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16. Abstract In an effort to evaluate and improve their practices to ensure the future excellence of the Texas highway system, the Texas Department of Transportation (TxDOT) sought a forum in which experts from other state departments of transportation could share their expertise. Thus, the Peer State Review of TxDOT Maintenance Practices project was organized and conducted for TxDOT by the Center for Transportation Research (CTR) at The University of Texas at Austin. The goal of the project was to conduct a workshop at CTR and in the Austin District that would educate the visiting peers on TxDOT's maintenance practices and invite their feedback. CTR and TxDOT arranged the participation of the following directors of maintenance: Steve Takigawa, CA; Roy Rissky, KS; Eric Pitts, GA; Jim Carney, MO; Jennifer Brandenburg, NC; and David Bierschbach, WA. One of the means used to capture the peer reviewers' opinions was a carefully designed booklet of 15 questions. The peers provided TxDOT with written responses to these questions, and the oral comments made during the workshop were also captured. This information was then compiled and summarized in the following report. An examination of the peers' comments suggests that TxDOT should use a more holistic, statewide approach to funding and planning rather than funding and planning for each district separately. Additionally, the peers stressed the importance of allocating funds based on the actual conditions of the roadways instead of on inventory. The visiting directors of maintenance also recommended continuing and proliferating programs that enhance communication, such as peer review workshops.					
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Chapter 1. Introduction

1.1 Project Goals

The Texas Department of Transportation (TxDOT) has requested that a Peer Review be conducted of the TxDOT Maintenance Program and Maintenance Practices. The purpose of the Peer Review is to provide TxDOT with an assessment of TxDOT maintenance practices and to identify potential areas for improvement based on the opinions of other State DOT experts.

1.2 Peer Review Process

1.2.1 Project Setup

The Peer State Review of TxDOT Maintenance Practices project was conducted and organized for TxDOT by the Center for Transportation Research (CTR) at The University of Texas at Austin. The main idea of the project was to conduct a workshop at CTR and in the Austin District. The areas of focus for this workshop included the following:

1. Maintenance Planning Process
2. Maintenance Practices at both the State and District levels
3. Four-Year Pavement Management Program Development
4. Maintenance Performance Measurement and Reporting
5. Funding Allocation at both the State and District levels

1.2.2 Peer States Participants

The following Director of Maintenance (DOM) from six peer states, with transportation systems similar to that of Texas or with transportation systems known for their exceptional highway maintenance programs, participated in the workshop:

Director of Maintenance	State	Factors Considered in State Selection
Steve Takigawa	California (CALTRANS)	Member four-state consortium; heavy freight traffic; high traffic volumes; climatic regions; urban networks
Roy Risky	Kansas (KDOT)	Strong public involvement in establishing maintenance level of service (LOS); uses tiered goal system; excellent system management
Eric Pitts	Georgia (GDOT)	Excellent pavement system condition; tied third nationwide for pavement conditions, per <i>Overdrive Magazine</i> 2008
Jim Carney	Missouri (MoDOT)	Strong public involvement; significant network improvement; ranked fifth nationwide in pavement conditions, per <i>Overdrive Magazine</i> 2008
Jennifer Brandenburg	North Carolina (NCDOT)	Large highway network; uses tiered goal system; implemented Agile Assets MMS
David Bierschbach	Washington (WsDOT)	Member four-state consortium; excellent PMS/MMS

1.2.3 Development of Booklet Questions

The summary of TxDOT's roadway maintenance practices (highway network and maintenance program, maintenance funding allocation process and formulas, Texas Condition Assessment Program (TxCAP), 4-year pavement management plan, and maintenance contract practices) was distributed to participants (Appendix A – Information Summary).

CTR also prepared the booklet of questions to make the peer review an effective process and yield desired results. The booklet was designed with 15 questions to address following areas of focus: (1) Maintenance Planning Process, (2) Four-Year Pavement Management Program Development, (3) Maintenance Performance and Measurement Reporting, (4) Funding Allocation (Funding Levels and Allocation Formula), and (5) Overall Maintenance Operations (Appendix B – Booklet of Questions).

1.2.4 Webinar with the Peer Review Participants

A before-the-workshop Webinar was conducted on September 29, 2010, to give an overview of the purpose of the peer review and to apprise the reviewers of the workshop agenda. They were given a schedule of the presentations and discussions, as well as information on their travel and accommodation logistics.

1.2.5 Workshop and Road Rally

The 3-day peer review workshop was held October 5–7, 2010. The detailed Agenda can be found in Appendix C (Workshop Agenda).

