the program level, some estimation of expected additional funding would be required. At the funding category level, there would need to be some estimation of how expected additional funding would be categorized, and the likelihood of projects being delayed in each category. At the project level, prioritized lists of projects in each funding category would need to be assembled, down past the level of expected funding to the region where projects could be substituted in case of delays or lower prices. An additional complication at the project level is the need to create and manage a letting volume profile, with contingency plans for backfilling depending on the funds available. Each of these approaches requires a significant amount of data and estimation.

Figure 4.23 illustrates a way of estimating dollar values of backlog. Essentially, for additional funding you need to construct a probability distribution, and select a level of probability that you are comfortable with, e.g., there is a greater than 50% probability of an extra $X billion. For delayed projects, the amount of backlog has to be equal to the value of the delayed projects (really, the sum of project values times the months of delay, or total dollar-months). For changes in prices, the backlog must be proportional to the percentage drop in prices (bearing in mind that when prices rise again, the reverse will happen—a backlog of unfundable projects will build up).



Similarly, for delayed projects, backlog = expected value of projects delayed

For changes in prices:
If construction prices dropped y% from engineer's estimates,
Then you can buy {100/(100-y)} in extra projects.
Then backlog should be {100/(100-y)} -1 = {y/(100-y)}
E.g., if prices dropped 10%, backlog should be 10/90 = 11%.

Figure 4.23: Estimating a dollar value of backlog plans

These approaches to the three types of backlog can be combined into a joint probability estimate, as illustrated in Figure 4.24. Simulation would be needed to construct and combine the probabilities.

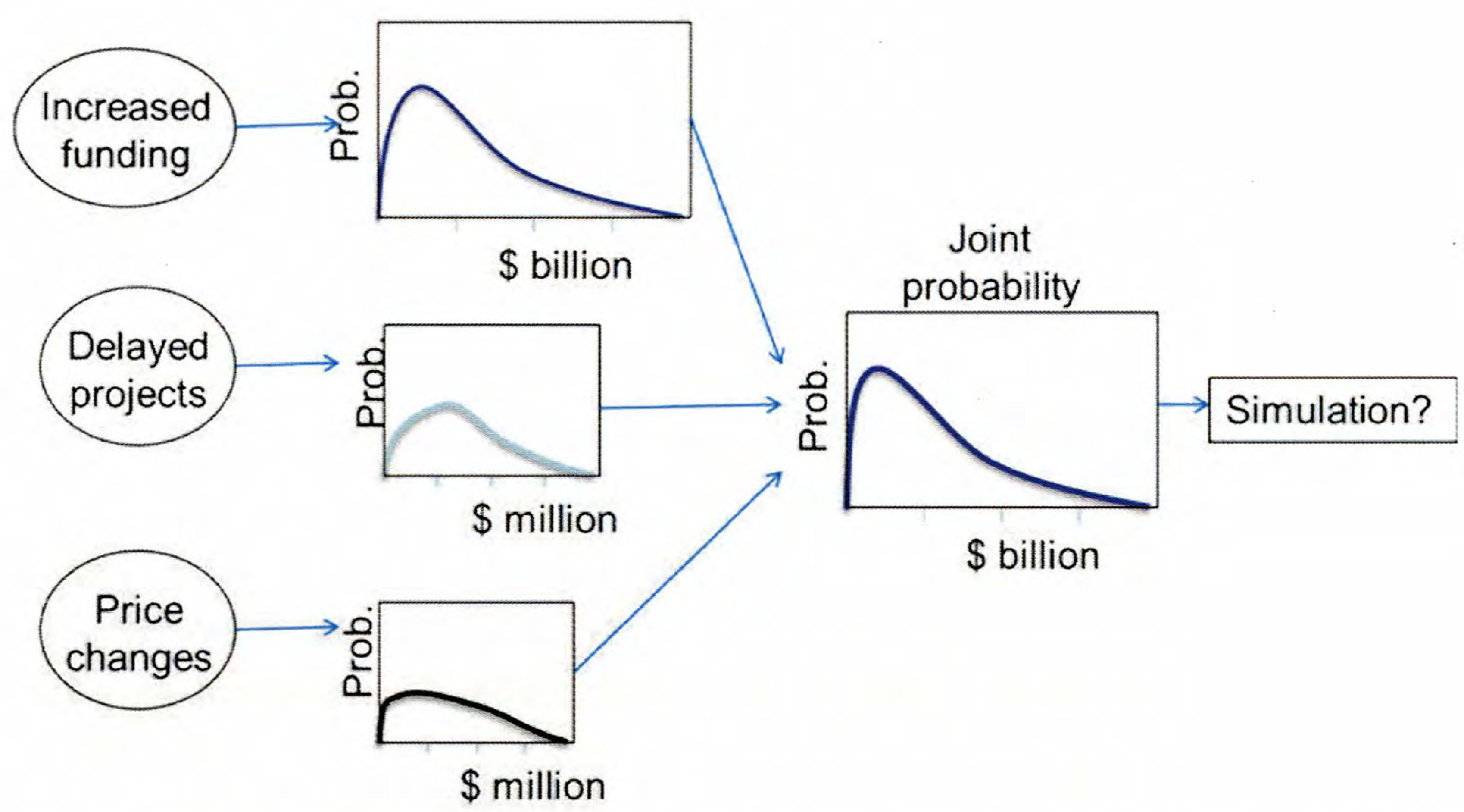


Figure 4.24: Program-level approach to estimating backlog

In constructing a probability of extra funding, past injections may not be predictive of the future. Instead, expert opinions based on understanding of political realities at the state and national level are needed. A possible rubric for capturing such opinions is shown in Table 4.11. The question to be answered in the table cells is "What is your estimate of the probability (a percentage, where 0 is no chance, 100 is certain) that TxDOT will get this amount of extra funding in this fiscal year?" The answers would be combined into a probability distribution of funding for each fiscal year.

Table 4.11: Possible rubric for capturing expert opinion on extra funding

$	FY 12	FY 13	FY 14	FY 15	FY 16	Etc.
0-500 m.	%					
0.5-1 b.						
1-1.5 b						
1.5-2 b.						
2-3 b.						
3-5 b.						

Regarding delayed projects, several questions would require data and analysis. Does TxDOT keep data on the projects that are pulled from letting because of delays? Are there any statistics on delays, causes, etc.? Is there any pattern to delayed projects? At a slightly higher level, is there any data on the amount of leftover funds each month and fiscal year due to delays? Is that data kept by funding category? What factors influence the amount of leftovers due to delays, and can any patterns be discerned? Preliminary inquiries indicate that most of this data is not available without significant digging into records.

The project-level approach to backlogging is even more complicated, as illustrated in Figure 4.25. Starting from a set of master lists of district needs such as the 30-year Plan and the Unified Transportation Plan (UTP), some project selection criteria would have to be applied, including a measure of benefits. Constraints such as staff availability and time to prepare PS&E would affect which projects get selected. The end result would be a shortlists of projects by district.

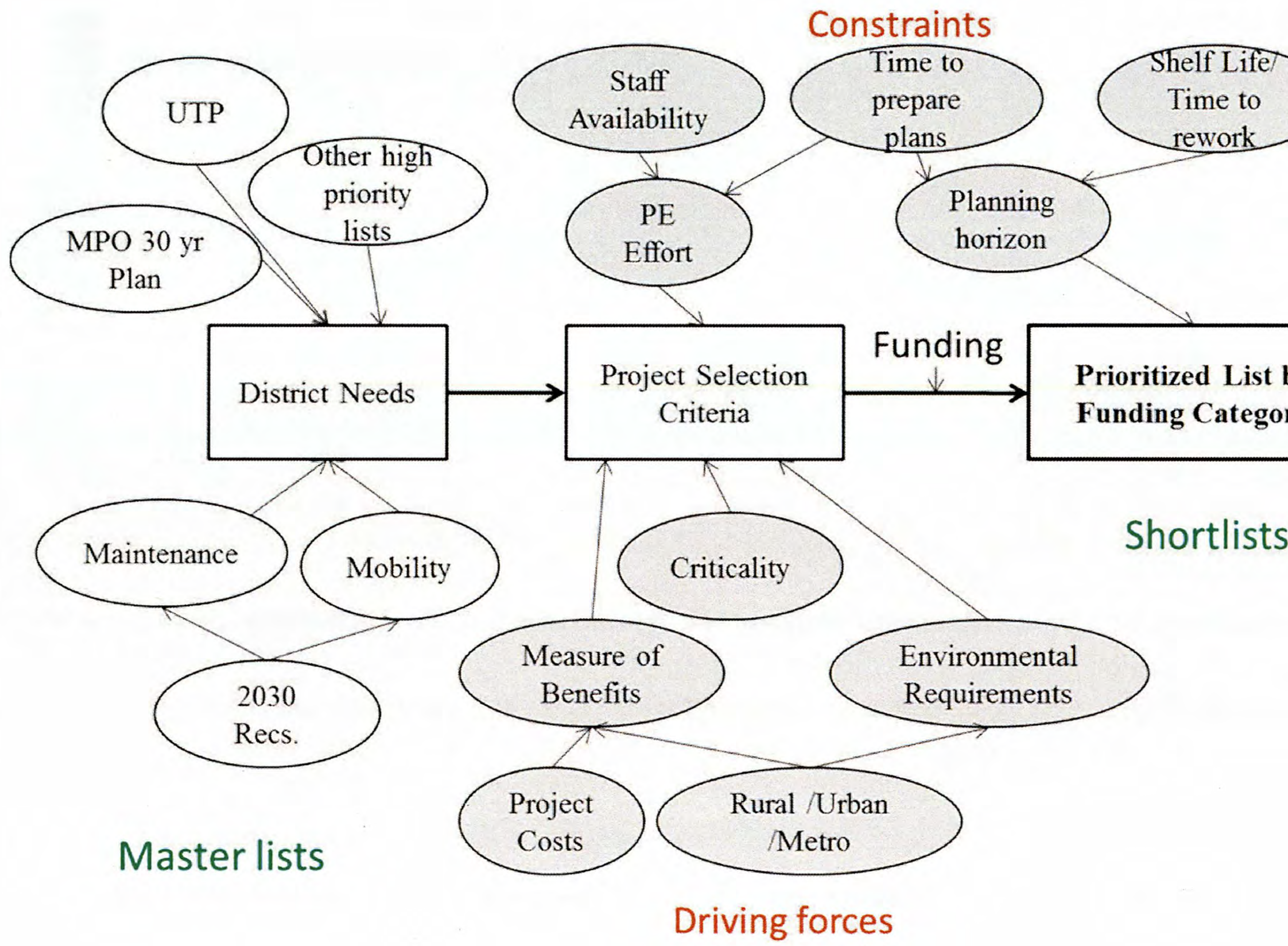


Figure 4.25: Project-level approach to estimating backlog

Some of the challenges of the project-level approach are readily apparent:

1. Planning horizon: because some projects require a long time to get from conception to letting, the backlogging decision has to be made far in advance of funding.
2. Need to estimate durations of major project phases in order to create letting volume and staff demand profiles
    i. Tie completion dates to costs (PE and construction)
3. Trade-off between rework risk and shelf life
4. How often to re-visit backlog analysis?

4.4.3 Discussions with District Staff

To identify some of the issues with backlogging and to assess district experience, the research team interviewed several district Directors of Transportation Planning and Development (TP&D). They indicated that districts have project development authority for projects in several funding categories, including Category (Cat) 5A and 5B (Congestion Mitigation/Air Quality [CMAQ] projects), Cat 7, Cat 11 Planning Authority (PA), Cat 11 PA-Traffic, and Cat 11 PA-Bridges. From these projects, a list of Preferred Lettings (PL) for FY 2011–13 plus part of 2014 has been compiled. The districts have been requested to complete the PS&E for the PL by August 2012, i.e., to have a backlog of about 50% more plans than can be let by August 2012. In other words, TxDOT's current backlog strategy is to build up a 50% letting program backlog by August 2012.

The district TP&D directors explained some of the restrictions on what backlog projects can be substituted in the event funds come available. Backfilling can only be done with projects from the same funding category. Any variation has to be approved by the Legislative Budget Board. The districts have very little discretion in substitutions, because Cat 2, 5, and 7 projects are picked by the MPO, not by the district. Because MPOs do not have the same level of experience as TxDOT in shepherding projects, delays have more drastic effects.

The researchers inquired whether any lessons had been learned from past experience in developing and using backlog projects to fill gaps. Four lessons were discussed:

1. **No potential CDA projects**: Any project that could potentially become a Comprehensive Development Agreement such as a toll concession will be reworked from scratch (although the district can develop the NEPA (environmental) approval).
2. **Choose small projects:** Hedge your bets by having many small projects instead of one large one ("easier to backfill with sand than with rocks"). One example was given of a large project that was delayed for more than one year when the U.S. Corps of Engineers deemed that they would have to issue a permit for the project.
3. **Constraints on use of funds**: The example of the ARRA was quoted, where many constraints meant that some less-than-optimal projects got built.
4. **Some projects never get built**. Backlogging comes with the risk that some projects never get funded. It is hard to discern any pattern, although it was mentioned that many rural mobility projects have been shelved.

District TP&D directors were asked which projects they would prefer to construct if funding comes available. The following were mentioned:

- Key connectors (e.g., a segment of two-lane road in a mostly four-lane corridor)
- Missing links (e.g., unfinished direct connectors)
- Additional phases of a corridor as sections with existing plans get funded.
- Bridges
- Safety projects
- Pavement rehabilitation

However, creating prioritized lists is difficult. The Transportation Commission would have to pick winners and losers in any statewide list. Other targeted lists such as the TTI top 100 (list of most congested areas of Texas) will take 10+ years to develop, or are so expensive (e.g., IH 45 in Houston) that funding is not likely to be put together.

Finally, district TP&D directors were questioned about the shelf life of PS&E and the risk of having to re-do work. Table 4.12 summarizes the discussions.

Table 4.12: Shelf life considerations for PS&E

Project type	Considerations	Shelf life?
Mobility: Environmental	•Corridor EIS req'd. Good for ~ 10 years. •If EPA rules change, EIS has to be redone.	✓
Mobility: ROW	•Expensive in urban areas. •'Clean ROW' now a rarity.	✓
Mobility: PS&E	Has to re-done if field conditions change	×
Bridges	Districts are short of BR staff/ consultant funds	✓
Preservation	Field evaluation every year	×

Mobility projects have three aspects/phases that affect their shelf life. Most require a NEPA approval, perhaps at the corridor level. This is typically good for 10 years unless the rules change. So getting ahead on environmental approvals is a good strategy. Most mobility projects also require right-of-way, which is expensive and difficult to clear in a timely manner. Early acquisition and clearing of ROW is a good strategy if funding is available. PS&E for mobility projects is the most risky, because field and traffic conditions change over time. In the context of the total time to develop a mobility project, PS&E time is relatively short, so it may be wise to hold off on PS&E preparation until funding is very likely.

Bridges are relatively good candidates for backlogging because designs are fairly standardized and TxDOT has good information on which bridges need to replaced or widened. Unfortunately, TxDOT's in-house capabilities in bridge design have diminished due to retirements and attrition; at the same time, the districts are short on funds to hire consultants. The district TP&D directors say that bridge PS&E have good shelf life, and the department should develop a large backlog of bridge projects. On the other hand, pavement preservation projects do not have much shelf life because field conditions change rapidly, and the designs must be based on recent field data. Some rehabilitation projects may be good candidates because they involve a design from base up and are not affected as much as surfacing projects by changing field conditions.

4.4.4 Conclusion and continuing work

Because of the complexities uncovered in this task and its dependence on the staffing models developed in Task 12B, the TxDOT panel decided to extend this task into FY 2012. Additional work will be undertaken in the following areas:

1. Interview departmental staff who are working on backlogging, and derive a basic definition and set of characteristics that can be shared with others outside the state.
2. Identify a set of states whose DOTs manage a highways network that could be regarded as similar to that of Texas and also contact states that are known for their innovation, particularly in the funding, planning, and policy arenas. The researchers will contact AASHTO and seek their help and use their resources to derive contacts at the state level where backlogging may be implemented.

3. Develop a questionnaire, present to the TxDOT panel, and test first within TxDOT and then on at a least one other state DOT. This will constitute the critical step of pilot testing the approach and making corrections to enhance its effectiveness.
4. Survey the states sampled from Step 2 above and draft an interview memo for each respondent, together with any data that can be provided to describe the size, cost, and characteristics of the projects, as well as any constraints that affect backlogging, so that comparisons can be made with those selected by TxDOT. Upon PD approval, the finalized survey document will be sent to either all 50 states or those states selected as most likely to impact Texas backlogging, with a follow-up to all remaining states.
5. The comparisons will be developed and then reviewed in detail by the CTR team to ensure that all the key categorizations, construction scheduling, and planning and economic factors are addressed. The results will then be presented to the TxDOT panel for review.
6. Changes recommended by the TxDOT panel will be addressed and a final report drafted. It is proposed to provide regular updates to the panel, not exceeding one month. Once edited, these will form the body of the report, and an executive summary will be added for policy makers to access as needed.