Day 1: October 5, 2010 @ CTR

The Director of CTR, Dr. Randy Machemehl, welcomed the peer state reviewers, and John Barton, P.E., Assistant Executive Director at TxDOT, highlighted the purpose of the peer review and the workshop.

The presentations on Day 1 included the following:

- Texas Highway Network and Maintenance Program
Toribio Garza, P.E., Director-Maintenance Division (Toribio.garza@txdot.gov)
- TxMAP, TxTAP and PMIS Overview
Neal Munn, Maintenance Division (Neal.munn@txdot.gov)
Brian Stanford, Traffic Operations Division (Brian.stanford@txdot.gov)
Jeff Seiders, P.E., Director-Materials and Pavement Section
(Jeffrey.seiders@txdot.gov)
- Maintenance Funding Allocation Process and Formulas
Tammy Sims, P.E., Maintenance Division (tammy.sims@txdot.gov)
- Maintenance Contracts
Bob Blackwell, Maintenance Division (Robert.blackwell@txdot.gov)
- Four-year Pavement Management Plan
Mario Jorge, P.E., District Engineer-Pharr (Mario.jorge@txdot.gov)

Day 2: October 6, 2010 @ Road Rally and Austin District Office

Before the workshop, CTR, in coordination with the Project Monitoring Committee (PMC) and the Austin District, developed a series of routes for use during the 4-hour Road Rally maintenance rating on Day 2 of the workshop. The routes were selected such that 34 1-mile-long rating sections were spaced along the route and each route linked to form an easy-to-follow circuit. Each rating section was numbered and matched to a set of rating sheets provided to each participant with a clear indication of the item to be rated (pavement condition, traffic operations, roadside condition, and overall condition of the section). Route segments included IH, US, SH, and FM roads with different levels of maintenance. A rating form was developed to allow easy rating of the sections; a sample is included in Appendix D. Six TxDOT vans were used for the Road Rally to carry the 42 people from peer states, CTR, and TxDOT who participated in the Road Rally.

After the Road Rally, presentations were made by Austin District personnel on district maintenance operations, training, staffing, planning, equipment, and materials. During and after each presentation, the peers and TxDOT engaged in a discussion on general observations, potential areas for improvement, and recommendations

Lowell Choate, P.E., Maintenance Engineer, Austin District, and Terry McCoy, P.E., Area Engineer, North Austin Area Office also coordinated a tour of the maintenance facilities and operations at the District office. The tour included a review of the Area Office grounds and discussion of maintenance equipment and operations including a tandem axle dump truck, detachable aggregate hoppers, a Gradall excavator, and a Wirtgen rotomilling machine among others. The tour also included a discussion on staffing and training requirements at TxDOT. A display and demonstration of pavement data collection equipment was conducted by Construction Division–Materials and Pavements Section staff, which included a profiler/rut bar van, skid system, Ground Penetrating Radar van, and a Falling Weight Deflectometer. The peer reviewers and participants provided feedback at each stage of the tour.

Day 3: October 7, 2010 @ CTR

An open discussion was held in which each peer state was given an opportunity to discuss their state's maintenance program. Each peer state also provided electronic manuals and other hardcopy materials for later review. The discussion session was followed by a facilitated consensus meeting on the peer rating of the TxDOT Maintenance Program. The peer reviewers asked to provide a consensus response to each of the 15 Questions in the Questionnaire Booklet and to provide two strengths and two areas for improvement. The consensus responses are detailed in this report, along with the individual written responses from each peer-participant. The day ended with a meeting summary and a workshop conclusion address.

1.3 Organization of Report

The information and observations accumulated during the workshop have been analyzed and systematically summarized in this report. The report has 11 chapters, including the current introduction chapter, which address the collected information in an organized fashion.

Chapter 2 describes the Texas Highway Network and Maintenance Program. The Maintenance division provides general program oversight and policies, while operations are conducted at the district level. Each district develops long-range strategies and one-year maintenance work plans to implement those strategies. The discussion is based on the presentation by Mr. Toribio Garza, P.E., on the same topic during the workshop.

In Chapter 3, the details are discussed of the Texas Maintenance Assessment Program (TxMAP) which is a manual, visual condition survey that documents the overall maintenance condition of the state highway system. This topic was presented by Mr. Neal Munn during the workshop.

An overview of the Texas Traffic Assessment Program (TxTAP) is discussed in Chapter 4 based on a presentation given by Mr. Brian Stanford P.E. TxTAP is used to evaluate the department's progress in the consistency, quality, and uniformity of traffic control devices on the state highway system.