Appendix A: Summary of Available Data

(Note: all appendices refer to Chapter 3)

Table A1: Summary of scores for 2008

		PMIS			TxTAP			TxMAP			TxCAP		
	Count	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.
PAR	146	70.38	102.560	10.127	77.32	116.132	10.776	76.06	70.282	8.383	73.13	83.374	9.131
FTW	169	76.92	152.367	12.344	77.91	166.585	12.907	79.07	86.111	9.280	77.45	102.825	10.140
WFS	138	79.12	134.170	11.583	78.19	196.949	14.034	79.55	81.608	9.034	79.06	80.575	8.976
AMA	204	75.53	117.156	10.824	83.14	131.211	11.455	84.65	53.099	7.287	79.79	64.620	8.039
LBB	260	75.66	137.603	11.730	77.70	171.629	13.101	82.24	82.659	9.092	78.04	84.291	9.181
ODA	175	82.01	105.357	10.264	82.89	146.135	12.089	82.97	74.871	8.653	82.48	72.573	8.519
SJT	169	81.79	71.725	8.469	82.36	92.409	9.613	83.11	38.799	6.229	82.30	39.739	6.304
ABL	169	81.78	90.195	9.497	81.94	144.183	12.008	86.65	60.970	7.808	83.27	59.213	7.695
WAC	150	77.72	116.107	10.775	82.50	122.952	11.088	81.04	46.187	6.796	79.67	59.266	7.698
TYL	184	78.55	124.916	11.177	85.05	98.393	9.919	79.13	49.562	7.040	80.03	57.698	7.596
LFK	141	75.28	129.221	11.368	82.21	104.031	10.200	78.87	52.487	7.245	77.46	90.611	9.519
HOU	138	77.17	99.814	9.991	68.08	146.259	12.094	74.25	88.545	9.410	74.47	76.518	8.747
YKM	177	77.48	101.965	10.098	81.51	130.414	11.420	82.28	49.795	7.057	79.73	53.846	7.338
AUS	155	77.01	99.772	9.989	78.02	144.725	12.030	81.07	70.847	8.417	78.43	66.580	8.160
SAT	201	77.57	120.614	10.982	74.75	160.526	12.670	79.55	137.662	11.733	77.60	85.296	9.236
CRP	136	71.72	85.471	9.245	72.02	88.207	9.392	76.54	46.992	6.855	73.23	44.772	6.691
BRY	161	80.21	88.192	9.391	84.30	93.078	9.648	82.85	50.017	7.072	81.82	51.843	7.200
DAL	168	73.01	190.303	13.795	77.06	149.489	12.227	80.14	107.388	10.363	75.96	106.828	10.336
ATL	131	82.36	113.161	10.638	81.63	113.414	10.650	86.71	81.081	9.004	83.52	74.319	8.621
BMT	113	78.52	155.951	12.488	77.55	173.423	13.169	83.38	114.649	10.707	79.78	106.509	10.320
PHR	99	77.06	100.513	10.026	83.22	94.648	9.729	77.16	47.089	6.862	78.32	50.125	7.080
LRD	106	74.66	105.796	10.286	80.30	116.125	10.776	79.18	50.651	7.117	77.14	62.292	7.893
BWD	144	80.30	87.732	9.367	78.13	135.361	11.634	80.37	60.903	7.804	79.89	56.959	7.547
ELP	99	84.96	56.391	7.509	79.20	130.228	11.412	85.89	63.964	7.998	84.09	41.946	6.477
CHS	128	81.27	104.160	10.206	78.23	208.411	14.436	86.33	103.813	10.189	82.18	85.913	9.269
All Districts	3861	77.80	123.457	11.111	79.48	149.890	12.243	81.24	81.068	9.004	79.13	78.663	8.869

Table A2: Summary of scores for 2009

		PMIS			TxTAP			TxMAP			TxCAP		
	Count	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.
PAR	160	71.08	59.449	7.710	76.29	93.369	9.663	77.00	41.873	6.471	73.90	36.086	6.007
FTW	171	72.31	95.900	9.793	74.22	83.377	9.131	76.58	56.195	7.496	73.97	61.386	7.835
WFS	141	72.25	110.459	10.510	75.68	135.497	11.640	75.05	61.054	7.814	73.78	64.217	8.014
AMA	210	76.00	64.007	8.000	80.01	83.924	9.161	79.86	44.637	6.681	77.96	41.069	6.408
LBB	258	78.21	62.901	7.931	76.71	122.825	11.083	80.16	38.995	6.245	78.50	40.335	6.351
ODA	182	83.13	65.579	8.098	82.88	78.178	8.842	83.29	64.495	8.031	83.12	46.692	6.833
SJT	172	76.53	60.122	7.754	83.70	92.454	9.615	83.21	27.394	5.234	79.97	32.525	5.703
ABL	179	74.53	76.533	8.748	78.67	97.503	9.874	80.12	35.567	5.964	77.04	41.641	6.453
WAC	161	74.69	40.003	6.325	80.10	80.623	8.979	80.22	42.518	6.521	77.43	27.055	5.201
TYL	187	72.26	81.613	9.034	79.75	84.186	9.175	76.83	50.592	7.113	75.13	47.223	6.872
LFK	142	69.83	64.292	8.018	75.37	63.575	7.973	73.19	42.209	6.497	71.94	41.424	6.436
HOU	135	74.04	99.368	9.968	77.29	118.903	10.904	80.16	42.596	6.527	76.52	55.944	7.480
YKM	183	71.34	57.810	7.603	75.25	86.196	9.284	76.61	50.527	7.108	73.70	39.121	6.255
AUS	178	72.67	112.046	10.585	79.57	137.890	11.743	77.91	73.749	8.588	75.62	76.189	8.729
SAT	230	73.36	112.392	10.601	78.95	94.218	9.707	77.65	54.256	7.366	75.77	63.825	7.989
CRP	138	73.65	101.557	10.078	75.30	137.417	11.723	79.34	43.412	6.589	75.69	62.606	7.912
BRY	158	73.35	75.199	8.672	83.36	90.932	9.536	82.13	31.728	5.633	77.99	36.601	6.050
DAL	189	73.99	75.259	8.675	80.02	86.142	9.281	79.52	45.107	6.716	76.86	45.892	6.774
ATL	147	71.86	46.020	6.784	77.70	75.683	8.700	74.60	40.758	6.384	73.85	28.643	5.352
BMT	110	77.78	77.770	8.819	80.18	105.575	10.275	78.89	52.028	7.213	78.59	47.861	6.918
PHR	118	81.18	57.808	7.603	77.58	79.308	8.905	77.93	47.696	6.906	79.49	41.357	6.431
LRD	99	76.18	99.087	9.954	80.93	132.110	11.494	80.47	28.412	5.330	78.42	55.486	7.449
BWD	135	75.11	60.983	7.809	79.33	99.833	9.992	80.68	32.546	5.705	77.62	36.995	6.082
ELP	104	77.77	71.745	8.470	77.70	83.327	9.128	81.56	50.160	7.082	78.90	47.377	6.883
CHS	128	77.28	45.811	6.768	76.07	123.437	11.110	80.02	35.366	5.947	77.86	29.308	5.414
All Districts	4015	74.75	84.207	9.176	78.55	104.085	10.202	78.92	51.684	7.189	76.76	51.682	7.189

Table A3: Summary of scores for 2010

		PMIS			TxTAP			TxMAP			TxCAP		
	Count	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.
PAR	166	74.99	60.654	7.788	76.57	91.757	9.579	77.58	57.596	7.589	76.08	42.176	6.494
FTW	164	73.50	70.380	8.389	78.96	89.482	9.460	78.35	52.906	7.274	76.05	47.213	6.871
WFS	145	71.96	63.278	7.955	74.88	101.807	10.090	77.06	43.691	6.610	74.08	40.223	6.342
AMA	196	76.55	74.207	8.614	80.14	112.443	10.604	82.77	41.323	6.428	79.13	47.364	6.882
LBB	257	76.83	80.807	8.989	79.00	95.272	9.761	80.80	40.669	6.377	78.45	44.319	6.657
ODA	175	81.34	51.971	7.209	82.65	63.904	7.994	80.33	41.527	6.444	81.30	33.811	5.815
SJT	165	78.23	61.144	7.819	82.11	87.058	9.330	80.26	39.504	6.285	79.61	36.519	6.043
ABL	185	74.34	53.979	7.347	76.49	77.142	8.783	77.63	28.467	5.335	75.76	32.228	5.677
WAC	168	73.66	74.716	8.644	81.85	107.066	10.347	78.96	42.352	6.508	76.89	47.286	6.877
TYL	175	74.63	94.675	9.730	84.27	66.584	8.160	80.28	46.402	6.812	78.25	51.941	7.207
LFK	140	78.94	74.474	8.630	82.19	73.598	8.579	78.24	37.479	6.122	79.38	40.674	6.378
HOU	150	74.91	79.405	8.911	75.53	110.702	10.521	78.30	46.867	6.846	76.05	49.014	7.001
YKM	168	77.10	71.196	8.438	81.85	97.504	9.874	80.41	39.252	6.265	79.04	44.637	6.681
AUS	166	75.97	103.489	10.173	81.03	105.731	10.283	80.91	59.373	7.705	78.46	67.298	8.204
SAT	225	77.91	78.390	8.854	83.77	63.510	7.969	80.61	40.540	6.367	79.89	41.506	6.443
CRP	141	78.16	56.643	7.526	79.35	114.957	10.722	81.67	43.246	6.576	79.45	40.674	6.378
BRY	146	78.41	62.215	7.888	82.86	80.313	8.962	82.09	30.173	5.493	80.40	34.401	5.865
DAL	177	72.65	111.106	10.541	80.38	122.506	11.068	79.04	54.247	7.365	76.11	67.684	8.227
ATL	130	77.01	66.711	8.168	82.12	76.611	8.753	81.23	38.956	6.242	79.30	38.266	6.186
BMT	106	83.52	110.646	10.519	81.43	107.414	10.364	80.66	67.261	8.201	82.25	60.166	7.757
PHR	103	78.01	76.939	8.771	76.17	121.250	11.011	77.30	64.239	8.015	77.43	52.793	7.266
LRD	112	75.21	60.846	7.800	81.18	117.425	10.836	82.11	36.493	6.041	78.47	41.471	6.440
BWD	145	74.03	45.642	6.756	82.93	94.673	9.730	81.29	45.631	6.755	77.99	32.557	5.706
ELP	103	82.60	47.018	6.857	80.21	140.109	11.837	80.83	65.228	8.076	81.59	44.223	6.650
CHS	124	77.31	51.724	7.192	71.06	94.751	9.734	78.83	30.517	5.524	76.52	29.046	5.389
All Districts	3932	76.52	78.746	8.874	80.10	103.422	10.170	79.93	46.836	6.844	78.26	47.723	6.908

Table A4: Summary of scores of all three years (2008–10)

		PMIS			TxTAP			TxMAP			TxCAP		
District	Count	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.	Mean	Variance	S.d.
PAR	472	72.24	77.09	8.780	76.71	99.60	9.980	77.03	49.59	7.042	70.31	86.40	9.295
FTW	504	74.25	109.97	10.487	77.00	116.98	10.816	77.99	66.17	8.135	75.78	78.13	8.839
WFS	424	74.39	112.39	10.602	76.23	145.27	12.053	77.20	64.86	8.053	76.34	67.73	8.230
AMA	610	76.02	84.95	9.217	81.10	110.64	10.519	82.40	50.21	7.086	77.66	51.79	7.197
LBB	775	76.90	94.76	9.734	77.80	130.61	11.428	81.07	54.83	7.404	78.39	57.13	7.558
ODA	532	82.17	74.45	8.629	82.81	95.49	9.772	82.21	61.88	7.866	81.76	57.04	7.553
SJT	506	78.84	68.94	8.303	82.74	90.81	9.530	82.21	36.87	6.072	81.10	36.76	6.063
ABL	533	76.77	84.46	9.190	78.95	109.80	10.479	81.32	55.26	7.433	79.54	53.23	7.296
WAC	479	75.28	78.59	8.865	81.46	103.74	10.185	80.03	44.16	6.645	77.57	41.61	6.451
TYL	546	75.14	106.89	10.339	82.99	88.59	9.412	78.71	50.79	7.127	77.67	55.39	7.442
LFK	423	74.66	102.96	10.147	79.90	90.38	9.507	76.75	50.35	7.096	75.70	68.69	8.288
HOU	423	75.37	93.69	9.679	73.66	139.98	11.831	77.57	64.76	8.047	76.90	60.79	7.797
YKM	528	75.23	84.65	9.201	79.45	113.61	10.659	79.72	52.23	7.227	76.50	52.58	7.252
AUS	499	75.11	108.46	10.415	79.58	130.25	11.413	79.89	69.97	8.365	77.17	68.85	8.297
SAT	656	76.21	107.35	10.361	79.32	116.94	10.814	79.25	76.42	8.742	77.68	67.49	8.215
CRP	415	74.55	87.98	9.380	75.60	122.14	11.052	79.22	48.71	6.980	76.56	59.67	7.724
BRY	465	77.31	83.93	9.162	83.53	88.32	9.398	82.36	37.54	6.127	79.81	45.12	6.717
DAL	534	73.24	123.19	11.099	79.21	119.81	10.946	79.56	67.67	8.226	77.27	64.74	8.046
ATL	408	76.87	92.56	9.621	80.37	91.73	9.577	80.60	78.05	8.834	77.82	75.66	8.699
BMT	329	79.88	120.92	10.996	79.68	131.33	11.460	81.00	81.45	9.025	79.14	63.62	7.976
PHR	320	78.88	79.92	8.940	78.87	105.77	10.285	77.49	52.62	7.254	79.63	53.31	7.301
LRD	317	75.33	87.64	9.362	80.81	120.94	10.997	80.62	39.94	6.320	78.28	56.77	7.534
BWD	424	76.51	72.14	8.494	80.15	113.88	10.672	80.78	46.58	6.825	78.65	46.62	6.828
ELP	306	81.73	67.06	8.189	79.03	117.93	10.860	82.72	64.25	8.015	80.46	44.59	6.677
CHS	380	78.63	70.58	8.401	75.16	150.91	12.285	81.75	67.43	8.211	80.11	58.26	7.633
All Districts	11808	76.34	96.78	9.838	79.37	119.23	10.919	80.02	60.27	7.763	77.86	63.70	7.981

Table A5: Relative ranking of districts by scores

	PMIS			TxTAP			TxMAP			TxCAP		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
LOWEST	PAR	LFK	WFS	HOU	FTW	CHS	HOU	LFK	WFS	PAR	LFK	WFS
	CRP	PAR	DAL	CRP	YKM	WFS	PAR	ATL	PHR	CRP	YKM	ABL
	DAL	YKM	FTW	SAT	CRP	HOU	CRP	WFS	PAR	HOU	WFS	FTW
	LRD	ATL	WAC	DAL	LFK	PHR	PHR	FTW	ABL	DAL	ATL	HOU
	LFK	WFS	BWD	PAR	WFS	ABL	LFK	YKM	LFK	LRD	PAR	PAR
	AMA	TYL	ABL	BMT	CHS	PAR	FTW	TYL	HOU	FTW	FTW	DAL
	LBB	FTW	TYL	LBB	PAR	FTW	TYL	PAR	FTW	LFK	TYL	CHS
	FTW	AUS	HOU	FTW	LBB	LBB	LRD	SAT	CHS	SAT	AUS	WAC
	AUS	BRY	PAR	AUS	HOU	CRP	SAT	AUS	WAC	LBB	CRP	PHR
	PHR	SAT	LRD	BWD	PHR	AMA	WFS	PHR	DAL	PHR	SAT	BWD
	HOU	CRP	AUS	WFS	ATL	ELP	DAL	BMT	SJT	AUS	HOU	TYL
	YKM	DAL	AMA	CHS	ELP	DAL	BWD	CRP	TYL	WFS	DAL	LBB
	SAT	HOU	LBB	ELP	ABL	AUS	WAC	DAL	ODA	WAC	ABL	AUS
	WAC	ABL	ATL	LRD	SAT	LRD	AUS	AMA	YKM	YKM	WAC	LRD
	BMT	WAC	YKM	YKM	BWD	BMT	LBB	CHS	SAT	BMT	BWD	YKM
	TYL	BWD	CHS	ATL	AUS	WAC	YKM	ABL	BMT	AMA	CHS	AMA
	WFS	AMA	SAT	ABL	TYL	YKM	BRY	HOU	LBB	BWD	AMA	ATL
	BRY	LRD	PHR	LFK	AMA	SJT	ODA	LBB	ELP	TYL	BRY	LFK
	BWD	SJT	CRP	SJT	DAL	ATL	SJT	WAC	AUS	BRY	LRD	CRP
	CHS	CHS	SJT	WAC	WAC	LFK	BMT	LRD	ATL	CHS	LBB	SJT
	ABL	ELP	BRY	ODA	BMT	ODA	AMA	BWD	BWD	SJT	BMT	SAT
	SJT	BMT	LFK	AMA	LRD	BRY	ELP	ELP	CRP	ODA	ELP	BRY
	ODA	LBB	ODA	PHR	ODA	BWD	CHS	BRY	BRY	ABL	PHR	ODA
	ATL	PHR	ELP	BRY	BRY	SAT	ABL	SJT	LRD	ATL	SJT	ELP
HIGHEST	ELP	ODA	BMT	TYL	SJT	TYL	ATL	ODA	AMA	ELP	ODA	BMT

Appendix B: Tolerable Error Estimation

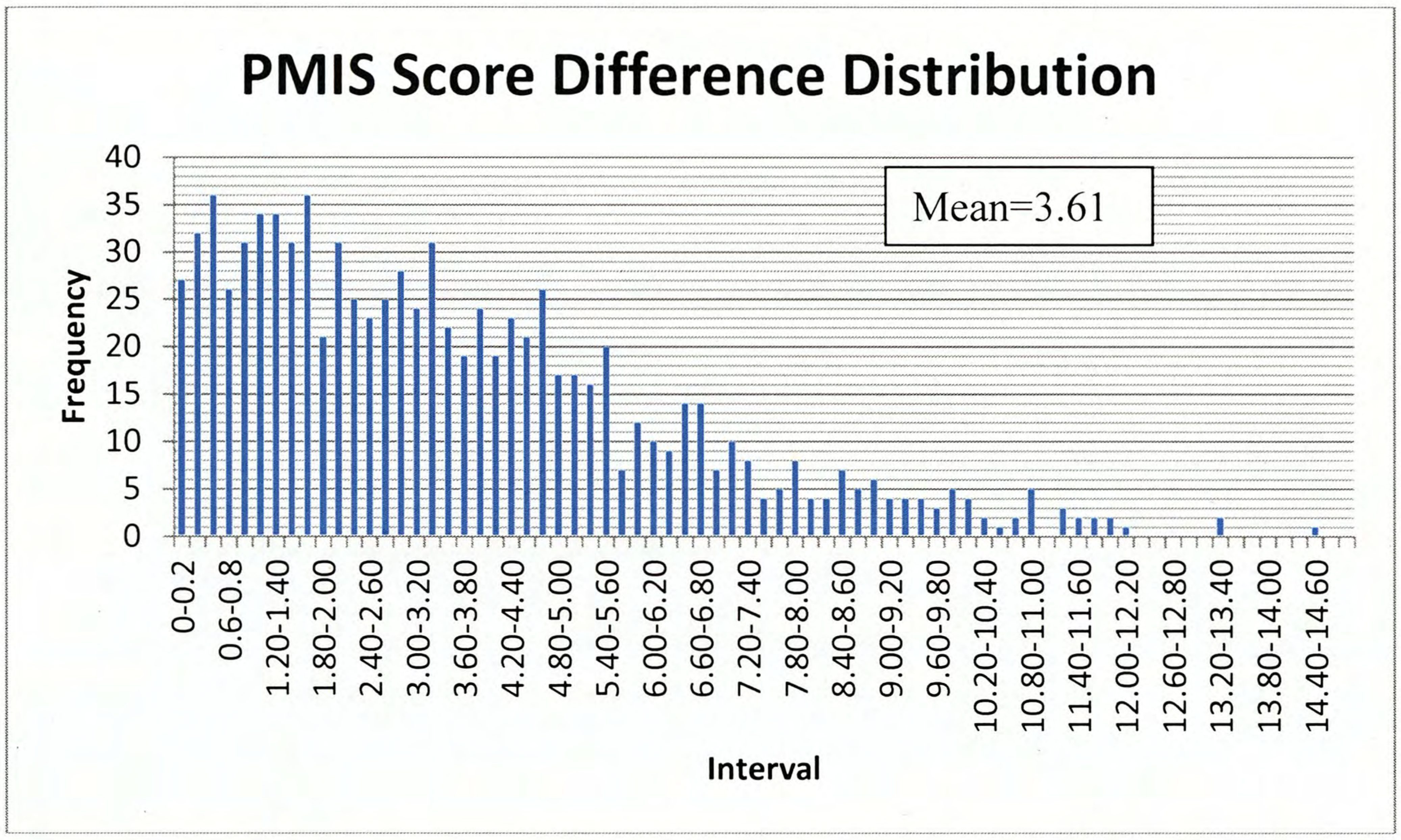


Figure B1: Distribution of differences of PMIS scores

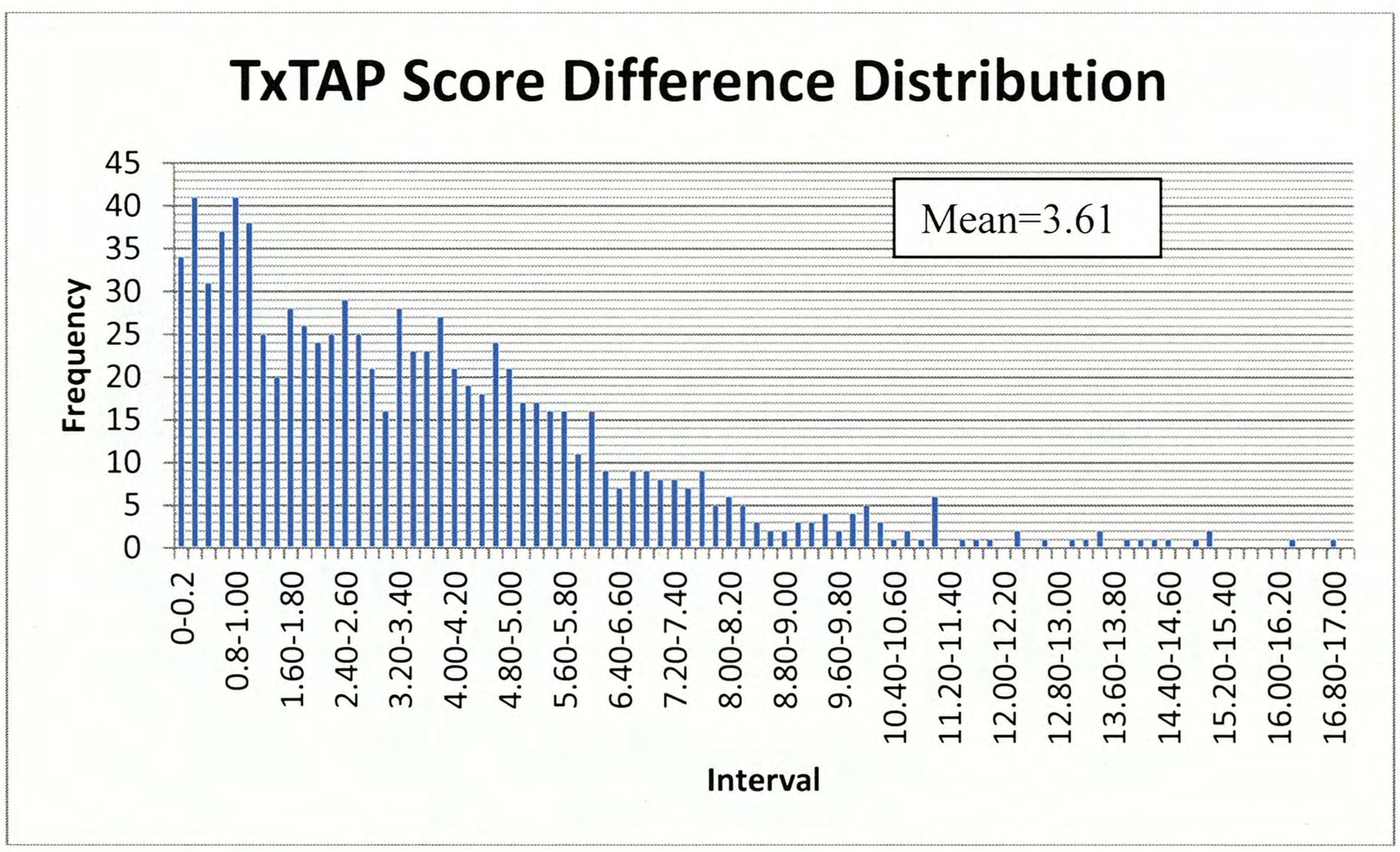


Figure B2: Distribution of differences of TxTAP scores

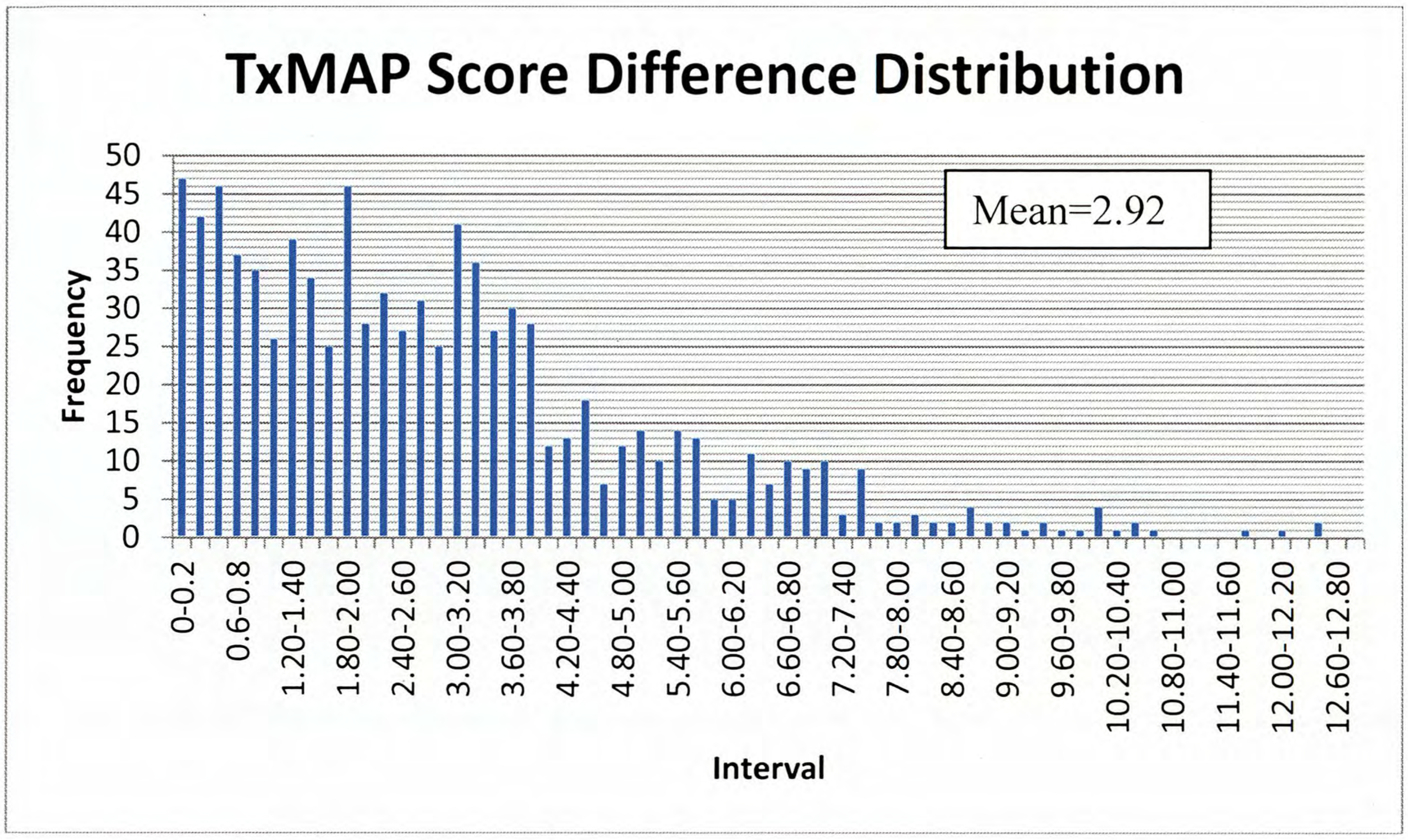


Figure B3: Distribution of differences of TxMAP scores

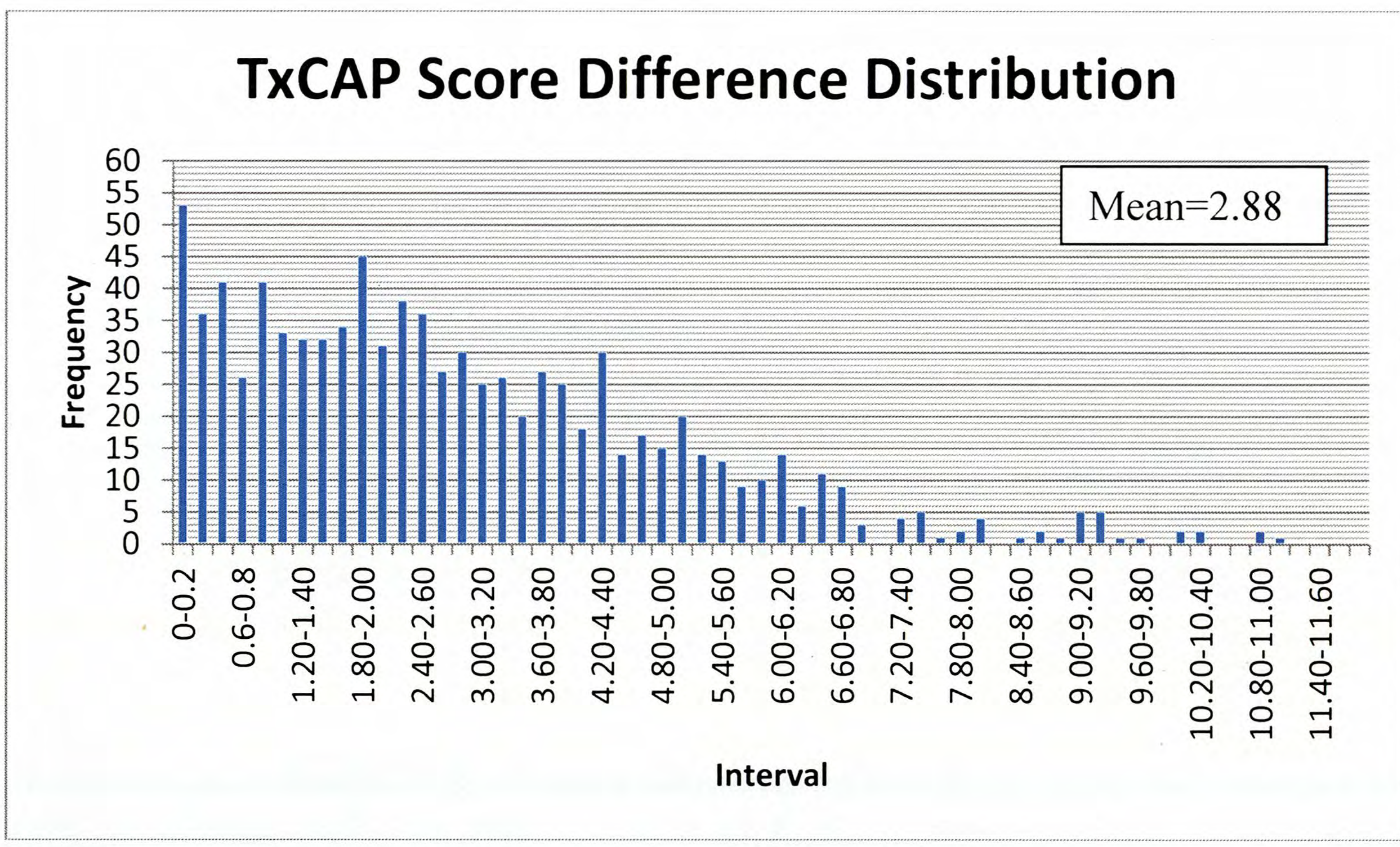


Figure B4: Distribution of differences of TxCAP scores

Appendix C: Sample Size Variation with Different Parameters

Table C1: Required sample size for PMIS (based on 2008–2010)

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	76.34	8380	6105	5039	3885
97	σ =	9.838	6852	4812	3871	2869
95	e =	0.5	6105	4190	3315	2393
90			5039	3315	2543	1745

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	76.34	2095	1526	1260	971
97	σ =	9.838	1713	1203	968	717
95	e =	1	1526	1047	829	598
90			1260	829	636	436

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	76.34	524	382	315	243
97	σ =	9.838	428	301	242	179
95	e =	2	382	262	207	150
90			315	207	159	109

Table C2: Required sample size for TxTAP (based on 2008–2010)

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	79.37	10324	7521	6208	4786
97	σ =	10.919	8441	5928	4769	3535
95	e =	0.5	7521	5161	4084	2948
90			6208	4084	3133	2150

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	79.37	2581	1880	1552	1197
97	σ =	10.919	2110	1482	1192	884
95	e =	1	1880	1290	1021	737
90			1552	1021	783	537

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	79.37	645	470	388	299
97	σ =	10.919	528	370	298	221
95	e =	2	470	323	255	184
90			388	255	196	134

Table C3: Required sample size for TxMAP (based on 2008–2010)

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	80.02	5219	3802	3138	2419
97	σ =	7.763	4267	2997	2411	1787
95	e =	0.5	3802	2609	2065	1490
90			3138	2065	1584	1087

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	80.02	1305	950	785	605
97	σ =	7.763	1067	749	603	447
95	e =	1	950	652	516	373
90			785	516	396	272

			Sample Sizes			
Conf. Level, (1-α)%	**β =**		**0.01**	**0.05**	**0.1**	**0.2**
99	μ =	80.02	326	238	196	151
97	σ =	7.763	267	187	151	112
95	e =	2	238	163	129	93
90			196	129	99	68

Appendix D: Comparison of Scores Using *t*-test at 95% Confidence Level

Table D1: Matrix of differences for TxCAP for 2010 (an example)

	WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
WFS		1.68	1.97	1.98	2.01	2.04	2.44	2.81	3.35	3.91	4.18	4.38	4.39	4.40	4.97	5.06	5.22	5.31	5.38	5.54	5.82	6.33	7.22	7.52	8.17
ABL	-1.68		0.29	0.29	0.33	0.36	0.76	1.13	1.67	2.23	2.50	2.69	2.71	2.71	3.28	3.38	3.54	3.62	3.70	3.85	4.13	4.65	5.54	5.83	6.49
FTW	-1.97	-0.29		0.00	0.04	0.07	0.47	0.84	1.38	1.94	2.21	2.40	2.42	2.42	2.99	3.09	3.25	3.34	3.41	3.56	3.84	4.36	5.25	5.54	6.20
HOU	-1.98	-0.29	0.00		0.03	0.06	0.47	0.84	1.38	1.94	2.20	2.40	2.41	2.42	2.99	3.08	3.25	3.33	3.40	3.56	3.84	4.35	5.25	5.54	6.20
PAR	-2.01	-0.33	-0.04	-0.03		0.03	0.43	0.81	1.34	1.90	2.17	2.37	2.38	2.39	2.96	3.05	3.21	3.30	3.37	3.53	3.81	4.32	5.21	5.51	6.16
DAL	-2.04	-0.36	-0.07	-0.06	-0.03		0.40	0.78	1.31	1.87	2.14	2.34	2.35	2.36	2.93	3.02	3.19	3.27	3.34	3.50	3.78	4.29	5.18	5.48	6.13
CHS	-2.44	-0.76	-0.47	-0.47	-0.43	-0.40		0.37	0.91	1.47	1.74	1.94	1.95	1.95	2.53	2.62	2.78	2.87	2.94	3.09	3.38	3.89	4.78	5.08	5.73
WAC	-2.81	-1.13	-0.84	-0.84	-0.81	-0.78	-0.37		0.54	1.10	1.36	1.56	1.57	1.58	2.15	2.24	2.41	2.49	2.56	2.72	3.00	3.51	4.41	4.70	5.36
PHR	-3.35	-1.67	-1.38	-1.38	-1.34	-1.31	-0.91	-0.54		0.56	0.83	1.02	1.04	1.04	1.61	1.71	1.87	1.96	2.03	2.18	2.46	2.98	3.87	4.16	4.82
BWD	-3.91	-2.23	-1.94	-1.94	-1.90	-1.87	-1.47	-1.10	-0.56		0.27	0.46	0.48	0.48	1.05	1.15	1.31	1.39	1.47	1.62	1.90	2.42	3.31	3.60	4.26
TYL	-4.18	-2.50	-2.21	-2.20	-2.17	-2.14	-1.74	-1.36	-0.83	-0.27		0.20	0.21	0.22	0.79	0.88	1.05	1.13	1.20	1.36	1.64	2.15	3.05	3.34	3.99
LBB	-4.38	-2.69	-2.40	-2.40	-2.37	-2.34	-1.94	-1.56	-1.02	-0.46	-0.20		0.01	0.02	0.59	0.68	0.85	0.93	1.00	1.16	1.44	1.95	2.85	3.14	3.79
AUS	-4.39	-2.71	-2.42	-2.41	-2.38	-2.35	-1.95	-1.57	-1.04	-0.48	-0.21	-0.01		0.01	0.58	0.67	0.84	0.92	0.99	1.15	1.43	1.94	2.84	3.13	3.78
LRD	-4.40	-2.71	-2.42	-2.42	-2.39	-2.36	-1.95	-1.58	-1.04	-0.48	-0.22	-0.02	-0.01		0.57	0.66	0.83	0.91	0.98	1.14	1.42	1.93	2.83	3.12	3.77
YKM	-4.97	-3.28	-2.99	-2.99	-2.96	-2.93	-2.53	-2.15	-1.61	-1.05	-0.79	-0.59	-0.58	-0.57		0.09	0.26	0.34	0.41	0.57	0.85	1.36	2.26	2.55	3.20
AMA	-5.06	-3.38	-3.09	-3.08	-3.05	-3.02	-2.62	-2.24	-1.71	-1.15	-0.88	-0.68	-0.67	-0.66	-0.09		0.17	0.25	0.32	0.48	0.76	1.27	2.17	2.46	3.11
ATL	-5.22	-3.54	-3.25	-3.25	-3.21	-3.19	-2.78	-2.41	-1.87	-1.31	-1.05	-0.85	-0.84	-0.83	-0.26	-0.17		0.08	0.15	0.31	0.59	1.10	2.00	2.29	2.95
LFK	-5.31	-3.62	-3.34	-3.33	-3.30	-3.27	-2.87	-2.49	-1.96	-1.39	-1.13	-0.93	-0.92	-0.91	-0.34	-0.25	-0.08		0.07	0.23	0.51	1.02	1.92	2.21	2.86
CRP	-5.38	-3.70	-3.41	-3.40	-3.37	-3.34	-2.94	-2.56	-2.03	-1.47	-1.20	-1.00	-0.99	-0.98	-0.41	-0.32	-0.15	-0.07		0.16	0.44	0.95	1.84	2.14	2.79
SJT	-5.54	-3.85	-3.56	-3.56	-3.53	-3.50	-3.09	-2.72	-2.18	-1.62	-1.36	-1.16	-1.15	-1.14	-0.57	-0.48	-0.31	-0.23	-0.16		0.28	0.79	1.69	1.98	2.63
SAT	-5.82	-4.13	-3.84	-3.84	-3.81	-3.78	-3.38	-3.00	-2.46	-1.90	-1.64	-1.44	-1.43	-1.42	-0.85	-0.76	-0.59	-0.51	-0.44	-0.28		0.51	1.41	1.70	2.35
BRY	-6.33	-4.65	-4.36	-4.35	-4.32	-4.29	-3.89	-3.51	-2.98	-2.42	-2.15	-1.95	-1.94	-1.93	-1.36	-1.27	-1.10	-1.02	-0.95	-0.79	-0.51		0.90	1.19	1.84
ODA	-7.22	-5.54	-5.25	-5.25	-5.21	-5.18	-4.78	-4.41	-3.87	-3.31	-3.05	-2.85	-2.84	-2.83	-2.26	-2.17	-2.00	-1.92	-1.84	-1.69	-1.41	-0.90		0.29	0.95
ELP	-7.52	-5.83	-5.54	-5.54	-5.51	-5.48	-5.08	-4.70	-4.16	-3.60	-3.34	-3.14	-3.13	-3.12	-2.55	-2.46	-2.29	-2.21	-2.14	-1.98	-1.70	-1.19	-0.29		0.65
BMT	-8.17	-6.49	-6.20	-6.20	-6.16	-6.13	-5.73	-5.36	-4.82	-4.26	-3.99	-3.79	-3.78	-3.77	-3.20	-3.11	-2.95	-2.86	-2.79	-2.63	-2.35	-1.84	-0.95	-0.65	