In Chapter 5, the Pavement Management Information System (PMIS) used by TxDOT is described. It is an automated database that stores, retrieves, analyzes, and reports pavement condition information. The PMIS data is used to determine distress, ride, and condition scores at the route, district, and statewide level. The condition scores are essential in determining the requirement for maintenance and rehabilitation. The chapter is a summary of the presentation given by Mr. Jeff Seiders, P.E., during the workshop.

The TxDOT Maintenance Funding Allocation Process and Formulas are discussed in Chapter 6 and the discussion is based on the presentation by Ms. Tammy Sims, P.E. When the legislature passes an appropriation bill for the biennium (based on the Legislative Appropriation Request), the Maintenance division uses various funding formulas to determine each district's proposed budget. In response to the funding shortage, alternate pavement condition goal systems are being examined to improve the funding allocation approach that preserves the state pavement network under a constrained budget.

Chapter 7 is based on the presentation by Mr. Robert Blackwell, the contracting practices at TxDOT. TxDOT requires that all contracts proposed by the department for the improvement (construction, reconstruction, and maintenance) of a highway or state highway system should be submitted for competitive bids.

Mr. Mario Jorge, P.E., discussed the Four-year Pavement Management Plan in his presentation, which is covered in Chapter 8. Each district develops a 4-year pavement project expenditure plan based on the anticipated budget. The 25 individual district plans are combined to create the state-wide Four-year Pavement Management Plan. This plan provides the information necessary to predict pavement condition based on a specific funding level and specific project program of work. This plan is used to provide the Legislative Budget Board and the Governor with a detailed plan for the use of funds, including analysis of pavement condition score targets and how proposed maintenance spending will impact pavement scores in each district.

In Chapter 9, the District Maintenance operations are discussed. The chapter is based on the presentation by Mr. Lowell Choate, P.E., Austin District's Maintenance Engineer; Mr. Terry

McCoy, P.E., Area Engineer for the North Austin Area Office of TxDOT; Mr. Clint Dube, P.E., Asst. North Austin Area Office Engineer; and Mr. Paul Mehawk, manager of Austin District toll road maintenance.

The observations and results of the Road Rally conducted during the three-day workshop in the Austin district are detailed in Chapter 10. The results include the ratings of the peer state reviewers for the various road sections and a comparison of the ratings of the peer reviewers and TxDOT personnel. Furthermore, the discussions and peer state reviewers' observations prompted by the Road Rally are also summarized.

The booklet of questions and the answers provided by the peer state reviewers are analyzed and discussed in Chapter 11. The questions pertain to the Maintenance Planning Process, the Four-year Pavement Management Plan, the TxDOT Maintenance Performance and Reporting, Funding Allocation, and Overall Maintenance Operations. Each reviewer's observations are summarized, and the unanimous observations, arrived at after the consensus development meeting on Day 3 of the workshop, are also detailed.

Chapter 12 provides the conclusions and recommendations resulting from the whole exercise.

Chapter 2. Texas Highway Network and Maintenance Program

2.1 Introduction

TxDOT oversees the preservation, repair, and restoration of over 195,000 lane-miles of state-maintained highways. The current statewide pavement condition goal, set by the Texas Transportation Commission in 2002, is to achieve 90% of lane-miles in “good” or better condition by 2012. This goal weights all roadways equally, so that a lane-mile of high-traffic, metro, interstate highway has the same impact on the statewide condition score as a lane-mile of low-traffic, rural, farm-to-market road.

The Maintenance Division provides general program oversight and policies, while operations are conducted at the district level. TxDOT maintenance employees work in each of the 25 districts, primarily in the district offices or in one of the 251 maintenance sections, which are geographically situated to balance the number of lane miles being overseen. Each district office oversees two to eight area offices which, in turn, oversee several maintenance sections. Work is categorized into three areas: routine, preventive, and major maintenance. All three categories may be performed with state forces or by contract; however, most preventive and major maintenance work is contracted out.

For planning and budgeting, the following areas are used to determine the type of work activity required:

- Travel way
- Shoulder and side approaches
- Roadside
- Drainage
- Structures
- Traffic Operations (signs, striping, signals etc.)
- Emergency Operations

Each district develops both long-range strategies and one-year maintenance work plans to implement those strategies. The one-year plan is developed after the maintenance budget has been determined. The plan is based on a historical analysis of the amount of work performed and the resulting Levels of Service. In addition, the Maintenance Management Information System (MMIS) provides detailed statistics on highway maintenance activities to accomplish the following:

- provide data on work load and cost of maintenance activities to support budgeting and planning efforts,
- provide a tool for analyzing maintenance activities so that production efficiency can be improved,
- help identify sections of highway qualifying for rehabilitation,

- document the work accomplished to support the department's legislative budget requests, and
- provide data to compare costs of contracted and state force-performed maintenance activities.

2.2 Discussion

2.2.1 Topic 1: Mowing strategy

During the Facilitated Consensus Meeting on Ratings, the discussion began with a few comments about TxDOT's mowing strategies.

1. Toribio: "TxDOT used to mow up to the fence but strip mowing has been implemented as a cost cutting measure. Growing seasons vary throughout Texas some districts do 2-cycles, other 3-cycles of mowing."
2. KDOT: "Tree growth can be a real problem. We used to mow alternating sides but found that trees would become too big for our mowers to handle."
3. GDOT: "When we went to 2 rural mowing cycles per year people complained—we spend about \$20 million per year on mowing."
4. GDOT's Eric Pitts: "We usually mow the full ROW—all the way to the fence; it's recommended to mow (at least) 30 feet. However, we may do strip mowing depending on the ROW width—we look at mowable acres."
5. GDOT: "We looked at doing 2 mowing cycles—Memorial Day and Labor Day; but it really depends on the area of the state, in some areas it makes more sense to mow in October or November. We do use some mowing contracts."
6. Toribio Garza: "We have a good wild flower program and use native plantings."
7. MoDOT: "We typically include an item in our Construction contracts for native plantings in the ROW."
8. Lynn Passmore: "We have a problem with plant growth near the pavement edges—watering affects paving materials and we have a problem with our pavement edges (breaking down)."
9. MoDOT: "We do part ornamental grass, part native. Come up with strategy for Johnson grass."
10. Lynn Passmore: "We also have a problem with Johnson grass and noxious weeds. We need to come up with a way to get rid of Johnson grass."
11. MoDOT: "How about switch grass?"
12. Jim Carney: "Top five maintenance expenditures are:

- snow removal 53 million,
- signing,
- striping,
- mowing, and;
- pavements

We are working on strategies to reduce maintenance expenditures in the first four areas in order to move more money to pavements.”

2.2.2 Topic 2: Fuel Tax

Then the discussion turned to financing issues.

13. KDOT: “Do you use bonds?”
14. Toribio: “Yes, we’ve done bonding but we’re going to have to pay back the bonds with gas tax revenues. Currently we get 20 cents in gas tax revenues and 5 cents goes to the Department of Public Safety. About 4–5 cents goes to pay debt. We haven’t had a raise in the fuel tax since 1991.”
15. Toribio: “The Governor’s race is this year so likely no new taxes. We expect that a 10 cent increase in the fuel tax would raise about \$ 1 Billion.”
16. KDOT: “Have you done a study to see how much gas prices vary from station to station? You can see the price either 10 cents higher or lower from station to station. The news media really gives a lot of coverage to raising gas taxes by 10 cents—but there’s that much difference now in what you pay at the pump (depending on where you fill up). Put a dime on something, most people aren’t going to notice—media will make a big deal, but otherwise people wouldn’t notice.”
17. CALTRANS: “The price of gas in California right now runs from \$2.95 to \$3.15 a gallon.” However, there is a public perception credibility issue with CALTRANS—so unlikely we will see a gas tax increase.
18. KDOT: “We have good credibility with the public and the Legislature—10 years ago a new transportation bill was passed and we built what we said we were going to build. We were on time and under budget. If you ask for a budget increase but don’t use it for what you said you were going to use it for it kills your program. It’s hard to gain your credibility back once you’ve lost it.”
19. KDOT: “Jim and I have been on both sides of it—built up credibility over time, on time over budget, second came in on time on budget; get an increase, don’t use it for what might happen; people won’t vote for an increase without credibility.”
20. WsDOT: “Legislature added about 14 cents over the past five years; problem is that most projects have been bonded for the next ten years—lots of new infrastructure but don’t

have the money for maintenance now because money has already been spent for next 10 years.”

21. Toribio: “We expect only a small increase in our gas tax revenues over the next 15 years: 2005: we received \$2.2 Billion in 2021 \$2.45 Billion. We don’t have a lot of hope for an increase in the gas tax. We are looking more at the possibility of raising vehicle registration fees.”
22. KDOT: “Does Texas need to vote to raise (gas) taxes?”
23. Toribio Garza: “The Texas Transportation Commission set up an independent Committee comprised of people from the private sector, including business leaders from companies like HEB, Engineering Consultant firms; the Port of Corpus Christi; and t, BNSF Railroad, the Associated General Contractors (AGC); Dallas Area Rapid Transit (DART) and members of academia. This Committee was then asked to observe TxDOT’s practices and the state’s condition and assess the needs of the state. They reported that the current system was at about 87% of roads in good or better condition and then gave an estimate as to the level of funding needed to bring that figure up to 90%. This report helped TxDOT’s credibility enormously, as the public was given an independent assessment of the state’s needs. Texans were then able to trust that the reported needs were accurate, as they came from an independent committee.”