Table D2: Combined standard deviation for TxCAP scores for 2010 (an example)

n	S.d.	var	Mean		WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
				Mean	74.08	75.76	76.05	76.05	76.08	76.11	76.52	76.89	77.43	77.99	78.25	78.45	78.46	78.47	79.04	79.13	79.30	79.38	79.45	79.61	79.89	80.40	81.30	81.59	82.25
				var	40.223	32.228	47.213	49.014	42.176	67.684	29.046	47.286	52.793	32.557	51.941	44.319	67.298	41.471	44.637	47.364	38.266	40.674	40.674	36.519	41.506	34.401	33.811	44.223	60.166
				S.d.	6.342	5.677	6.871	7.001	6.494	8.227	5.389	6.877	7.266	5.706	7.207	6.657	8.204	6.440	6.681	6.882	6.186	6.378	6.378	6.043	6.443	5.865	5.815	6.650	7.757
				n	145	185	164	150	166	177	124	168	103	145	175	257	166	112	168	196	130	140	141	165	225	146	175	103	106
145	6.342	40.223	74.08	WFS	0.74	0.67	0.75	0.78	0.73	0.81	0.72	0.75	0.89	0.71	0.76	0.67	0.83	0.80	0.74	0.72	0.76	0.75	0.75	0.71	0.68	0.72	0.69	0.84	0.92
185	5.677	32.228	75.76	ABL	0.67	0.59	0.68	0.71	0.65	0.75	0.64	0.68	0.83	0.63	0.69	0.59	0.76	0.74	0.66	0.64	0.68	0.68	0.68	0.63	0.60	0.64	0.61	0.78	0.86
164	6.871	47.213	76.05	FTW	0.75	0.68	0.76	0.78	0.74	0.82	0.72	0.75	0.89	0.72	0.76	0.68	0.83	0.81	0.74	0.73	0.76	0.76	0.76	0.71	0.69	0.72	0.69	0.85	0.92
150	7.001	49.014	76.05	HOU	0.78	0.71	0.78	0.81	0.76	0.84	0.75	0.78	0.92	0.74	0.79	0.71	0.86	0.83	0.77	0.75	0.79	0.79	0.78	0.74	0.72	0.75	0.72	0.87	0.95
166	6.494	42.176	76.08	PAR	0.73	0.65	0.74	0.76	0.71	0.80	0.70	0.73	0.88	0.69	0.74	0.65	0.81	0.79	0.72	0.70	0.74	0.74	0.74	0.69	0.66	0.70	0.67	0.83	0.91
177	8.227	67.684	76.11	DAL	0.81	0.75	0.82	0.84	0.80	0.87	0.79	0.81	0.95	0.78	0.82	0.74	0.89	0.87	0.81	0.79	0.82	0.82	0.82	0.78	0.75	0.79	0.76	0.90	0.97
88	5.389	29.046	76.52	CHS	0.78	0.71	0.79	0.81	0.76	0.84	0.75	0.78	0.92	0.74	0.79	0.71	0.86	0.84	0.77	0.76	0.79	0.79	0.79	0.74	0.72	0.75	0.72	0.87	0.95
168	6.877	47.286	76.89	WAC	0.75	0.68	0.75	0.78	0.73	0.81	0.72	0.75	0.89	0.71	0.76	0.67	0.83	0.81	0.74	0.72	0.76	0.76	0.75	0.71	0.68	0.72	0.69	0.84	0.92
103	7.266	52.793	77.43	PHR	0.89	0.83	0.89	0.92	0.88	0.95	0.86	0.89	1.01	0.86	0.90	0.83	0.96	0.94	0.88	0.87	0.90	0.90	0.89	0.86	0.83	0.86	0.84	0.97	1.04
145	5.706	32.557	77.99	BWD	0.71	0.63	0.72	0.74	0.69	0.78	0.68	0.71	0.86	0.67	0.72	0.63	0.79	0.77	0.70	0.68	0.72	0.72	0.72	0.67	0.64	0.68	0.65	0.81	0.89
175	7.207	51.941	78.25	TYL	0.76	0.69	0.76	0.79	0.74	0.82	0.73	0.76	0.90	0.72	0.77	0.69	0.84	0.82	0.75	0.73	0.77	0.77	0.77	0.72	0.69	0.73	0.70	0.85	0.93
257	6.657	44.319	78.45	LBB	0.67	0.59	0.68	0.71	0.65	0.74	0.64	0.67	0.83	0.63	0.69	0.59	0.76	0.74	0.66	0.64	0.68	0.68	0.68	0.63	0.60	0.64	0.60	0.78	0.86
166	8.204	67.298	78.46	AUS	0.83	0.76	0.83	0.86	0.81	0.89	0.80	0.83	0.96	0.79	0.84	0.76	0.90	0.88	0.82	0.80	0.84	0.83	0.83	0.79	0.77	0.80	0.77	0.91	0.99
112	6.440	41.471	78.47	LRD	0.80	0.74	0.81	0.83	0.79	0.87	0.78	0.81	0.94	0.77	0.82	0.74	0.88	0.86	0.80	0.78	0.82	0.81	0.81	0.77	0.74	0.78	0.75	0.89	0.97
168	6.681	44.637	79.04	YKM	0.74	0.66	0.74	0.77	0.72	0.81	0.71	0.74	0.88	0.70	0.75	0.66	0.82	0.80	0.73	0.71	0.75	0.75	0.74	0.70	0.67	0.71	0.68	0.83	0.91
196	6.882	47.364	79.13	AMA	0.72	0.64	0.73	0.75	0.70	0.79	0.69	0.72	0.87	0.68	0.73	0.64	0.80	0.78	0.71	0.70	0.73	0.73	0.73	0.68	0.65	0.69	0.66	0.82	0.90
130	6.186	38.266	79.30	ATL	0.76	0.68	0.76	0.79	0.74	0.82	0.73	0.76	0.90	0.72	0.77	0.68	0.84	0.82	0.75	0.73	0.77	0.76	0.76	0.72	0.69	0.73	0.70	0.85	0.93
140	6.378	40.674	79.38	LFK	0.75	0.68	0.76	0.79	0.74	0.82	0.72	0.76	0.90	0.72	0.77	0.68	0.83	0.81	0.75	0.73	0.76	0.76	0.76	0.72	0.69	0.73	0.70	0.85	0.93
141	6.378	40.674	79.45	CRP	0.75	0.68	0.76	0.78	0.74	0.82	0.72	0.75	0.89	0.72	0.77	0.68	0.83	0.81	0.74	0.73	0.76	0.76	0.76	0.71	0.69	0.72	0.69	0.85	0.93
165	6.043	36.519	79.61	SJT	0.71	0.63	0.71	0.74	0.69	0.78	0.67	0.71	0.86	0.67	0.72	0.63	0.79	0.77	0.70	0.68	0.72	0.72	0.71	0.67	0.64	0.68	0.64	0.81	0.89
225	6.443	41.506	79.89	SAT	0.68	0.60	0.69	0.72	0.66	0.75	0.65	0.68	0.83	0.64	0.69	0.60	0.77	0.74	0.67	0.65	0.69	0.69	0.69	0.64	0.61	0.65	0.61	0.78	0.87
146	5.865	34.401	80.40	BRY	0.72	0.64	0.72	0.75	0.70	0.79	0.69	0.72	0.86	0.68	0.73	0.64	0.80	0.78	0.71	0.69	0.73	0.73	0.72	0.68	0.65	0.69	0.65	0.82	0.90
175	5.815	33.811	81.30	ODA	0.69	0.61	0.69	0.72	0.67	0.76	0.65	0.69	0.84	0.65	0.70	0.60	0.77	0.75	0.68	0.66	0.70	0.70	0.69	0.64	0.61	0.65	0.62	0.79	0.87
103	6.650	44.223	81.59	ELP	0.84	0.78	0.85	0.87	0.83	0.90	0.81	0.84	0.97	0.81	0.85	0.78	0.91	0.89	0.83	0.82	0.85	0.85	0.85	0.81	0.78	0.82	0.79	0.93	1.00
106	7.757	60.166	82.25	BMT	0.92	0.86	0.92	0.95	0.91	0.97	0.90	0.92	1.04	0.89	0.93	0.86	0.99	0.97	0.91	0.90	0.93	0.93	0.93	0.89	0.87	0.90	0.87	1.00	1.07

Table D3: *t*-statistics for TxCAP for 2010 (an example)

	WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
WFS		2.503276	2.622518	2.541211	2.755515	2.508938	3.412474	3.764957	3.771094	5.521741	5.513003	6.524752	5.309493	5.462224	6.738898	7.019628	6.907752	7.0421	7.148793	7.838591	8.558766	8.834059	10.52839	8.941141	8.888135
ABL	2.5032756		0.425899	0.413944	0.499047	0.476791	1.187098	1.677457	2.014558	3.531128	3.635874	4.575538	3.55317	3.677601	4.951359	5.233711	5.173028	5.317116	5.432769	6.127096	6.903344	7.256106	9.140237	7.509999	7.533053
FTW	2.6225181	0.425899		0.004426	0.050364	0.080857	0.649278	1.116985	1.542427	2.710458	2.884703	3.543859	2.901119	2.988083	4.024668	4.240168	4.261193	4.385371	4.486227	4.994305	5.594308	6.019965	7.570257	6.547317	6.701694
HOU	2.5412107	0.413944	0.004426		0.044096	0.074489	0.621746	1.076252	1.502497	2.608478	2.788946	3.398173	2.819	2.89941	3.885885	4.088008	4.12129	4.240627	4.33776	4.809251	5.372562	5.803557	7.276972	6.372801	6.550765
PAR	2.7555145	0.499047	0.050364	0.044096		0.036502	0.618323	1.101042	1.533729	2.750976	2.921962	3.62488	2.928906	3.021005	4.102086	4.329732	4.340524	4.469218	4.573576	5.115091	5.749983	6.171349	7.795747	6.662479	6.797291
DAL	2.5089381	0.476791	0.080857	0.074489	0.036502		0.513154	0.95318	1.388739	2.405533	2.596169	3.139094	2.646967	2.717894	3.637436	3.822125	3.872004	3.985079	4.077418	4.501573	5.018801	5.456386	6.833684	6.080917	6.2917
CHS	3.1317742	1.06837	0.596817	0.574605	0.565336	0.477399		0.477832	0.992228	1.97536	2.193402	2.730034	2.269637	2.336085	3.271744	3.460269	3.521027	3.638164	3.734015	4.167658	4.706048	5.167392	6.610157	5.824514	6.047165
WAC	3.7649567	1.677457	1.116985	1.076252	1.101042	0.95318	0.520335		0.6028	1.54275	1.792335	2.317851	1.897699	1.958765	2.908804	3.100807	3.174186	3.295508	3.395007	3.837469	4.397985	4.885146	6.397961	5.577141	5.812311
PHR	3.7710935	2.014558	1.542427	1.502497	1.533729	1.388739	1.053966	0.6028		0.652588	0.917945	1.237805	1.080918	1.111314	1.830132	1.963928	2.083443	2.181846	2.263558	2.549325	2.952409	3.440239	4.60761	4.291462	4.636375
BWD	5.5217408	3.531128	2.710458	2.608478	2.750976	2.405533	2.171885	1.54275	0.652588		0.367782	0.736744	0.598926	0.627444	1.505711	1.677418	1.820321	1.943753	2.046253	2.431614	2.978162	3.560771	5.122108	4.457747	4.784543
TYL	5.5130029	3.635874	2.884703	2.788946	2.921962	2.596169	2.383096	1.792335	0.917945	0.367782		0.289983	0.250374	0.267348	1.051589	1.198902	1.360041	1.473733	1.568637	1.886741	2.362677	2.946357	4.349961	3.918472	4.294542
LBB	6.5247518	4.575538	3.543859	3.398173	3.62488	3.139094	3.034669	2.317851	1.237805	0.736744	0.289983		0.014688	0.026758	0.891414	1.05843	1.239773	1.367958	1.475035	1.847699	2.411073	3.054526	4.707115	4.048271	4.41045
AUS	5.3094934	3.55317	2.901119	2.819	2.928906	2.646967	2.433714	1.897699	1.080918	0.598926	0.250374	0.014688		0.009705	0.706636	0.832843	0.999239	1.102364	1.18878	1.450474	1.860947	2.423142	3.664454	3.42505	3.835082
LRD	5.4622244	3.677601	2.988083	2.89941	3.021005	2.717894	2.514432	1.958765	1.111314	0.627444	0.267348	0.026758	0.009705		0.715175	0.845492	1.014826	1.120776	1.209539	1.481811	1.907497	2.481427	3.765584	3.489929	3.89743
YKM	6.7388975	4.951359	4.024668	3.885885	4.102086	3.637436	3.571563	2.908804	1.830132	1.505711	1.051589	0.891414	0.706636	0.715175		0.127834	0.343409	0.456872	0.552588	0.815919	1.26745	1.922477	3.33072	3.059172	3.509976
AMA	7.0196275	5.233711	4.240168	4.088008	4.329732	3.822125	3.792684	3.100807	1.963928	1.677418	1.198902	1.05843	0.832843	0.845492	0.127834		0.226658	0.342264	0.439923	0.703021	1.163237	1.838515	3.283499	3.002352	3.460529
ATL	6.907752	5.173028	4.261193	4.12129	4.340524	3.872004	3.826897	3.174186	2.083443	1.820321	1.360041	1.239773	0.999239	1.014826	0.343409	0.226658		0.109499	0.202198	0.435049	0.857548	1.516768	2.863318	2.695906	3.174336
LFK	7.0420998	5.317116	4.385371	4.240627	4.469218	3.985079	3.956421	3.295508	2.181846	1.943753	1.473733	1.367958	1.102364	1.120776	0.456872	0.342264	0.109499		0.092811	0.319622	0.739489	1.406824	2.754215	2.60436	3.091004
CRP	7.1487928	5.432769	4.486227	4.33776	4.573576	4.077418	4.061893	3.395007	2.263558	2.046253	1.568637	1.475035	1.18878	1.209539	0.552588	0.439923	0.202198	0.092811		0.221358	0.638407	1.312036	2.658344	2.524741	3.018395
SJT	7.838591	6.127096	4.994305	4.809251	5.115091	4.501573	4.585077	3.837469	2.549325	2.431614	1.886741	1.847699	1.450474	1.481811	0.815919	0.703021	0.435049	0.319622	0.221358		0.441093	1.171313	2.620066	2.455865	2.966267
SAT	8.5587663	6.903344	5.594308	5.372562	5.749983	5.018801	5.216836	4.397985	2.952409	2.978162	2.362677	2.411073	1.860947	1.907497	1.26745	1.163237	0.857548	0.739489	0.638407	0.441093		0.788087	2.287702	2.169869	2.714067
BRY	8.8340595	7.256106	6.019965	5.803557	6.171349	5.456386	5.669892	4.885146	3.440239	3.560771	2.946357	3.054526	2.423142	2.481427	1.922477	1.838515	1.516768	1.406824	1.312036	1.171313	0.788087		1.366921	1.458354	2.056292
ODA	10.528395	9.140237	7.570257	7.276972	7.795747	6.833684	7.313657	6.397961	4.60761	5.122108	4.349961	4.707115	3.664454	3.765584	3.33072	3.283499	2.863318	2.754215	2.658344	2.620066	2.287702	1.366921		0.372733	1.086597
ELP	8.9411412	7.509999	6.547317	6.372801	6.662479	6.080917	6.230885	5.577141	4.291462	4.457747	3.918472	4.048271	3.42505	3.489929	3.059172	3.002352	2.695906	2.60436	2.524741	2.455865	2.169869	1.458354	0.372733		0.654684
BMT	8.8881351	7.533053	6.701694	6.550765	6.797291	6.2917	6.398309	5.812311	4.636375	4.784543	4.294542	4.41045	3.835082	3.89743	3.509976	3.460529	3.174336	3.091004	3.018395	2.966267	2.714067	2.056292	1.086597	0.654684	

Appendix E: Results of *t*-test at 95% Confidence Level

Table E1: Results of *t*-test for TxCAP for 2010 at 95% confidence level – Are mean scores significantly different?

District		WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
	Mean	**74.08**	**75.76**	**76.05**	**76.05**	**76.08**	**76.11**	**76.52**	**76.89**	**77.43**	**77.99**	**78.25**	**78.45**	**78.46**	**78.47**	**79.04**	**79.13**	**79.30**	**79.38**	**79.45**	**79.61**	**79.89**	**80.40**	**81.30**	**81.59**	**82.25**
WFS	**74.08**		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	**75.76**	Yes		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**76.05**	Yes	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**76.05**	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**76.08**	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**76.11**	Yes	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	**76.52**	Yes	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**76.89**	Yes	No	No	No	No	No	No		No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	**77.43**	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	**77.99**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	**78.25**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
LBB	**78.45**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
AUS	**78.46**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
LRD	**78.47**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
YKM	**79.04**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
AMA	**79.13**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
ATL	**79.30**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
LFK	**79.38**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes
CRP	**79.45**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes
SJT	**79.61**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes
SAT	**79.89**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	Yes	Yes	Yes
BRY	**80.40**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	Yes
ODA	**81.30**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No
ELP	**81.59**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No
BMT	**82.25**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	

Table E2: Results of *t*-test for TxCAP for 2009 at 95% confidence level – Are mean scores significantly different?

District		LFK	YKM	WFS	ATL	PAR	FTW	TYL	AUS	CRP	SAT	HOU	DAL	ABL	WAC	BWD	CHS	AMA	BRY	LRD	LBB	BMT	ELP	PHR	SJT	ODA
	Mean	71.94	73.70	73.78	73.85	73.90	73.97	75.13	75.62	75.69	75.77	76.52	76.86	77.04	77.43	77.62	77.86	77.96	77.99	78.42	78.50	78.59	78.90	79.49	79.97	83.12
LFK	**71.94**		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	**73.70**	Yes		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**73.78**	Yes	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ATL	**73.85**	Yes	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**73.90**	Yes	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**73.97**	Yes	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	**75.13**	Yes	Yes	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	**75.62**	Yes	Yes	No	Yes	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**75.69**	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	**75.77**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**76.52**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**76.86**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
ABL	**77.04**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes
WAC	**77.43**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes
BWD	**77.62**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
CHS	**77.86**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
AMA	**77.96**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
BRY	**77.99**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes
LRD	**78.42**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	Yes
LBB	**78.50**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes
BMT	**78.59**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	Yes
ELP	**78.90**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	Yes
PHR	**79.49**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	Yes
SJT	**79.97**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No		Yes
ODA	**83.12**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Table E3: Results of *t*-test for TxCAP for 2008 at 95% confidence level – Are mean scores significantly different?

District		PAR	CRP	HOU	DAL	LRD	FTW	LFK	SAT	LBB	PHR	AUS	WFS	WAC	YKM	BMT	AMA	BWD	TYL	BRY	CHS	SJT	ODA	ABL	ATL	ELP
	Mean	73.13	73.23	74.47	75.96	77.14	77.45	77.46	77.60	78.04	78.32	78.43	79.06	79.67	79.73	79.78	79.79	79.89	80.03	81.82	82.18	82.30	82.48	83.27	83.52	84.09
PAR	**73.13**		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**73.23**	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**74.47**	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**75.96**	Yes	Yes	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	**77.14**	Yes	Yes	Yes	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**77.45**	Yes	Yes	Yes	No	No		No	No	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	**77.46**	Yes	Yes	Yes	No	No	No		No	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	**77.60**	Yes	Yes	Yes	No	No	No	No		No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	**78.04**	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	**78.32**	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	**78.43**	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**79.06**	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**79.67**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	**79.73**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BMT	**79.78**	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
AMA	**79.79**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	**79.89**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	**80.03**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		Yes	Yes	Yes	Yes	Yes	Yes	Yes
BRY	**81.82**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes		No	No	No	No	No	Yes
CHS	**82.18**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No		No	No	No	No	No
SJT	**82.30**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	Yes
ODA	**82.48**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No
ABL	**83.27**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No
ATL	**83.52**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No
ELP	**84.09**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	

Table E4: Results for TxCAP for 2008–2010 combined at 95% confidence level – Are mean scores significantly different?