2.2.3 Topic 3: Four-Year Plan

The Four-Year Pavement Management Plan was discussed including future pavement condition projection models that have been developed by UT/CTR.

24. CALTRANS: “We have something similar; still have hard time getting people to understand, broken it down, five year plan, been pretty successful.”
25. Toribio: “Because of additional funding through ARRA, Proposition 12 Bonds and other programs such as ‘pennies to the pavements’ we’ve actually achieved 1% higher observed conditions compared to model predictions. Each District has developed a four-yr pavement plan for each county; the Plan is fiscally constrained and lists specific projects and the project cost. There is a summary of rehabilitation and maintenance projects by year. The Plan is not only a method for being transparent with the public, but also helps districts manage projects. Districts develop county maps to show where work will be conducted and when.”

2.2.4 Topic 4: Work History

Jim Carney of MoDOT then began a discussion on work history by asking if TxDOT has a scale indicating the estimated lifespan of each treatment.

26. Jeff: “We don’t have a really good work history, but we’re about to see results; districts are asking for that work history, trying to figure out when they last touched the pavement.”

27. KDOT: “We use our PMS, we have history of road going back 20 some yrs, so when we drive the road we can ask what kind of structure, and what kind of maintenance has been done, we have guys taking cores; since 1983.”
28. Lynn: “Some districts have a lot of history, some have little: we’re looking for a way to find out how to organize that information.”
29. Jeff: “CTR has used 10 years of PMIS to build their models. Currently we are don’t have the advantage of knowing work history.”

2.2.5 Topic 5: Multi-Tier Goal System

Work that has been conducted to evaluate a Multi-Tier Goal System for TxDOT was presented. Roughly 25% of the state system carries 72% of all truck traffic. However, currently we have set the same goal (90% ‘Good’ or better) for all roadways. Preliminary assessments of an MTG system for Texas shows that high traffic, high priority routes will get more money—since urban districts have the majority of high ADT routes they tend to get more money under an MTG system, and rural districts less money.

30. Jennifer Brandenburg stated that North Carolina has implemented a three-tier system; however, funding is still allocated according to the old (one-tier) system; so it’s difficult to assess whether the multi-tiered approach has improved conditions.
31. KDOT: “We have five classes A–E, with rural roads, we’re still trying to get the right treatment, but not as worried about them as high-volume roads, but we’re in a rural state so it’s important to the people who live there.”
32. GDOT: “We are currently investigating an MTG system for Georgia. Rural districts are concerned that Atlanta will get all the money with a tiered system.”
33. CALTRANS: “We have 12 districts. If we decided to move funds from rural areas to LA and San Fran, rural people would be out of a job. Planning is needed; however, it is difficult to change funding allocations because it affects people’s jobs and lives.”
34. Toribio: “Everything is by formula; the big driver is PMIS condition. The method for allocation money is the size and condition of the system. The majority of funds go to the metro districts because ADT is highest and pavements are worse there; but rural Texas still does OK.”
35. CALTRANS: “Our funding still drives staffing needs.”

TxDOT personnel could be shifted throughout the state to accommodate staffing needs. Currently the department shares (design) resources between districts depending on work load.

36. CALTRANS: “We are unionized and cannot share people between engineering and maintenance for example.”

2.2.6 Topic 6: Outsourcing

In Texas, most outsourcing is for design. The state legislature requires that 35% of the projects should be outsourced.

- 37. KDOT: “We keep our core construction staff. We contract out with consultants, maybe 80% of design is out sourced; in construction our guys were just overseeing ‘inspection-as needed’ contracts.”
- 38. WsDOT: “We have unions too, most design is done in-house.”
- 39. KDOT: “A lot of cities and counties use consultants for their inspection because it’s cheaper.”
- 40. Toribio: “TxDOT is becoming like Kansas where we have base staff and then outsource. However, we don’t have money for outsourcing right now.”

2.2.7 Topic 7: Accountability

- 41. CALTRANS: “How do you hold in-house maintenance staff accountable for how much they have to spend and which projects they complete? How much accountability is there in the field for meeting the goals of the Four-Year plan?”
- 42. Toribio: “Every supervisor has the Four-Year plan; with regard to routine maintenance, a lot of work is involved in preparing the road for next year’s seal coat program. We envision this tool being available to public so they can pull up a map and see what TxDOT plans for roads in their community; this allows the district engineer and everyone in the district to track what’s going on.”
- 43. CALTRANS: “When I allocate funds but a district doesn’t spend it on the appropriate activities the district is required to return the money. We have over one hundred maintenance activities to track; but I’ve identified the top 6 or 7 activities for which I’ve established performance measures.”