District		PAR	LFK	FTW	WFS	YKM	CRP	HOU	AUS	DAL	WAC	AMA	TYL	SAT	ATL	LRD	LBB	BWD	BMT	ABL	PHR	BRY	CHS	ELP	SJT	ODA
	Mean	70.31	75.70	75.78	76.34	76.50	76.56	76.90	77.17	77.27	77.57	77.66	77.67	77.68	77.82	78.28	78.39	78.65	79.14	79.54	79.63	79.81	80.11	80.46	81.10	81.76
PAR	**70.31**		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	**75.70**	Yes		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**75.78**	Yes	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**76.34**	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	**76.50**	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**76.56**	Yes	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**76.90**	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	**77.17**	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**77.27**	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**77.57**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AMA	**77.66**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	**77.67**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	**77.68**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ATL	**77.82**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	**78.28**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	**78.39**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	**78.65**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes
BMT	**79.14**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes
ABL	**79.54**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	Yes	Yes
PHR	**79.63**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	Yes	Yes
BRY	**79.81**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	Yes	Yes
CHS	**80.11**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	Yes	Yes
ELP	**80.46**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	Yes
SJT	**81.10**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No
ODA	**81.76**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	

Table E5: Results of *t*-test for PMIS for 2010 at 95% confidence level – Are mean scores significantly different?

District		WFS	DAL	FTW	WAC	BWD	ABL	TYL	HOU	PAR	LRD	AUS	AMA	LBB	ATL	YKM	CHS	SAT	PHR	CRP	SJT	BRY	LFK	ODA	ELP	BMT
	Mean	71.96	72.65	73.50	73.66	74.03	74.34	74.63	74.91	74.99	75.21	75.97	76.55	76.83	77.01	77.10	77.31	77.91	78.01	78.16	78.23	78.41	78.94	81.34	82.60	83.52
WFS	**71.96**		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**72.65**	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**73.50**	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**73.66**	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	**74.03**	Yes	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	**74.34**	Yes	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	**74.63**	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**74.91**	Yes	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**74.99**	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	**75.21**	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	**75.97**	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AMA	**76.55**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
LBB	**76.83**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
ATL	**77.01**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes
YKM	**77.10**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
CHS	**77.31**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
SAT	**77.91**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
PHR	**78.01**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes
CRP	**78.16**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes
SJT	**78.23**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes
BRY	**78.41**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	Yes	Yes	Yes
LFK	**78.94**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		Yes	Yes	Yes
ODA	**81.34**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No	No
ELP	**82.60**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No
BMT	**83.52**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	

Table E6: Results of *t*-test for PMIS for 2009 at 95% confidence level – Are mean scores significantly different?

District		LFK	PAR	YKM	ATL	WFS	TYL	FTW	AUS	BRY	SAT	CRP	DAL	HOU	ABL	WAC	BWD	AMA	LRD	SJT	CHS	ELP	BMT	LBB	PHR	ODA
	Mean	**69.83**	**71.08**	**71.34**	**71.86**	**72.25**	**72.26**	**72.31**	**72.67**	**73.35**	**73.36**	**73.65**	**73.99**	**74.04**	**74.53**	**74.69**	**75.11**	**76.00**	**76.18**	**76.53**	**77.28**	**77.77**	**77.78**	**78.21**	**81.18**	**83.13**
LFK	**69.83**		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**71.08**	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	**71.34**	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ATL	**71.86**	Yes	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**72.25**	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	**72.26**	Yes	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**72.31**	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	**72.67**	Yes	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BRY	**73.35**	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	**73.36**	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**73.65**	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**73.99**	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**74.04**	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	**74.53**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**74.69**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	**75.11**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
AMA	**76.00**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
LRD	**76.18**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes
SJT	**76.53**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	Yes	Yes	Yes
CHS	**77.28**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	Yes	Yes
ELP	**77.77**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	Yes	Yes
BMT	**77.78**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	Yes	Yes
LBB	**78.21**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No		Yes	Yes
PHR	**81.18**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
ODA	**83.13**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Table E7: Results of *t*-test for PMIS for 2008 at 95% confidence level – Are mean scores significantly different?

District		PAR	CRP	DAL	LRD	LFK	AMA	LBB	FTW	AUS	PHR	HOU	YKM	SAT	WAC	BMT	TYL	WFS	BRY	BWD	CHS	ABL	SJT	ODA	ATL	ELP
	Mean	70.38	71.72	73.01	74.66	75.28	75.53	75.66	76.92	77.01	77.06	77.17	77.48	77.57	77.72	78.52	78.55	79.12	80.21	80.30	81.27	81.78	81.79	82.01	82.36	84.96
PAR	**70.38**		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**71.72**	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**73.01**	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	**74.66**	Yes	Yes	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	**75.28**	Yes	Yes	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AMA	**75.53**	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	**75.66**	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**76.92**	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	**77.01**	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	**77.06**	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**77.17**	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	**77.48**	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	**77.57**	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**77.72**	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BMT	**78.52**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
TYL	**78.55**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**79.12**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes
BRY	**80.21**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	Yes
BWD	**80.30**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	Yes
CHS	**81.27**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No		No	No	No	No	Yes
ABL	**81.78**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	Yes
SJT	**81.79**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	Yes
ODA	**82.01**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	Yes
ATL	**82.36**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		Yes
ELP	**84.96**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Table E8: Results for PMIS for 2008, 2009, and 2010 combined at 95% confidence level – Are mean scores significantly different?

District		PAR	DAL	FTW	WFS	CRP	LFK	AUS	TYL	YKM	WAC	LRD	HOU	AMA	SAT	BWD	ABL	ATL	LBB	BRY	CHS	SJT	PHR	BMT	ELP	ODA
	Mean	72.24	73.24	74.25	74.39	74.55	74.66	75.11	75.14	75.23	75.28	75.33	75.37	76.02	76.21	76.51	76.77	76.87	76.90	77.31	78.63	78.84	78.88	79.88	81.73	82.17
PAR	72.24		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	73.24	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	74.25	Yes	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	74.39	Yes	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	74.55	Yes	Yes	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	74.66	Yes	Yes	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	75.11	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	75.14	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	75.23	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	75.28	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	75.33	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	75.37	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AMA	76.02	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	76.21	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
BWD	76.51	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
ABL	76.77	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
ATL	76.87	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes
LBB	76.90	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes
BRY	77.31	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		Yes	Yes	Yes	Yes	Yes	Yes
CHS	78.63	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No	No	No	Yes	Yes
SJT	78.84	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	Yes	Yes
PHR	78.88	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	Yes	Yes
BMT	79.88	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		Yes	Yes
ELP	81.73	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No
ODA	82.17	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	

Table E9: Results of *t*-test for TxTAP for 2010 at 95% confidence level – Are mean scores significantly different?

District		CHS	WFS	HOU	PHR	ABL	PAR	FTW	LBB	CRP	AMA	ELP	DAL	AUS	LRD	BMT	WAC	YKM	SJT	ATL	LFK	ODA	BRY	BWD	SAT	TYL
	Mean	71.06	74.88	75.53	76.17	76.49	76.57	78.96	79.00	79.35	80.14	80.21	80.38	81.03	81.18	81.43	81.85	81.85	82.11	82.12	82.19	82.65	82.86	82.93	83.77	84.27
CHS	**71.06**		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**74.88**	Yes		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**75.53**	Yes	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	**76.17**	Yes	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	**76.49**	Yes	No	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**76.57**	Yes	No	No	No	No		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**78.96**	Yes	Yes	Yes	Yes	Yes	Yes		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	**79.00**	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**79.35**	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AMA	**80.14**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
ELP	**80.21**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
DAL	**80.38**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
AUS	**81.03**	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No		No	No	No	No	No	No	No	No	No	No	Yes	Yes
LRD	**81.18**	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes
BMT	**81.43**	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes
WAC	**81.85**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes
YKM	**81.85**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes
SJT	**82.11**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes
ATL	**82.12**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	No	No	Yes
LFK	**82.19**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No		No	No	No	No	Yes
ODA	**82.65**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No		No	No	No	No
BRY	**82.86**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No	No		No	No	No
BWD	**82.93**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No		No	No
SAT	**83.77**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No
TYL	**84.27**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	

Table E10: Results of *t*-test for TxTAP for 2009 at 95% confidence level – Are mean scores significantly different?

		FTW	YKM	CRP	LFK	WFS	CHS	PAR	LBB	HOU	PHR	ATL	ELP	ABL	SAT	BWD	AUS	TYL	AMA	DAL	WAC	BMT	LRD	ODA	BRY	SJT
	Mean	74.22	75.25	75.3	75.37	75.68	76.07	76.29	76.71	77.29	77.58	77.7	77.7	78.67	78.95	79.33	79.57	79.75	80.01	80.02	80.1	80.18	80.93	82.88	83.36	83.7
FTW	**74.22**		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	**75.25**	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**75.3**	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	**75.37**	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**75.68**	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	**76.07**	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**76.29**	Yes	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	**76.71**	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**77.29**	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	**77.58**	Yes	Yes	No	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ATL	**77.7**	Yes	Yes	No	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ELP	**77.7**	Yes	Yes	No	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
ABL	**78.67**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
SAT	**78.95**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes
BWD	**79.33**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
AUS	**79.57**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
TYL	**79.75**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
AMA	**80.01**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes
DAL	**80.02**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes
WAC	**80.1**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes
BMT	**80.18**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	Yes	Yes	Yes
LRD	**80.93**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	Yes
ODA	**82.88**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No
BRY	**83.36**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No
SJT	**83.7**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	

Table E11: Results of *t*-test for TxTAP for 2008 at 95% confidence level – Are mean scores significantly different?

District		HOU	CRP	SAT	DAL	PAR	BMT	LBB	FTW	AUS	BWD	WFS	CHS	ELP	LRD	YKM	ATL	ABL	LFK	SJT	WAC	ODA	AMA	PHR	BRY	TYL
	Mean	68.08	72.02	74.75	77.06	77.32	77.55	77.70	77.91	78.02	78.13	78.19	78.23	79.20	80.30	81.51	81.63	81.94	82.21	82.36	82.50	82.89	83.14	83.22	84.30	85.05
HOU	68.08		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	72.02	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	74.75	Yes	Yes		No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	77.06	Yes	Yes	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	77.32	Yes	Yes	Yes	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BMT	77.55	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	77.70	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	77.91	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	78.02	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	78.13	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	78.19	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	78.23	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ELP	79.20	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	80.30	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
YKM	81.51	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	Yes	Yes
ATL	81.63	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	Yes	Yes
ABL	81.94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	Yes	Yes
LFK	82.21	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	Yes
SJT	82.36	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	Yes
WAC	82.50	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	Yes
ODA	82.89	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No
AMA	83.14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No
PHR	83.22	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No
BRY	84.30	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No
TYL	85.05	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	

Table E12: Results for TxTAP for 2008–2010 combined at 95% confidence level – Are mean scores significantly different?

District		HOU	CHS	CRP	WFS	PAR	FTW	LBB	PHR	ABL	ELP	DAL	SAT	YKM	AUS	BMT	LFK	BWD	ATL	LRD	AMA	WAC	SJT	ODA	TYL	BRY
	Mean	73.66	75.16	75.60	76.23	76.71	77.00	77.80	78.87	78.95	79.03	79.21	79.32	79.45	79.58	79.68	79.90	80.15	80.37	80.81	81.10	81.46	82.74	82.81	82.99	83.53
HOU	73.66		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	75.16	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	75.60	Yes	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	76.23	Yes	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	76.71	Yes	Yes	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	77.00	Yes	Yes	No	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBB	77.80	Yes	Yes	Yes	Yes	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	78.87	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	78.95	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ELP	79.03	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	79.21	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	79.32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	79.45	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
AUS	79.58	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
BMT	79.68	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
LFK	79.90	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes
BWD	80.15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes
ATL	80.37	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes
LRD	80.81	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes
AMA	81.10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	Yes	Yes	Yes	Yes
WAC	81.46	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		Yes	Yes	Yes	Yes
SJT	82.74	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No	No	No
ODA	82.81	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No
TYL	82.99	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No
BRY	83.53	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	

Table E13: Results of *t*-test for TxMAP for 2010 at 95% confidence level – Are mean scores significantly different?

District		WFS	PHR	PAR	ABL	LFK	HOU	FTW	CHS	WAC	DAL	SJT	TYL	ODA	YKM	SAT	BMT	LBB	ELP	AUS	ATL	BWD	CRP	BRY	LRD	AMA
	Mean	77.06	77.30	77.58	77.63	78.24	78.30	78.35	78.83	78.96	79.04	80.26	80.28	80.33	80.41	80.61	80.66	80.80	80.83	80.91	81.23	81.29	81.67	82.09	82.11	82.77
WFS	**77.06**		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	**77.30**	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**77.58**	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABL	**77.63**	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	**78.24**	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	**78.30**	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**78.35**	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHS	**78.83**	Yes	No	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**78.96**	Yes	No	No	Yes	No	No	No	No		No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**79.04**	Yes	No	No	Yes	No	No	No	No	No		No	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SJT	**80.26**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
TYL	**80.28**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
ODA	**80.33**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
YKM	**80.41**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes
SAT	**80.61**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
BMT	**80.66**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	No	No	No	Yes
LBB	**80.80**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	No	Yes
ELP	**80.83**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	No	Yes
AUS	**80.91**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	No	No	Yes
ATL	**81.23**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	No	No	Yes
BWD	**81.29**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No		No	No	No	Yes
CRP	**81.67**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No		No	No	No
BRY	**82.09**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No		No	No
LRD	**82.11**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No
AMA	**82.77**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	

Table E14: Results of *t*-test for TxMAP for 2009 at 95% confidence level – Are mean scores significantly different?

District		LFK	ATL	WFS	FTW	YKM	TYL	PAR	SAT	AUS	PHR	BMT	CRP	DAL	AMA	CHS	ABL	HOU	LBB	WAC	LRD	BWD	ELP	BRY	SJT	ODA
	Mean	73.19	74.60	75.05	76.58	76.61	76.83	77.00	77.65	77.91	77.93	78.89	79.34	79.52	79.86	80.02	80.12	80.16	80.16	80.22	80.47	80.68	81.56	82.13	83.21	83.29
LFK	73.19		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ATL	74.60	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	75.05	Yes	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	76.58	Yes	Yes	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	76.61	Yes	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	76.83	Yes	Yes	Yes	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	77.00	Yes	Yes	Yes	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	77.65	Yes	Yes	Yes	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	77.91	Yes	Yes	Yes	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	77.93	Yes	Yes	Yes	No	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BMT	78.89	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
CRP	79.34	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
DAL	79.52	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
AMA	79.86	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
CHS	80.02	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	No	Yes	Yes	Yes
ABL	80.12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes
HOU	80.16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes
LBB	80.16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes
WAC	80.22	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes
LRD	80.47	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes
BWD	80.68	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No		No	Yes	Yes	Yes
ELP	81.56	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	Yes	No
BRY	82.13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No
SJT	83.21	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No
ODA	83.29	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	

Table E15: Results of *t*-test for TxMAP for 2008 at 95% confidence level – Are mean scores significantly different?

District		HOU	PAR	CRP	PHR	LFK	FTW	TYL	LRD	SAT	WFS	DAL	BWD	WAC	AUS	LBB	YKM	BRY	ODA	SJT	BMT	AMA	ELP	CHS	ABL	ATL
	Mean	74.25	76.06	76.54	77.16	78.87	79.07	79.13	79.18	79.55	79.55	80.14	80.37	81.04	81.07	82.24	82.28	82.85	82.97	83.11	83.38	84.65	85.89	86.33	86.65	86.71
HOU	**74.25**		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	**76.06**	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	**76.54**	Yes	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	**77.16**	Yes	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LFK	**78.87**	Yes	Yes	Yes	No		No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	**79.07**	Yes	Yes	Yes	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	**79.13**	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LRD	**79.18**	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	**79.55**	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	**79.55**	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	**80.14**	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BWD	**80.37**	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	**81.04**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	**81.07**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
LBB	**82.24**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
YKM	**82.28**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes
BRY	**82.85**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes
ODA	**82.97**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes
SJT	**83.11**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	Yes	Yes	Yes	Yes	Yes
BMT	**83.38**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No		No	No	Yes	Yes	Yes
AMA	**84.65**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	Yes	Yes
ELP	**85.89**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No
CHS	**86.33**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No
ABL	**86.65**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No
ATL	**86.71**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	

Table E16: Results for TxMAP for 2008–2010 combined at 95% confidence level – Are mean scores significantly different?

District		LFK	PAR	WFS	PHR	HOU	FTW	TYL	CRP	SAT	DAL	YKM	AUS	WAC	ATL	LRD	BWD	BMT	LBB	ABL	CHS	ODA	SJT	BRY	AMA	ELP
	Mean	76.75	77.03	77.20	77.49	77.57	77.99	78.71	79.22	79.25	79.56	79.72	79.89	80.03	80.60	80.62	80.78	81.00	81.07	81.32	81.75	82.21	82.21	82.36	82.40	82.72
LFK	76.75		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAR	77.03	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WFS	77.20	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHR	77.49	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HOU	77.57	No	No	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FTW	77.99	Yes	Yes	No	No	No		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TYL	78.71	Yes	Yes	Yes	Yes	Yes	No		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	79.22	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAT	79.25	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DAL	79.56	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YKM	79.72	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AUS	79.89	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WAC	80.03	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ATL	80.60	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
LRD	80.62	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
BWD	80.78	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	No	No	Yes	Yes	Yes	Yes	Yes
BMT	81.00	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	No	Yes	Yes	Yes	Yes	Yes
LBB	81.07	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No	No	Yes	Yes	Yes	Yes	Yes
ABL	81.32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No		No	No	Yes	Yes	Yes	Yes
CHS	81.75	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No		No	No	No	No	No
ODA	82.21	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No	No
SJT	82.21	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No		No	No	No
BRY	82.36	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No		No	No
AMA	82.40	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No		No
ELP	82.72	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	

Appendix F: Current Level of Confidence

Table F1: Level of confidence for significant difference for TxCAP scores for 2010