2.2.8 Topic 8: Treatment Selection

- 44. KDOT: “Is the four-year plan ‘cookie-cutter’ style? Sometimes roads last longer because of better construction practices. Do they go out and look and pick something for that specific road, or is it just that it hasn’t been done in this amount of time, so we’ll do it?”
- 45. Toribio: “We conduct peer reviews of the districts. We travel the roads with district staff and ask them what they had planned—we look at all the details; but, it’s up to the District Engineer ultimately to decide what types of treatments to select.”
- 46. KDOT: “We need to get away from prescriptive measures, we need to do the right treatment at the right time.”
- 47. Lonnie: “When developing a four-year plan especially looking at the routine maintenance schedule we are looking at programs of work and what we estimate will be needed.”

48. CALTRANS: “You don’t have deterioration models for each (PMIS) segment; we’re trying to get there too. We are trying to build models by (climatic) zones and by segments.”
49. Jeff: “Lonnie and Lynn drive their roads then they decide what to maintain for the next two years.
50. KDOT: “We like to conduct our pavement condition evaluation and do maintenance soon after, but sometimes we have to make predictions of what the route will look like in several years.”

Chapter 3. TxMAP

3.1 Introduction

The Texas Maintenance Assessment Program (TxMAP) is a condition survey that documents the overall maintenance condition of the state highway system. This assessment provides documentation to TxDOT districts on maintenance functions that need additional attention and allows maintenance managers to monitor the condition for determining resource needs. The TxDOT executive administration sets the annual goal of an overall condition score of 80. This performance measure, with the FY 2009 target of an overall statewide condition score of 80, is included in House Bill 1 (80th Regular Session), the General Appropriations Act for the FYs 2008–2009 Biennium.

TxMAP inspections consist of the evaluation of 10% of the Interstate Highway System and 5% of all other highways. The department randomly selects each one-mile section for the Texas Reference Marker (TRM) System-based evaluation. The TxMAP process evaluates more than 4,000 one-mile sections of highway each year.

For each one-mile section of highway, TxMAP assesses 23 elements separated into 3 highway components: pavements, traffic operations, and roadside. The program categorizes each element and assigns a weighted multiplier to each element as follows: pavements (50%), traffic operations (25%), and roadside (25%).

The department collects data from the districts, and the staff calculates the scores for each district throughout the year and then stores the information in the Maintenance Division's TxMAP database. After all of the district information is complete, the Maintenance Division calculates the statewide scores at the end of the fiscal year.

For FY 2009, the department evaluated more than 4,000 one-mile sections statewide out of the 79,849 centerline miles of state-maintained highways. The combined TxMAP statewide score has risen steadily over past fiscal years but fell slightly in FY 2009. The combined statewide score in FY 2008 was 79.36 and in FY 2009 it fell to 76.91.

The results help identify areas for improvement and determine conditions that could be damaging to roads, such as adverse weather patterns or increased traffic. Scores could also indicate that different methods might be more appropriate for work functions in certain areas. This information is useful during the budgeting process; funds can be allocated where they are needed most.

TxMAP has become a valuable tool in helping the department determine its budgeting needs. The statistics generated from this program help the department justify the agency's Legislative Appropriations Request. Although TxMAP fulfills its original purpose as a maintenance management tool, TxMAP also helps the department fulfill another requirement implemented by the Government Accounting Standards Board (GASB): GASB Requirement No. 34 calls for government agencies to report their own net worth, including the value and condition of their

assets. TxMAP helps satisfy this standard by providing tangible statistics documenting the condition of infrastructure maintained by TxDOT.

3.2 Discussion

3.2.1 Topic 1: TxMAP

1. Toribio: “Neal is one of the raters that collects the data and runs reports for 254 counties, 25 districts, four regions.”
2. CALTRANS: “Is there one maintenance section per county?”
3. Neal: “Probably a little less, some districts establish maintenance sections based on lane-miles; others by counties.
4. Neal: “The dividing line is down the middle of the state; west Texas is very rural; east Texas and the central region are urbanized. We drive the TxMAP sections at about 15-20 miles an hour, in order to see everything that’s going on.”
5. KDOT: “Did you say you have another system that looks at the same things?”
6. Neal: “TxTAP looks in detail at signs, railroads crossings, signal boxes, etc.”

3.2.2 Topic 2: Inspection Speed

7. KDOT: “Regarding drainage; if you are driving down the road how can you determine what condition your pipes are in? Do you have another evaluation system that looks at the side- and cross-drainage systems?”
8. NCDOT: “We measure blocked pipes.”
9. Neal: “If we see erosion; if we see trees; if we see a blockage, we note these, we do it all by sight. We just report the major things.”
10. MoDOT: “Are your rating forms set it up on computers?”
11. Neal: “Yes.”
12. Neal: “The rating system is unbiased since personnel from other districts ride with us to conduct the evaluation. It also helps train maintenance personnel what we’re looking for.”
13. NCDOT: “Is the TxMAP rating conducted within a certain time period?”
14. Neal: “Yes, we complete the ratings for all districts within a year. We take pictures of things that are really bad; district can see their scores and have pictures to match it; also take good pictures to share between neighbors. Recently, we’ve started meeting with

district personnel and report our findings before we take it out—they’ve found that helpful. We can answer their questions while things are still fresh in our minds.”

3.2.3 Topic 3: Reporting and Level of Service (LOS)

15. Toribio: “TxMAP is a good system, its encouraged people to look more at their pavement conditions. The statistical significance of the system is something that’s being looked at.”
16. KDOT: “We’re good at determining statewide and district-wide maintenance condition levels; however, when we get to the area or subarea levels, the information is not as accurate.”
17. Toribio: “It’s the randomness; we rate 5% using the TxMAP system, PMIS rates 100%. We combined TxMAP, TxTAP and PMIS and report statewide and district conditions in the TxCAP report.”
18. NCDOT: “We also have rating systems that looks at different things; we have a condition survey, then we have our version of TxMAP which is more focused on maintenance conditions such as potholes.”
19. KDOT: “I see a problem with the legislature getting all these different results, it would be better if they received one consistent story. We learned that we need to give a consistent message all the time.”
20. NCDOT: “The sample size you collect depends on what you are doing with the data. At the planning level, we do about 23,000 samples, we run an analysis to determine the required statistical significance and arrive at the necessary sample size.”
21. CALTRANS: “For your traffic operations, you only do a 20% sample; how, did that number come about?”
22. CALTRANS: “Also, how do you rate your ramps? If you’re only looking at lane-miles, you’re missing out on quite a bit of the story; your diagrams don’t show a trend. We develop a tread diagram for each component.”
23. Tammy: “We do develop trend diagrams for each component of our system.”
24. CALTRANS: “Our largest condition rating effort is our five-year maintenance program. We evaluate pavements, drainage, and bridges; we do rest areas, landscaping, so on.”
25. Tammy: “Is your condition rating program based on an inventory system?”
26. CALTRANS: “We don’t have all our components inventoried.”
27. NCDOT: “It does work better to have inventory tracked, but it’s too much effort, so we estimate it.”

28. CALTRANS: “Our rating system is organized by ADT, terrain and inventory. Level of Service should be about the same if you put same effort in it, look by zone, activity, how much effort, and LOS.”

3.2.4 Topic 4: Maintenance Priorities and Level of Service

29. CALTRANS: “Have you done a study to see if 87% ‘Good’ or better pavement condition is acceptable to the public?”

30. Toribio: “We’re starting to look at getting public input. How did you do it?”

31. CALTRANS: “We did a phone survey and also did an internet survey, but you have to be careful that you don’t end up getting responses from kids who don’t drive.”

32. Toribio: “Was it successful?”

33. CALTRANS: “We tried to put in a reality test question: ‘How long do you think it should take CALTRANS to respond to a report of a stop sign that is down. We got responses as low as 15 minutes, so obviously some public expectations aren’t realistic.’”

34. Toribio: “But were these methods useful for obtaining public opinion?”

35. CALTRANS: “Yes, overall.”

36. KDOT: “I might disagree (with basing condition standards on public opinion polls). Maintenance personnel take a lot of pride in what they do; so, as an example, if the Level of Service for striping is not in their control there is a loss of job satisfaction.”

37. CALTRANS: “I tell Maintenance personnel that setting the required Level of Service is my responsibility, if they don’t spend where they should, it’s their fault. I don’t hold them to a certain Level of Service; I hold them a spending standard. They have all these things to deal with (emergencies, litter, etc.); so they aren’t going to pay attention to a specific Level of Service; therefore we manage in terms of spending (resource allocation).”

38. WsDOT: “We have 34 different areas for measuring Levels of Service, that’s how we were able to get additional money. We showed the legislature our targets and said we needed a certain amount of money to get to those targets. We provided graphs showing where (in the state) we’re missing our targets; they saw the maps and trends and were able to identify areas where targets were mostly being missed. We obtained about \$17 million. We were able to show the legislature that missing our targets was a funding issue, and we were able to get more funds.”