District		WFS	ABL	FTW	HOU	PAR	DAL	CHS	WAC	PHR	BWD	TYL	LBB	AUS	LRD	YKM	AMA	ATL	LFK	CRP	SJT	SAT	BRY	ODA	ELP	BMT
	Mean	**74.08**	**75.76**	**76.05**	**76.05**	**76.08**	**76.11**	**76.52**	**76.89**	**77.43**	**77.99**	**78.25**	**78.45**	**78.46**	**78.47**	**79.04**	**79.13**	**79.30**	**79.38**	**79.45**	**79.61**	**79.89**	**80.40**	**81.30**	**81.59**	**82.25**
WFS	**74.08**		99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	**75.76**	99%		33%	32%	38%	37%	76%	91%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	**76.05**	99%	33%	0%	0%	4%	6%	48%	74%	88%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	**76.05**	99%	32%	0%	0%	4%	6%	47%	72%	87%	99%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	**76.08**	99%	38%	4%	4%	0%	3%	46%	73%	87%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	**76.11**	99%	37%	6%	6%	3%	0%	39%	66%	83%	98%	99%	100%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CHS	**76.52**	100%	76%	48%	47%	46%	39%	0%	40%	71%	97%	98%	100%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WAC	**76.89**	100%	91%	74%	72%	73%	66%	40%	0%	45%	88%	93%	98%	94%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	**77.43**	100%	95%	88%	87%	87%	83%	71%	45%	0%	49%	64%	78%	72%	73%	93%	95%	96%	97%	98%	99%	100%	100%	100%	100%	100%
BWD	**77.99**	100%	100%	99%	99%	99%	98%	97%	88%	49%	0%	29%	54%	45%	47%	87%	91%	93%	95%	96%	98%	100%	100%	100%	100%	100%
TYL	**78.25**	100%	100%	100%	99%	100%	99%	98%	93%	64%	29%	0%	23%	20%	21%	71%	77%	83%	86%	88%	94%	98%	100%	100%	100%	100%
LBB	**78.45**	100%	100%	100%	100%	100%	100%	100%	98%	78%	54%	23%	0%	1%	2%	63%	71%	78%	83%	86%	93%	98%	100%	100%	100%	100%
AUS	**78.46**	100%	100%	100%	99%	100%	99%	98%	94%	72%	45%	20%	1%	0%	1%	52%	59%	68%	73%	76%	85%	94%	98%	100%	100%	100%
LRD	**78.47**	100%	100%	100%	100%	100%	99%	99%	95%	73%	47%	21%	2%	1%	0%	52%	60%	69%	74%	77%	86%	94%	99%	100%	100%	100%
YKM	**79.04**	100%	100%	100%	100%	100%	100%	100%	100%	93%	87%	71%	63%	52%	52%	0%	10%	27%	35%	42%	58%	79%	94%	100%	100%	100%
AMA	**79.13**	100%	100%	100%	100%	100%	100%	100%	100%	95%	91%	77%	71%	59%	60%	10%	0%	18%	27%	34%	52%	75%	93%	100%	100%	100%
ATL	**79.30**	100%	100%	100%	100%	100%	100%	100%	100%	96%	93%	83%	78%	68%	69%	27%	18%	0%	9%	16%	34%	61%	87%	100%	99%	100%
LFK	**79.38**	100%	100%	100%	100%	100%	100%	100%	100%	97%	95%	86%	83%	73%	74%	35%	27%	9%	0%	7%	25%	54%	84%	99%	99%	100%
CRP	**79.45**	100%	100%	100%	100%	100%	100%	100%	100%	98%	96%	88%	86%	76%	77%	42%	34%	16%	7%	0%	18%	48%	81%	99%	99%	100%
SJT	**79.61**	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	94%	93%	85%	86%	58%	52%	34%	25%	18%	0%	34%	76%	99%	99%	100%
SAT	**79.89**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	94%	94%	79%	75%	61%	54%	48%	34%	0%	57%	98%	97%	99%
BRY	**80.40**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	99%	94%	93%	87%	84%	81%	76%	57%	0%	83%	85%	96%
ODA	**81.30**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	98%	83%	0%	29%	72%
ELP	**81.59**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	97%	85%	29%	0%	49%
BMT	**82.25**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	96%	72%	49%	0%

Table F2: Level of confidence for significant difference for TxCAP scores for 2009

District		LFK	YKM	WFS	ATL	PAR	FTW	TYL	AUS	CRP	SAT	HOU	DAL	ABL	WAC	BWD	CHS	AMA	BRY	LRD	LBB	BMT	ELP	PHR	SJT	ODA
	Mean	71.94	73.70	73.78	73.85	73.90	73.97	75.13	75.62	75.69	75.77	76.52	76.86	77.04	77.43	77.62	77.86	77.96	77.99	78.42	78.50	78.59	78.90	79.49	79.97	83.12
LFK	71.94		99%	97%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	73.70	99%		8%	18%	23%	28%	96%	98%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	73.78	97%	8%		7%	11%	17%	89%	95%	95%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ATL	73.85	99%	18%	7%		6%	14%	94%	97%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	73.90	99%	23%	11%	6%		8%	92%	97%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	73.97	99%	28%	17%	14%	8%		86%	94%	94%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	75.13	100%	96%	89%	94%	92%	86%		45%	49%	62%	91%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
AUS	75.62	100%	98%	95%	97%	97%	94%	45%	0%	5%	14%	67%	87%	92%	98%	98%	99%	100%	100%	99%	100%	100%	100%	100%	100%	100%
CRP	75.69	100%	98%	95%	98%	97%	94%	49%	5%	0%	7%	63%	84%	90%	97%	98%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%
SAT	75.77	100%	100%	98%	99%	99%	97%	62%	14%	7%	0%	64%	87%	92%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	76.52	100%	100%	100%	100%	100%	100%	91%	67%	63%	64%	0%	32%	48%	76%	81%	90%	93%	93%	94%	99%	97%	99%	100%	100%	100%
DAL	76.86	100%	100%	100%	100%	100%	100%	99%	87%	84%	87%	32%	0%	21%	63%	71%	85%	90%	90%	92%	99%	96%	98%	100%	100%	100%
ABL	77.04	100%	100%	100%	100%	100%	100%	99%	92%	90%	92%	48%	21%	0%	46%	59%	77%	84%	84%	88%	98%	94%	97%	100%	100%	100%
WAC	77.43	100%	100%	100%	100%	100%	100%	100%	98%	97%	99%	76%	63%	46%	0%	23%	50%	62%	62%	75%	94%	86%	94%	100%	100%	100%
BWD	77.62	100%	100%	100%	100%	100%	100%	100%	98%	98%	99%	81%	71%	59%	23%	0%	26%	37%	39%	61%	82%	75%	86%	98%	100%	100%
CHS	77.86	100%	100%	100%	100%	100%	100%	100%	99%	99%	100%	90%	85%	77%	50%	26%	0%	12%	15%	47%	70%	63%	79%	97%	100%	100%
AMA	77.96	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	93%	90%	84%	62%	37%	12%	0%	3%	40%	63%	57%	75%	96%	100%	100%
BRY	77.99	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	93%	90%	84%	62%	39%	15%	3%	0%	37%	59%	54%	73%	95%	100%	100%
LRD	78.42	100%	100%	100%	100%	100%	100%	100%	99%	99%	100%	94%	92%	88%	75%	61%	47%	40%	37%	0%	7%	14%	36%	74%	92%	100%
LBB	78.50	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	98%	94%	82%	70%	63%	59%	7%	0%	10%	39%	83%	99%	100%
BMT	78.59	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	96%	94%	86%	75%	63%	57%	54%	14%	10%	0%	25%	69%	92%	100%
ELP	78.90	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	97%	94%	86%	79%	75%	73%	36%	39%	25%	0%	49%	82%	100%
PHR	79.49	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	97%	96%	95%	74%	83%	69%	49%	0%	49%	100%
SJT	79.97	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	99%	92%	82%	49%	0%	100%
ODA	83.12	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Table F3: Level of confidence for significant difference for TxCAP scores for 2008

District		PAR	CRP	HOU	DAL	LRD	FTW	LFK	SAT	LBB	PHR	AUS	WFS	WAC	YKM	BMT	AMA	BWD	TYL	BRY	CHS	SJT	ODA	ABL	ATL	ELP
	Mean	73.13	73.23	74.47	75.96	77.14	77.45	77.46	77.60	78.04	78.32	78.43	79.06	79.67	79.73	79.78	79.79	79.89	80.03	81.82	82.18	82.30	82.48	83.27	83.52	84.09
PAR	73.13		8%	79%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	73.23	8%		81%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	74.47	79%	81%		83%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	75.96	99%	99%	83%		71%	82%	81%	89%	97%	97%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LRD	77.14	100%	100%	99%	71%		22%	22%	35%	65%	74%	80%	92%	99%	99%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	77.45	100%	100%	99%	82%	22%		1%	12%	46%	59%	66%	86%	97%	98%	94%	98%	98%	99%	100%	100%	100%	100%	100%	100%	100%
LFK	77.46	100%	100%	99%	81%	22%	1%		11%	45%	58%	65%	85%	97%	98%	93%	98%	98%	99%	100%	100%	100%	100%	100%	100%	100%
SAT	77.60	100%	100%	100%	89%	35%	12%	11%		39%	55%	63%	86%	98%	99%	94%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
LBB	78.04	100%	100%	100%	97%	65%	46%	45%	39%		24%	34%	72%	94%	97%	88%	97%	97%	99%	100%	100%	100%	100%	100%	100%	100%
PHR	78.32	100%	100%	100%	97%	74%	59%	58%	55%	24%		9%	52%	84%	88%	77%	89%	90%	94%	100%	100%	100%	100%	100%	100%	100%
AUS	78.43	100%	100%	100%	98%	80%	66%	65%	63%	34%	9%		47%	83%	87%	75%	88%	89%	94%	100%	100%	100%	100%	100%	100%	100%
WFS	79.06	100%	100%	100%	99%	92%	86%	85%	86%	72%	52%	47%		46%	52%	44%	55%	59%	69%	100%	99%	100%	100%	100%	100%	100%
WAC	79.67	100%	100%	100%	100%	99%	97%	97%	98%	94%	84%	83%	46%		5%	8%	11%	19%	33%	99%	98%	100%	100%	100%	100%	100%
YKM	79.73	100%	100%	100%	100%	99%	98%	98%	99%	97%	88%	87%	52%	5%		4%	7%	15%	30%	99%	99%	100%	100%	100%	100%	100%
BMT	79.78	100%	100%	100%	100%	97%	94%	93%	94%	88%	77%	75%	44%	8%	4%		1%	7%	17%	93%	94%	98%	98%	100%	100%	100%
AMA	79.79	100%	100%	100%	100%	99%	98%	98%	99%	97%	89%	88%	55%	11%	7%	1%		9%	23%	99%	98%	100%	100%	100%	100%	100%
BWD	79.89	100%	100%	100%	100%	99%	98%	98%	99%	97%	90%	89%	59%	19%	15%	7%	9%		13%	98%	97%	100%	100%	100%	100%	100%
TYL	80.03	100%	100%	100%	100%	100%	99%	99%	100%	99%	94%	94%	69%	33%	30%	17%	23%	13%		97%	97%	100%	100%	100%	100%	100%
BRY	81.82	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	93%	99%	98%	97%		28%	48%	55%	92%	93%	99%
CHS	82.18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	99%	94%	98%	97%	97%	28%		10%	22%	72%	77%	93%
SJT	82.30	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	100%	100%	48%	10%		17%	79%	82%	97%
ODA	82.48	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	100%	100%	55%	22%	17%		64%	71%	92%
ABL	83.27	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	72%	79%	64%		20%	65%
ATL	83.52	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	93%	77%	82%	71%	20%		43%
ELP	84.09	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	93%	97%	92%	65%	43%	

Table F4: Level of confidence for significant difference for TxCAP scores for 2008, 2009, and 2010

District		PAR	LFK	FTW	WFS	YKM	CRP	HOU	AUS	DAL	WAC	AMA	TYL	SAT	ATL	LRD	LBB	BWD	BMT	ABL	PHR	BRY	CHS	ELP	SJT	ODA
	Mean	70.31	75.70	75.78	76.34	76.50	76.56	76.90	77.17	77.27	77.57	77.66	77.67	77.68	77.82	78.28	78.39	78.65	79.14	79.54	79.63	79.81	80.11	80.46	81.10	81.76
PAR	70.31		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	75.70	100%		32%	74%	88%	88%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	75.78	100%	32%		56%	76%	77%	94%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	76.34	100%	74%	56%		24%	31%	69%	87%	92%	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	76.50	100%	88%	76%	24%		10%	59%	83%	90%	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	76.56	100%	88%	77%	31%	10%		48%	75%	83%	96%	98%	98%	98%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	76.90	100%	97%	94%	69%	59%	48%		39%	52%	84%	89%	88%	88%	89%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
AUS	77.17	100%	99%	98%	87%	83%	75%	39%		15%	60%	70%	70%	70%	74%	95%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	77.27	100%	100%	99%	92%	90%	83%	52%	15%		50%	61%	61%	61%	68%	94%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WAC	77.57	100%	100%	100%	99%	99%	96%	84%	60%	50%		17%	18%	19%	36%	83%	96%	98%	100%	100%	100%	100%	100%	100%	100%	100%
AMA	77.66	100%	100%	100%	99%	99%	98%	89%	70%	61%	17%		2%	3%	24%	77%	93%	97%	99%	100%	100%	100%	100%	100%	100%	100%
TYL	77.67	100%	100%	100%	99%	99%	98%	88%	70%	61%	18%	2%		0%	21%	75%	91%	97%	99%	100%	100%	100%	100%	100%	100%	100%
SAT	77.68	100%	100%	100%	99%	99%	98%	88%	70%	61%	19%	3%	0%		21%	75%	91%	97%	99%	100%	100%	100%	100%	100%	100%	100%
ATL	77.82	100%	100%	100%	99%	99%	97%	89%	74%	68%	36%	24%	21%	21%		56%	73%	87%	97%	100%	100%	100%	100%	100%	100%	100%
LRD	78.28	100%	100%	100%	100%	100%	100%	98%	95%	94%	83%	77%	75%	75%	56%		16%	50%	84%	98%	98%	100%	100%	100%	100%	100%
LBB	78.39	100%	100%	100%	100%	100%	100%	100%	99%	99%	96%	93%	91%	91%	73%	16%		47%	85%	99%	99%	100%	100%	100%	100%	100%
BWD	78.65	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	97%	97%	97%	87%	50%	47%		62%	95%	94%	99%	100%	100%	100%	100%
BMT	79.14	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	97%	84%	85%	62%		55%	59%	78%	90%	98%	100%	100%
ABL	79.54	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	99%	95%	55%		13%	44%	74%	93%	100%	100%
PHR	79.63	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	99%	94%	59%	13%		27%	60%	86%	100%	100%
BRY	79.81	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	78%	44%	27%		46%	81%	100%	100%
CHS	80.11	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	90%	74%	60%	46%		47%	96%	100%
ELP	80.46	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	93%	86%	81%	47%		83%	99%
SJT	81.10	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	96%	83%		88%
ODA	81.76	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	88%	

Table F5: Level of confidence for significant difference for PMIS scores for 2010

District		WFS	DAL	FTW	WAC	BWD	ABL	TYL	HOU	PAR	LRD	AUS	AMA	LBB	ATL	YKM	CHS	SAT	PHR	CRP	SJT	BRY	LFK	ODA	ELP	BMT
	Mean	**71.96**	**72.65**	**73.50**	**73.66**	**74.03**	**74.34**	**74.63**	**74.91**	**74.99**	**75.21**	**75.97**	**76.55**	**76.83**	**77.01**	**77.10**	**77.31**	**77.91**	**78.01**	**78.16**	**78.23**	**78.41**	**78.94**	**81.34**	**82.60**	**83.52**
WFS	**71.96**		49%	90%	93%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	**72.65**	49%		59%	67%	84%	92%	93%	96%	98%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	**73.50**	90%	59%		14%	46%	68%	75%	85%	90%	92%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WAC	**73.66**	93%	67%	14%		33%	57%	67%	79%	86%	88%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
BWD	**74.03**	98%	84%	46%	33%		31%	48%	66%	76%	79%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	**74.34**	99%	92%	68%	57%	31%		25%	47%	58%	65%	91%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	**74.63**	99%	93%	75%	67%	48%	25%		21%	30%	42%	78%	95%	98%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	**74.91**	100%	96%	85%	79%	66%	47%	21%		7%	23%	68%	91%	96%	96%	97%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%
PAR	**74.99**	100%	98%	90%	86%	76%	58%	30%	7%		18%	67%	93%	97%	97%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LRD	**75.21**	100%	98%	92%	88%	79%	65%	42%	23%	18%		52%	84%	92%	92%	94%	97%	100%	99%	100%	100%	100%	100%	100%	100%	100%
AUS	**75.97**	100%	100%	98%	97%	95%	91%	78%	68%	67%	52%		44%	62%	67%	73%	81%	95%	92%	97%	98%	98%	99%	100%	100%	100%
AMA	**76.55**	100%	100%	100%	100%	100%	99%	95%	91%	93%	84%	44%		26%	38%	46%	61%	89%	83%	93%	95%	96%	99%	100%	100%	100%
LBB	**76.83**	100%	100%	100%	100%	100%	100%	98%	96%	97%	92%	62%	26%		16%	25%	43%	82%	75%	89%	91%	93%	98%	100%	100%	100%
ATL	**77.01**	100%	100%	100%	100%	100%	100%	98%	96%	97%	92%	67%	38%	16%		7%	24%	67%	62%	77%	80%	85%	94%	100%	100%	100%
YKM	**77.10**	100%	100%	100%	100%	100%	100%	99%	97%	98%	94%	73%	46%	25%	7%		19%	65%	60%	76%	79%	84%	94%	100%	100%	100%
CHS	**77.31**	100%	100%	100%	100%	100%	100%	99%	99%	99%	97%	81%	61%	43%	24%	19%		51%	48%	65%	70%	77%	90%	100%	100%	100%
SAT	**77.91**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	95%	89%	82%	67%	65%	51%		7%	23%	29%	43%	73%	100%	100%	100%
PHR	**78.01**	100%	100%	100%	100%	100%	100%	100%	99%	100%	99%	92%	83%	75%	62%	60%	48%	7%		12%	16%	29%	59%	100%	100%	100%
CRP	**78.16**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	93%	89%	77%	76%	65%	23%	12%		6%	21%	58%	100%	100%	100%
SJT	**78.23**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	95%	91%	80%	79%	70%	29%	16%	6%		16%	55%	100%	100%	100%
BRY	**78.41**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	96%	93%	85%	84%	77%	43%	29%	21%	16%		42%	100%	100%	100%
LFK	**78.94**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	98%	94%	94%	90%	73%	59%	58%	55%	42%		99%	100%	100%
ODA	**81.34**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%		85%	94%
ELP	**82.60**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	85%		54%
BMT	**83.52**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	54%	

Table F6: Level of confidence for significant difference for PMIS scores for 2009

District		LFK	PAR	YKM	ATL	WFS	TYL	FTW	AUS	BRY	SAT	CRP	DAL	HOU	ABL	WAC	BWD	AMA	LRD	SJT	CHS	ELP	BMT	LBB	PHR	ODA
	Mean	69.83	71.08	71.34	71.86	72.25	72.26	72.31	72.67	73.35	73.36	73.65	73.99	74.04	74.53	74.69	75.11	76.00	76.18	76.53	77.28	77.77	77.78	78.21	81.18	83.13
LFK	69.83		83%	91%	98%	97%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	71.08	83%		24%	65%	72%	81%	80%	89%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	71.34	91%	24%		49%	62%	71%	70%	83%	98%	98%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ATL	71.86	98%	65%	49%		29%	36%	37%	59%	91%	91%	92%	99%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	72.25	97%	72%	62%	29%		0%	4%	27%	67%	67%	74%	89%	85%	96%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	72.26	99%	81%	71%	36%	0%		4%	31%	75%	75%	80%	94%	90%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	72.31	99%	80%	70%	37%	4%	4%		25%	69%	69%	76%	91%	87%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
AUS	72.67	99%	89%	83%	59%	27%	31%	25%		49%	49%	60%	81%	76%	93%	97%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%
BRY	73.35	100%	99%	98%	91%	67%	75%	69%	49%		1%	21%	51%	47%	79%	88%	93%	100%	98%	100%	100%	100%	100%	100%	100%	100%
SAT	73.36	100%	99%	98%	91%	67%	75%	69%	49%	1%		20%	50%	46%	78%	88%	93%	100%	98%	100%	100%	100%	100%	100%	100%	100%
CRP	73.65	100%	99%	98%	92%	74%	80%	76%	60%	21%	20%		26%	25%	59%	70%	82%	98%	94%	99%	100%	100%	100%	100%	100%	100%
DAL	73.99	100%	100%	100%	99%	89%	94%	91%	81%	51%	50%	26%		3%	45%	61%	77%	98%	93%	100%	100%	100%	100%	100%	100%	100%
HOU	74.04	100%	100%	99%	97%	85%	90%	87%	76%	47%	46%	25%	3%		35%	49%	68%	94%	89%	98%	100%	100%	100%	100%	100%	100%
ABL	74.53	100%	100%	100%	100%	96%	99%	97%	93%	79%	78%	59%	45%	35%		15%	46%	91%	83%	98%	100%	100%	100%	100%	100%	100%
WAC	74.69	100%	100%	100%	100%	98%	100%	99%	97%	88%	88%	70%	61%	49%	15%		39%	92%	82%	98%	100%	100%	100%	100%	100%	100%
BWD	75.11	100%	100%	100%	100%	99%	100%	99%	98%	93%	93%	82%	77%	68%	46%	39%		69%	62%	89%	98%	99%	99%	100%	100%	100%
AMA	76.00	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	94%	91%	92%	69%		13%	49%	88%	92%	92%	100%	100%	100%
LRD	76.18	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	94%	93%	89%	83%	82%	62%	13%		24%	65%	78%	78%	93%	100%	100%
SJT	76.53	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	98%	98%	98%	89%	49%	24%		63%	78%	78%	97%	100%	100%
CHS	77.28	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	88%	65%	63%		37%	37%	77%	100%	100%
ELP	77.77	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	92%	78%	78%	37%		0%	35%	100%	100%
BMT	77.78	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	92%	78%	78%	37%	0%		34%	100%	100%
LBB	78.21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	93%	97%	77%	35%	34%		100%	100%
PHR	81.18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		96%
ODA	83.13	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	96%	

Table F7: Level of confidence for significant difference for PMIS scores for 2008

District		PAR	CRP	DAL	LRD	LFK	AMA	LBB	FTW	AUS	PHR	HOU	YKM	SAT	WAC	BMT	TYL	WFS	BRY	BWD	CHS	ABL	SJT	ODA	ATL	ELP
	Mean	**70.38**	**71.72**	**73.01**	**74.66**	**75.28**	**75.53**	**75.66**	**76.92**	**77.01**	**77.06**	**77.17**	**77.48**	**77.57**	**77.72**	**78.52**	**78.55**	**79.12**	**80.21**	**80.30**	**81.27**	**81.78**	**81.79**	**82.01**	**82.36**	**84.96**
PAR	**70.38**		75%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	**71.72**	75%		67%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	**73.01**	95%	67%		74%	88%	95%	96%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LRD	**74.66**	100%	98%	74%		34%	51%	58%	90%	93%	91%	94%	97%	98%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	**75.28**	100%	100%	88%	34%		17%	25%	78%	83%	80%	86%	93%	94%	94%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
AMA	**75.53**	100%	100%	95%	51%	17%		9%	75%	82%	77%	85%	93%	94%	94%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LBB	**75.66**	100%	100%	96%	58%	25%	9%		71%	79%	74%	82%	92%	93%	93%	96%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	**76.92**	100%	100%	99%	90%	78%	75%	71%		5%	8%	15%	35%	40%	46%	71%	80%	89%	99%	99%	100%	100%	100%	100%	100%	100%
AUS	**77.01**	100%	100%	100%	93%	83%	82%	79%	5%		3%	11%	33%	38%	45%	71%	82%	90%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	**77.06**	100%	100%	99%	91%	80%	77%	74%	8%	3%		6%	26%	31%	38%	65%	75%	86%	99%	99%	100%	100%	100%	100%	100%	100%
HOU	**77.17**	100%	100%	100%	94%	86%	85%	82%	15%	11%	6%		22%	27%	35%	65%	76%	87%	99%	99%	100%	100%	100%	100%	100%	100%
YKM	**77.48**	100%	100%	100%	97%	93%	93%	92%	35%	33%	26%	22%		6%	16%	54%	66%	81%	99%	99%	100%	100%	100%	100%	100%	100%
SAT	**77.57**	100%	100%	100%	98%	94%	94%	93%	40%	38%	31%	27%	6%		10%	50%	62%	78%	99%	99%	100%	100%	100%	100%	100%	100%
WAC	**77.72**	100%	100%	100%	98%	94%	94%	93%	46%	45%	38%	35%	16%	10%		41%	51%	71%	97%	97%	99%	100%	100%	100%	100%	100%
BMT	**78.52**	100%	100%	100%	99%	97%	97%	96%	71%	71%	65%	65%	54%	50%	41%		2%	30%	78%	79%	94%	98%	98%	99%	99%	100%
TYL	**78.55**	100%	100%	100%	100%	99%	99%	99%	80%	82%	75%	76%	66%	62%	51%	2%		34%	86%	88%	97%	100%	100%	100%	100%	100%
WFS	**79.12**	100%	100%	100%	100%	99%	100%	99%	89%	90%	86%	87%	81%	78%	71%	30%	34%		62%	65%	89%	97%	98%	98%	98%	100%
BRY	**80.21**	100%	100%	100%	100%	100%	100%	100%	99%	100%	99%	99%	99%	99%	97%	78%	86%	62%		7%	64%	87%	89%	91%	93%	100%
BWD	**80.30**	100%	100%	100%	100%	100%	100%	100%	99%	100%	99%	99%	99%	99%	97%	79%	88%	65%	7%		58%	83%	86%	88%	91%	100%
CHS	**81.27**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	94%	97%	89%	64%	58%		34%	36%	46%	60%	100%
ABL	**81.78**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	97%	87%	83%	34%		1%	17%	37%	100%
SJT	**81.79**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	98%	89%	86%	36%	1%		17%	38%	100%
ODA	**82.01**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	98%	91%	88%	46%	17%	17%		23%	99%
ATL	**82.36**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	98%	93%	91%	60%	37%	38%	23%		97%
ELP	**84.96**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	97%	

Table F8: Level of confidence for significant difference for PMIS scores for 2008, 2009, and 2010

District		PAR	DAL	FTW	WFS	CRP	LFK	AUS	TYL	YKM	WAC	LRD	HOU	AMA	SAT	BWD	ABL	ATL	LBB	BRY	CHS	SJT	PHR	BMT	ELP	ODA
	Mean	**72.24**	**73.24**	**74.25**	**74.39**	**74.55**	**74.66**	**75.11**	**75.14**	**75.23**	**75.28**	**75.33**	**75.37**	**76.02**	**76.21**	**76.51**	**76.77**	**76.87**	**76.90**	**77.31**	**78.63**	**78.84**	**78.88**	**79.88**	**81.73**	**82.17**
PAR	**72.24**		89%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	**73.24**	89%		87%	90%	95%	96%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	**74.25**	100%	87%		16%	36%	46%	81%	84%	89%	90%	88%	91%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	**74.39**	100%	90%	16%		18%	30%	70%	73%	80%	82%	80%	84%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	**74.55**	100%	95%	36%	18%		13%	61%	64%	73%	76%	73%	78%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	**74.66**	100%	96%	46%	30%	13%		50%	53%	63%	67%	64%	70%	97%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
AUS	**75.11**	100%	99%	81%	70%	61%	50%		3%	15%	21%	24%	30%	87%	92%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	**75.14**	100%	100%	84%	73%	64%	53%	3%		12%	18%	21%	27%	87%	93%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	**75.23**	100%	100%	89%	80%	73%	63%	15%	12%		7%	12%	18%	85%	92%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
WAC	**75.28**	100%	100%	90%	82%	76%	67%	21%	18%	7%		6%	11%	82%	90%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
LRD	**75.33**	100%	100%	88%	80%	73%	64%	24%	21%	12%	6%		5%	72%	82%	92%	97%	97%	99%	100%	100%	100%	100%	100%	100%	100%
HOU	**75.37**	100%	100%	91%	84%	78%	70%	30%	27%	18%	11%	5%		72%	83%	93%	98%	98%	99%	100%	100%	100%	100%	100%	100%	100%
AMA	**76.02**	100%	100%	100%	99%	99%	97%	87%	87%	85%	82%	72%	72%		27%	62%	83%	84%	91%	98%	100%	100%	100%	100%	100%	100%
SAT	**76.21**	100%	100%	100%	99%	99%	98%	92%	93%	92%	90%	82%	83%	27%		39%	67%	71%	80%	94%	100%	100%	100%	100%	100%	100%
BWD	**76.51**	100%	100%	100%	100%	100%	100%	97%	98%	97%	97%	92%	93%	62%	39%		35%	44%	53%	83%	100%	100%	100%	100%	100%	100%
ABL	**76.77**	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	97%	98%	83%	67%	35%		14%	19%	65%	100%	100%	100%	100%	100%	100%
ATL	**76.87**	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	97%	98%	84%	71%	44%	14%		3%	51%	99%	100%	100%	100%	100%	100%
LBB	**76.90**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	91%	80%	53%	19%	3%		55%	100%	100%	100%	100%	100%	100%
BRY	**77.31**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	94%	83%	65%	51%	55%		97%	99%	98%	100%	100%	100%
CHS	**78.63**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	97%		29%	30%	91%	100%	100%
SJT	**78.84**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	29%		6%	86%	100%	100%
PHR	**78.88**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	30%	6%		80%	100%	100%
BMT	**79.88**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	91%	86%	80%		98%	100%
ELP	**81.73**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%		54%
ODA	**82.17**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	54%	

Table F9: Level of confidence for significant difference for TxTAP scores for 2010

District		CHS	WFS	HOU	PHR	ABL	PAR	FTW	LBB	CRP	AMA	ELP	DAL	AUS	LRD	BMT	WAC	YKM	SJT	ATL	LFK	ODA	BRY	BWD	SAT	TYL
	Mean	**71.06**	**74.88**	**75.53**	**76.17**	**76.49**	**76.57**	**78.96**	**79.00**	**79.35**	**80.14**	**80.21**	**80.38**	**81.03**	**81.18**	**81.43**	**81.85**	**81.85**	**82.11**	**82.12**	**82.19**	**82.65**	**82.86**	**82.93**	**83.77**	**84.27**
CHS	**71.06**		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	**74.88**	100%		41%	65%	87%	87%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	**75.53**	100%	41%		36%	63%	64%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	**76.17**	100%	65%	36%		20%	24%	97%	98%	97%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	**76.49**	100%	87%	63%	20%		7%	99%	100%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	**76.57**	100%	87%	64%	24%	7%		98%	99%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	**78.96**	100%	100%	100%	97%	99%	98%		3%	26%	73%	63%	80%	94%	92%	95%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
LBB	**79.00**	100%	100%	100%	98%	100%	99%	3%		25%	76%	64%	82%	96%	93%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	**79.35**	100%	100%	100%	97%	99%	98%	26%	25%		50%	44%	60%	83%	82%	87%	96%	96%	98%	98%	99%	100%	100%	100%	100%	100%
AMA	**80.14**	100%	100%	100%	100%	100%	100%	73%	76%	50%		4%	17%	58%	59%	69%	88%	89%	94%	93%	95%	99%	99%	99%	100%	100%
ELP	**80.21**	100%	100%	100%	99%	99%	99%	63%	64%	44%	4%		9%	43%	47%	57%	75%	76%	83%	83%	85%	93%	94%	94%	99%	100%
DAL	**80.38**	100%	100%	100%	100%	100%	100%	80%	82%	60%	17%	9%		43%	46%	58%	80%	81%	88%	88%	90%	97%	97%	97%	100%	100%
AUS	**81.03**	100%	100%	100%	100%	100%	100%	94%	96%	83%	58%	43%	43%		9%	25%	53%	54%	68%	67%	72%	89%	91%	91%	100%	100%
LRD	**81.18**	100%	100%	100%	100%	100%	100%	92%	93%	82%	59%	47%	46%	9%		14%	39%	40%	54%	54%	58%	78%	81%	82%	97%	99%
BMT	**81.43**	100%	100%	100%	100%	100%	100%	95%	96%	87%	69%	57%	58%	25%	14%		25%	26%	41%	41%	46%	70%	74%	75%	96%	98%
WAC	**81.85**	100%	100%	100%	100%	100%	100%	99%	100%	96%	88%	75%	80%	53%	39%	25%		0%	19%	19%	25%	57%	65%	66%	95%	98%
YKM	**81.85**	100%	100%	100%	100%	100%	100%	99%	100%	96%	89%	76%	81%	54%	40%	26%	0%		19%	20%	25%	58%	66%	67%	96%	99%
SJT	**82.11**	100%	100%	100%	100%	100%	100%	100%	100%	98%	94%	83%	88%	68%	54%	41%	19%	19%		1%	6%	43%	53%	55%	93%	98%
ATL	**82.12**	100%	100%	100%	100%	100%	100%	100%	100%	98%	93%	83%	88%	67%	54%	41%	19%	20%	1%		5%	41%	51%	53%	92%	97%
LFK	**82.19**	100%	100%	100%	100%	100%	100%	100%	100%	99%	95%	85%	90%	72%	58%	46%	25%	25%	6%	5%		37%	48%	51%	92%	97%
ODA	**82.65**	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	93%	97%	89%	78%	70%	57%	58%	43%	41%	37%		18%	22%	84%	94%
BRY	**82.86**	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	94%	97%	91%	81%	74%	65%	66%	53%	51%	48%	18%		5%	68%	85%
BWD	**82.93**	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	94%	97%	91%	82%	75%	66%	67%	55%	53%	51%	22%	5%		61%	81%
SAT	**83.77**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%	97%	96%	95%	96%	93%	92%	92%	84%	68%	61%		46%
TYL	**84.27**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	99%	98%	97%	97%	94%	85%	81%	46%	

Table F10: Level of confidence for significant difference for TxTAP scores for 2009

District		FTW	YKM	CRP	LFK	WFS	CHS	PAR	LBB	HOU	PHR	ATL	ELP	ABL	SAT	BWD	AUS	TYL	AMA	DAL	WAC	BMT	LRD	ODA	BRY	SJT
	Mean	**74.22**	**75.25**	**75.30**	**75.37**	**75.68**	**76.07**	**76.29**	**76.71**	**77.29**	**77.58**	**77.70**	**77.70**	**78.67**	**78.95**	**79.33**	**79.57**	**79.75**	**80.01**	**80.02**	**80.10**	**80.18**	**80.93**	**82.88**	**83.36**	**83.70**
FTW	**74.22**		70%	62%	76%	77%	87%	95%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	**75.25**	70%		4%	10%	28%	51%	69%	87%	92%	97%	99%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	**75.30**	62%	4%		5%	22%	42%	57%	75%	85%	92%	95%	93%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	**75.37**	76%	10%	5%		21%	44%	64%	84%	90%	96%	98%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	**75.68**	77%	28%	22%	21%		22%	37%	61%	76%	86%	90%	87%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CHS	**76.07**	87%	51%	42%	44%	22%		14%	41%	63%	76%	82%	78%	97%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	**76.29**	95%	69%	57%	64%	37%	14%		32%	59%	75%	82%	77%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LBB	**76.71**	99%	87%	75%	84%	61%	41%	32%		38%	58%	68%	62%	95%	98%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	**77.29**	99%	92%	85%	90%	76%	63%	59%	38%		18%	27%	25%	75%	86%	89%	92%	97%	98%	98%	98%	97%	99%	100%	100%	100%
PHR	**77.58**	100%	97%	92%	96%	86%	76%	75%	58%	18%		9%	8%	68%	81%	86%	90%	96%	98%	98%	98%	96%	98%	100%	100%	100%
ATL	**77.70**	100%	99%	95%	98%	90%	82%	82%	68%	27%	9%		0%	66%	81%	85%	90%	96%	98%	98%	98%	96%	98%	100%	100%	100%
ELP	**77.70**	100%	97%	93%	96%	87%	78%	77%	62%	25%	8%	0%		60%	75%	81%	86%	93%	96%	96%	96%	94%	97%	100%	100%	100%
ABL	**78.67**	100%	100%	99%	100%	99%	97%	97%	95%	75%	68%	66%	60%		23%	44%	57%	72%	83%	82%	84%	78%	90%	100%	100%	100%
SAT	**78.95**	100%	100%	100%	100%	99%	99%	99%	98%	86%	81%	81%	75%	23%		27%	43%	61%	76%	75%	77%	70%	86%	100%	100%	100%
BWD	**79.33**	100%	100%	100%	100%	99%	99%	99%	98%	89%	86%	85%	81%	44%	27%		16%	30%	48%	47%	51%	49%	73%	100%	100%	100%
AUS	**79.57**	100%	100%	100%	100%	100%	99%	100%	99%	92%	90%	90%	86%	57%	43%	16%		13%	31%	31%	36%	35%	65%	100%	100%	100%
TYL	**79.75**	100%	100%	100%	100%	100%	100%	100%	100%	97%	96%	96%	93%	72%	61%	30%	13%		22%	22%	28%	28%	62%	100%	100%	100%
AMA	**80.01**	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	98%	96%	83%	76%	48%	31%	22%		1%	8%	12%	52%	100%	100%	100%
DAL	**80.02**	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	98%	96%	82%	75%	47%	31%	22%	1%		7%	11%	50%	100%	100%	100%
WAC	**80.10**	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	98%	96%	84%	77%	51%	36%	28%	8%	7%		5%	46%	100%	100%	100%
BMT	**80.18**	100%	100%	100%	100%	100%	100%	100%	100%	97%	96%	96%	94%	78%	70%	49%	35%	28%	12%	11%	5%		38%	98%	99%	100%
LRD	**80.93**	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	97%	90%	86%	73%	65%	62%	52%	50%	46%	38%		86%	92%	96%
ODA	**82.88**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	86%		37%	60%
BRY	**83.36**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	92%	37%		26%
SJT	**83.70**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	96%	60%	26%	

Table F11: Level of confidence for significant difference for TxTAP scores for 2008

District		FTW	YKM	CRP	LFK	WFS	CHS	PAR	LBB	HOU	PHR	ATL	ELP	ABL	SAT	BWD	AUS	TYL	AMA	DAL	WAC	BMT	LRD	ODA	BRY	SJT
	Mean	**74.22**	**75.25**	**75.30**	**75.37**	**75.68**	**76.07**	**76.29**	**76.71**	**77.29**	**77.58**	**77.70**	**77.70**	**78.67**	**78.95**	**79.33**	**79.57**	**79.75**	**80.01**	**80.02**	**80.10**	**80.18**	**80.93**	**82.88**	**83.36**	**83.70**
FTW	**74.22**		70%	62%	76%	77%	87%	95%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	**75.25**	70%		4%	10%	28%	51%	69%	87%	92%	97%	99%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	**75.30**	62%	4%		5%	22%	42%	57%	75%	85%	92%	95%	93%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	**75.37**	76%	10%	5%		21%	44%	64%	84%	90%	96%	98%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	**75.68**	77%	28%	22%	21%		22%	37%	61%	76%	86%	90%	87%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CHS	**76.07**	87%	51%	42%	44%	22%		14%	41%	63%	76%	82%	78%	97%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	**76.29**	95%	69%	57%	64%	37%	14%		32%	59%	75%	82%	77%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LBB	**76.71**	99%	87%	75%	84%	61%	41%	32%		38%	58%	68%	62%	95%	98%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	**77.29**	99%	92%	85%	90%	76%	63%	59%	38%		18%	27%	25%	75%	86%	89%	92%	97%	98%	98%	98%	97%	99%	100%	100%	100%
PHR	**77.58**	100%	97%	92%	96%	86%	76%	75%	58%	18%		9%	8%	68%	81%	86%	90%	96%	98%	98%	98%	96%	98%	100%	100%	100%
ATL	**77.70**	100%	99%	95%	98%	90%	82%	82%	68%	27%	9%		0%	66%	81%	85%	90%	96%	98%	98%	98%	96%	98%	100%	100%	100%
ELP	**77.70**	100%	97%	93%	96%	87%	78%	77%	62%	25%	8%	0%		60%	75%	81%	86%	93%	96%	96%	96%	94%	97%	100%	100%	100%
ABL	**78.67**	100%	100%	99%	100%	99%	97%	97%	95%	75%	68%	66%	60%		23%	44%	57%	72%	83%	82%	84%	78%	90%	100%	100%	100%
SAT	**78.95**	100%	100%	100%	100%	99%	99%	99%	98%	86%	81%	81%	75%	23%		27%	43%	61%	76%	75%	77%	70%	86%	100%	100%	100%
BWD	**79.33**	100%	100%	100%	100%	99%	99%	99%	98%	89%	86%	85%	81%	44%	27%		16%	30%	48%	47%	51%	49%	73%	100%	100%	100%
AUS	**79.57**	100%	100%	100%	100%	100%	99%	100%	99%	92%	90%	90%	86%	57%	43%	16%		13%	31%	31%	36%	35%	65%	100%	100%	100%
TYL	**79.75**	100%	100%	100%	100%	100%	100%	100%	100%	97%	96%	96%	93%	72%	61%	30%	13%		22%	22%	28%	28%	62%	100%	100%	100%
AMA	**80.01**	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	98%	96%	83%	76%	48%	31%	22%		1%	8%	12%	52%	100%	100%	100%
DAL	**80.02**	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	98%	96%	82%	75%	47%	31%	22%	1%		7%	11%	50%	100%	100%	100%
WAC	**80.10**	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	98%	96%	84%	77%	51%	36%	28%	8%	7%		5%	46%	100%	100%	100%
BMT	**80.18**	100%	100%	100%	100%	100%	100%	100%	100%	97%	96%	96%	94%	78%	70%	49%	35%	28%	12%	11%	5%		38%	98%	99%	100%
LRD	**80.93**	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	97%	90%	86%	73%	65%	62%	52%	50%	46%	38%		86%	92%	96%
ODA	**82.88**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	86%		37%	60%
BRY	**83.36**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	92%	37%		26%
SJT	**83.70**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	96%	60%	26%	

Table F12: Level of confidence for significant difference for TxTAP scores for 2008, 2009, and 2010

District		HOU	CHS	CRP	WFS	PAR	FTW	LBB	PHR	ABL	ELP	DAL	SAT	YKM	AUS	BMT	LFK	BWD	ATL	LRD	AMA	WAC	SJT	ODA	TYL	BRY
	Mean	73.66	75.16	75.60	76.23	76.71	77.00	77.80	78.87	78.95	79.03	79.21	79.32	79.45	79.58	79.68	79.90	80.15	80.37	80.81	81.10	81.46	82.74	82.81	82.99	83.53
HOU	73.66		92%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CHS	75.16	92%		40%	78%	95%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	75.60	99%	40%		56%	88%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	76.23	100%	78%	56%		48%	69%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	76.71	100%	95%	88%	48%		34%	92%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	77.00	100%	98%	95%	69%	34%		79%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LBB	77.80	100%	100%	100%	97%	92%	79%		87%	94%	90%	97%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	78.87	100%	100%	100%	100%	100%	99%	87%		9%	15%	35%	47%	56%	64%	66%	84%	90%	96%	98%	100%	100%	100%	100%	100%	100%
ABL	78.95	100%	100%	100%	100%	100%	100%	94%	9%		8%	30%	44%	56%	64%	65%	86%	92%	97%	98%	100%	100%	100%	100%	100%	100%
ELP	79.03	100%	100%	100%	100%	100%	99%	90%	15%	8%		18%	29%	41%	50%	53%	74%	83%	91%	96%	99%	100%	100%	100%	100%	100%
DAL	79.21	100%	100%	100%	100%	100%	100%	97%	35%	30%	18%		14%	28%	40%	45%	71%	82%	92%	96%	100%	100%	100%	100%	100%	100%
SAT	79.32	100%	100%	100%	100%	100%	100%	99%	47%	44%	29%	14%		17%	31%	37%	65%	79%	90%	95%	100%	100%	100%	100%	100%	100%
YKM	79.45	100%	100%	100%	100%	100%	100%	99%	56%	56%	41%	28%	17%		15%	23%	51%	69%	83%	92%	99%	100%	100%	100%	100%	100%
AUS	79.58	100%	100%	100%	100%	100%	100%	99%	64%	64%	50%	40%	31%	15%		10%	36%	57%	74%	88%	98%	99%	100%	100%	100%	100%
BMT	79.68	100%	100%	100%	100%	100%	100%	99%	66%	65%	53%	45%	37%	23%	10%		22%	44%	62%	80%	94%	98%	100%	100%	100%	100%
LFK	79.90	100%	100%	100%	100%	100%	100%	100%	84%	86%	74%	71%	65%	51%	36%	22%		28%	52%	76%	94%	98%	100%	100%	100%	100%
BWD	80.15	100%	100%	100%	100%	100%	100%	100%	90%	92%	83%	82%	79%	69%	57%	44%	28%		24%	58%	84%	94%	100%	100%	100%	100%
ATL	80.37	100%	100%	100%	100%	100%	100%	100%	96%	97%	91%	92%	90%	83%	74%	62%	52%	24%		43%	75%	90%	100%	100%	100%	100%
LRD	80.81	100%	100%	100%	100%	100%	100%	100%	98%	98%	96%	96%	95%	92%	88%	80%	76%	58%	43%		30%	60%	99%	99%	100%	100%
AMA	81.10	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%	99%	98%	94%	94%	84%	75%	30%		44%	99%	100%	100%	100%
WAC	81.46	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	94%	90%	60%	44%		96%	97%	99%	100%
SJT	82.74	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	96%		9%	33%	81%
ODA	82.81	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	97%	9%		24%	76%
TYL	82.99	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	33%	24%		64%
BRY	83.53	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	81%	76%	64%	

Table F13: Level of confidence for significant difference for TxMAP scores for 2010

District		WFS	PHR	PAR	ABL	LFK	HOU	FTW	CHS	WAC	DAL	SJT	TYL	ODA	YKM	SAT	BMT	LBB	ELP	AUS	ATL	BWD	CRP	BRY	LRD	AMA
	Mean	77.06	77.30	77.58	77.63	78.24	78.30	78.35	78.83	78.96	79.04	80.26	80.28	80.33	80.41	80.61	80.66	80.80	80.83	80.91	81.23	81.29	81.67	82.09	82.11	82.77
WFS	77.06		20%	48%	60%	88%	89%	90%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	77.30	20%		22%	29%	68%	70%	72%	90%	92%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	77.58	48%	22%		6%	60%	62%	65%	89%	93%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ABL	77.63	60%	29%	6%		65%	67%	70%	94%	96%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	78.24	88%	68%	60%	65%		6%	11%	59%	68%	71%	100%	99%	100%	100%	100%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%
HOU	78.30	89%	70%	62%	67%	6%		5%	52%	62%	66%	99%	99%	99%	100%	100%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%
FTW	78.35	90%	72%	65%	70%	11%	5%		48%	58%	62%	99%	99%	99%	99%	100%	98%	100%	99%	100%	100%	100%	100%	100%	100%	100%
CHS	78.83	98%	90%	89%	94%	59%	52%	48%		15%	23%	96%	96%	97%	98%	99%	95%	100%	97%	99%	100%	100%	100%	100%	100%	100%
WAC	78.96	99%	92%	93%	96%	68%	62%	58%	15%		9%	93%	93%	95%	96%	99%	93%	100%	95%	99%	100%	100%	100%	100%	100%	100%
DAL	79.04	99%	93%	93%	96%	71%	66%	62%	23%	9%		90%	90%	92%	94%	97%	90%	99%	93%	98%	99%	100%	100%	100%	100%	100%
SJT	80.26	100%	100%	100%	100%	100%	99%	99%	96%	93%	90%		3%	8%	18%	41%	34%	61%	46%	60%	81%	83%	94%	99%	99%	100%
TYL	80.28	100%	100%	100%	100%	99%	99%	99%	96%	93%	90%	3%		5%	14%	37%	31%	57%	43%	57%	79%	81%	93%	99%	98%	100%
ODA	80.33	100%	100%	100%	100%	100%	99%	99%	97%	95%	92%	8%	5%		10%	34%	28%	54%	41%	55%	78%	80%	93%	99%	98%	100%
YKM	80.41	100%	100%	100%	100%	100%	100%	99%	98%	96%	94%	18%	14%	10%		24%	21%	46%	34%	48%	73%	76%	91%	99%	98%	100%
SAT	80.61	100%	100%	100%	100%	100%	100%	100%	99%	99%	97%	41%	37%	34%	24%		5%	25%	19%	32%	63%	66%	87%	98%	96%	100%
BMT	80.66	100%	100%	100%	100%	99%	98%	98%	95%	93%	90%	34%	31%	28%	21%	5%		12%	11%	19%	44%	48%	70%	88%	86%	98%
LBB	80.80	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	61%	57%	54%	46%	25%	12%		3%	12%	47%	52%	80%	97%	94%	100%
ELP	80.83	100%	100%	100%	100%	99%	99%	99%	97%	95%	93%	46%	43%	41%	34%	19%	11%	3%		7%	32%	36%	62%	83%	81%	96%
AUS	80.91	100%	100%	100%	100%	100%	100%	100%	99%	99%	98%	60%	57%	55%	48%	32%	19%	12%	7%		30%	35%	65%	88%	85%	99%
ATL	81.23	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	81%	79%	78%	73%	63%	44%	47%	32%	30%		6%	43%	78%	73%	97%
BWD	81.29	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	83%	81%	80%	76%	66%	48%	52%	36%	35%	6%		37%	73%	69%	96%
CRP	81.67	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	93%	93%	91%	87%	70%	80%	62%	65%	43%	37%		44%	42%	87%
BRY	82.09	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	98%	88%	97%	83%	88%	78%	73%	44%		2%	71%
LRD	82.11	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	98%	98%	96%	86%	94%	81%	85%	73%	69%	42%	2%		63%
AMA	82.77	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	96%	99%	97%	96%	87%	71%	63%	

Table F14: Level of confidence for significant difference for TxMAP scores for 2009

District		LFK	ATL	WFS	FTW	YKM	TYL	PAR	SAT	AUS	PHR	BMT	CRP	DAL	AMA	CHS	ABL	HOU	LBB	WAC	LRD	BWD	ELP	BRY	SJT	ODA
	Mean	73.19	74.60	75.05	76.58	76.61	76.83	77.00	77.65	77.91	77.93	78.89	79.34	79.52	79.86	80.02	80.12	80.16	80.16	80.22	80.47	80.68	81.56	82.13	83.21	83.29
LFK	73.19		94%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ATL	74.60	94%		41%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	75.05	97%	41%		92%	94%	97%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	76.58	100%	99%	92%		4%	25%	41%	85%	88%	89%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	76.61	100%	99%	94%	4%		23%	40%	85%	88%	89%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	76.83	100%	100%	97%	25%	23%		19%	75%	81%	82%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	77.00	100%	100%	98%	41%	40%	19%		65%	73%	75%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SAT	77.65	100%	100%	100%	85%	85%	75%	65%		25%	27%	86%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
AUS	77.91	100%	100%	100%	88%	88%	81%	73%	25%		2%	70%	91%	95%	99%	99%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	77.93	100%	100%	100%	89%	89%	82%	75%	27%	2%		69%	90%	95%	99%	99%	100%	99%	100%	99%	100%	100%	100%	100%	100%	100%
BMT	78.89	100%	100%	100%	99%	99%	98%	97%	86%	70%	69%		39%	54%	76%	81%	86%	85%	89%	88%	93%	96%	99%	100%	100%	100%
CRP	79.34	100%	100%	100%	100%	100%	100%	100%	98%	91%	90%	39%		19%	53%	62%	72%	70%	77%	75%	85%	93%	99%	100%	100%	100%
DAL	79.52	100%	100%	100%	100%	100%	100%	100%	99%	95%	95%	54%	19%		39%	51%	63%	61%	69%	68%	81%	90%	98%	100%	100%	100%
AMA	79.86	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	76%	53%	39%		17%	31%	31%	37%	39%	61%	77%	96%	100%	100%	100%
CHS	80.02	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	81%	62%	51%	17%		12%	15%	17%	22%	46%	64%	92%	100%	100%	100%
ABL	80.12	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	86%	72%	63%	31%	12%		5%	6%	12%	39%	60%	92%	100%	100%	100%
HOU	80.16	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	85%	70%	61%	31%	15%	5%			6%	32%	51%	88%	99%	100%	100%
LBB	80.16	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	89%	77%	69%	37%	17%	6%			8%	37%	59%	92%	100%	100%	100%
WAC	80.22	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	88%	75%	68%	39%	22%	12%	6%	8%		27%	48%	88%	100%	100%	100%
LRD	80.47	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	93%	85%	81%	61%	46%	39%	32%	37%	27%		22%	79%	98%	100%	100%
BWD	80.68	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	96%	93%	90%	77%	64%	60%	51%	59%	48%	22%		70%	97%	100%	100%
ELP	81.56	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	98%	96%	92%	92%	88%	92%	88%	79%	70%		50%	96%	94%
BRY	82.13	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%	98%	97%	50%		93%	88%
SJT	83.21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	96%	93%		9%
ODA	83.29	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	88%	9%	

Table F15: Level of confidence for significant difference for TxMAP scores for 2008

District		HOU	PAR	CRP	PHR	LFK	FTW	TYL	LRD	SAT	WFS	DAL	BWD	WAC	AUS	LBB	YKM	BRY	ODA	SJT	BMT	AMA	ELP	CHS	ABL	ATL
	Mean	**74.25**	**76.06**	**76.54**	**77.16**	**78.87**	**79.07**	**79.13**	**79.18**	**79.55**	**79.55**	**80.14**	**80.37**	**81.04**	**81.07**	**82.24**	**82.28**	**82.85**	**82.97**	**83.11**	**83.38**	**84.65**	**85.89**	**86.33**	**86.65**	**86.71**
HOU	**74.25**		91%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	**76.06**	91%		40%	74%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	**76.54**	98%	40%		50%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	**77.16**	99%	74%	50%		94%	95%	98%	96%	97%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LFK	**78.87**	100%	100%	99%	94%		17%	25%	27%	49%	51%	79%	91%	99%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	**79.07**	100%	100%	99%	95%	17%	0%	5%	9%	34%	35%	68%	82%	97%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	**79.13**	100%	100%	100%	98%	25%	5%	0%	5%	33%	35%	71%	86%	99%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LRD	**79.18**	100%	100%	100%	96%	27%	9%	5%	0%	26%	28%	63%	79%	96%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SAT	**79.55**	100%	100%	100%	97%	49%	34%	33%	26%	0%	0%	39%	56%	86%	84%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	**79.55**	100%	100%	100%	98%	51%	35%	35%	28%	0%	0%	41%	58%	88%	86%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	**80.14**	100%	100%	100%	99%	79%	68%	71%	63%	39%	41%	0%	17%	64%	62%	97%	97%	99%	99%	100%	99%	100%	100%	100%	100%	100%
BWD	**80.37**	100%	100%	100%	100%	91%	82%	86%	79%	56%	58%	17%	0%	56%	54%	97%	98%	100%	99%	100%	99%	100%	100%	100%	100%	100%
WAC	**81.04**	100%	100%	100%	100%	99%	97%	99%	96%	86%	88%	64%	56%	0%	3%	87%	89%	98%	98%	100%	96%	100%	100%	100%	100%	100%
AUS	**81.07**	100%	100%	100%	100%	98%	96%	98%	95%	84%	86%	62%	54%	3%	0%	82%	84%	96%	96%	99%	94%	100%	100%	100%	100%	100%
LBB	**82.24**	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	97%	97%	87%	82%	0%	4%	55%	60%	76%	67%	100%	100%	100%	100%	100%
YKM	**82.28**	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	97%	98%	89%	84%	4%	0%	54%	59%	75%	66%	100%	100%	100%	100%	100%
BRY	**82.85**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	98%	96%	55%	54%	0%	12%	28%	36%	98%	100%	100%	100%	100%
ODA	**82.97**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	98%	96%	60%	59%	12%	0%	14%	26%	96%	99%	100%	100%	100%
SJT	**83.11**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	76%	75%	28%	14%	0%	19%	97%	100%	100%	100%	100%
BMT	**83.38**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	96%	94%	67%	66%	36%	26%	19%	0%	74%	95%	97%	99%	99%
AMA	**84.65**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	96%	97%	74%	0%	81%	89%	99%	97%
ELP	**85.89**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	95%	81%	0%	28%	55%	53%
CHS	**86.33**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	89%	28%	0%	23%	25%
ABL	**86.65**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	55%	23%	0%	5%
ATL	**86.71**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	97%	53%	25%	5%	0%

Table F16: Level of confidence for significant difference for TxMAP scores for 2008, 2009, and 2010 combined

District		LFK	PAR	WFS	PHR	HOU	FTW	TYL	CRP	SAT	DAL	YKM	AUS	WAC	ATL	LRD	BWD	BMT	LBB	ABL	CHS	ODA	SJT	BRY	AMA	ELP
	Mean	**76.75**	**77.03**	**77.20**	**77.49**	**77.57**	**77.99**	**78.71**	**79.22**	**79.25**	**79.56**	**79.72**	**79.89**	**80.03**	**80.60**	**80.62**	**80.78**	**81.00**	**81.07**	**81.32**	**81.75**	**82.21**	**82.21**	**82.36**	**82.40**	**82.72**
LFK	**76.75**		45%	61%	83%	88%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PAR	**77.03**	45%		26%	62%	71%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
WFS	**77.20**	61%	26%		39%	49%	86%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PHR	**77.49**	83%	62%	39%		12%	64%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
HOU	**77.57**	88%	71%	49%	12%		57%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
FTW	**77.99**	99%	95%	86%	64%	57%		87%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TYL	**78.71**	100%	100%	100%	98%	98%	87%		73%	76%	93%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CRP	**79.22**	100%	100%	100%	100%	100%	99%	73%		5%	51%	72%	81%	93%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SAT	**79.25**	100%	100%	100%	100%	100%	99%	76%	5%		47%	69%	79%	91%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DAL	**79.56**	100%	100%	100%	100%	100%	100%	93%	51%	47%		27%	48%	69%	93%	96%	99%	98%	100%	100%	100%	100%	100%	100%	100%	100%
YKM	**79.72**	100%	100%	100%	100%	100%	100%	98%	72%	69%	27%		27%	52%	90%	94%	98%	97%	100%	100%	100%	100%	100%	100%	100%	100%
AUS	**79.89**	100%	100%	100%	100%	100%	100%	99%	81%	79%	48%	27%		24%	78%	84%	92%	93%	99%	100%	100%	100%	100%	100%	100%	100%
WAC	**80.03**	100%	100%	100%	100%	100%	100%	100%	93%	91%	69%	52%	24%		71%	79%	90%	90%	99%	100%	100%	100%	100%	100%	100%	100%
ATL	**80.60**	100%	100%	100%	100%	100%	100%	100%	99%	99%	93%	90%	78%	71%		3%	26%	46%	64%	82%	94%	100%	100%	100%	100%	100%
LRD	**80.62**	100%	100%	100%	100%	100%	100%	100%	100%	99%	96%	94%	84%	79%	3%		26%	47%	69%	86%	96%	100%	100%	100%	100%	100%
BWD	**80.78**	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	98%	92%	90%	26%	26%		29%	50%	76%	93%	100%	100%	100%	100%	100%
BMT	**81.00**	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	97%	93%	90%	46%	47%	29%		9%	41%	75%	95%	97%	98%	98%	99%
LBB	**81.07**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	64%	69%	50%	9%		46%	83%	99%	100%	100%	100%	100%
ABL	**81.32**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	82%	86%	76%	41%	46%		58%	94%	97%	98%	99%	99%
CHS	**81.75**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	96%	93%	75%	83%	58%		60%	64%	77%	79%	88%
ODA	**82.21**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	95%	99%	94%	60%		1%	27%	33%	62%
SJT	**82.21**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%	97%	64%	1%		30%	36%	66%
BRY	**82.36**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	98%	77%	27%	30%		7%	49%
AMA	**82.40**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	99%	79%	33%	36%	7%		44%
ELP	**82.72**	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	99%	88%	62%	66%	49%	44%	

Center for Transportation Research
The University of Texas at Austin
1616 Guadalupe Street
Austin, TX 78701

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