39. Toribio: “So you set a Level of Service for each component and a funding level to meet those targets?”

40. CALTRANS: “I don’t have enough funding to meet those targets, it might take billions of dollars to raise a particular LOS half a point or five points: for example, crack sealing, striping, guard rail, litter, and (drainage?).”
41. Toribio: “So you’re providing more funding on litter pick up because it’s important to the public based on surveys? We reduced funding for litter pickup because we were told too much was being spent on litter.”
42. CALTRANS: “If the staff doesn’t spend money allocated to another category, I take the money and put in pavements. I have set just five performance measures to make sure that staff spends the money where it needs to be.”
43. Unknown: “Do you have any part of the survey where you ask if you only had \$100 and pavement maintenance costs \$85, would litter still be an issue?”
44. CALTRANS: “Yes, our questions were phrased to see what the actual priorities are. Most people were more safety oriented; litter was put as a low priority, however, litter is the item that the public complains about the most.”
45. GDOT: “When our budget got tight, we were told to cut back on litter pick up. I answered 20–30 letters a week about litter, but none about pavement condition even though that was bad too.”
46. Toribio: “We get a lot of complaints about the way things look; mowing and litter, expectations remain high.”
47. CALTRANS: “We categorized all activities in terms of Safety, Preservation, and Service. We then break these down in terms of Level of Service, so I know how much each of these contributes, I fund 100% of safety activities.”
48. Toribio: “How long have you had this model?”
49. CALTRANS: “It was adopted it in 1998.”
50. Toribio: “Has it been changed since you adopted it?”
51. CALTRANS: “No, however we have modified our budget model.”
52. Toribio: “Is it a needs-based budget model?”
53. CALTRANS: “If you tell me a Level of Service for each area, I can tell you resources I need.”
54. Toribio: “Have you calculated goals?”
55. CALTRANS: “Not for everything.”

56. WsDOT: “We have also developed a needs-based model which was adopted in 1995. The model has been successful with the legislature; we sat down with the legislative staff, and educated them on our Maintenance Effectiveness Program.”

57. CALTRANS: “We don’t track all ITS elements; cameras, detectors etc., we don’t have an LOS for these items.”

58. WsDOT: “That was one of our backlogged items, ITS is a real problem.”

59. Jeff: “Have you thought about changing the direction (of implementing new ITS systems)?”

60. WsDOT: “No, the public really likes the ITS.”

61. Jeff: “Have you determined cost recovery for ITS?”

62. WsDOT: “Talked about it a little.”

3.2.5 Other Discussions

63. MoDOT: “Is TxMAP used for performance based contracts?”

64. Neal: “Contract managers use a modified version of TxMAP.”

65. KDOT: “How important is the Gray Notebook?”

66. WsDOT: “The Gray Notebook is published quarterly by the DOT and helps us communicate with public”

67. MoDOT: “We have the TRACKER.”

68. TxDOT: “We have that too, yours got us doing that.”

Chapter 4. TxTAP

4.1 Introduction

The Texas Traffic Assessment Program (TxTAP) allows TxDOT to evaluate the department's progress in the consistency, quality, and uniformity of traffic control devices on the state highway system. Traffic control devices (signs, signals, work zones, railroad crossings) are an important contributor to overall traffic safety on the state highway system. The TxDOT administration sets the annual target of an overall condition score that varies each year, based on historical trends and expected budgets. This performance measure, with the FY 2009 target of an overall statewide condition score of 76.50, is included in House Bill 1 (80th Regular Session), the General Appropriations Act for the FYs 2008–2009 Biennium. Collection, analysis, and reportage of this data as a legislative performance measure began in FY 2004.

The TxDOT Traffic Operations Division conducts the annual evaluation of the various types of traffic control devices in each of TxDOT's 25 field districts. Each district review consists of 20 to 30 randomly selected segments on the state highway system, 5 to 16 signalized intersections, 3 to 4 work zones, and 2 to 6 railroad crossings. The review includes an evaluation of at least one highway segment for each county in the district and at least one highway segment in each urban area in the district. Additionally, the review evaluates at least three highway segments at night.

Each district receives a score for uniformity, quality, and consistency of these devices. The Traffic Operations Division staff then compiles the average of the 25 individual district scores to derive an annual statewide average. The measure produces a statewide score for traffic control devices that is updated each year. TxDOT reviews TxTAP scores to identify those districts that need improvements to their traffic control devices. The department includes TxTAP scores in the annual performance evaluations for each District Engineer (DE).

Traffic control devices play an important role in highway safety and efficiency. The TxTAP measure is not only used to monitor the overall quality of the state highway system's traffic control devices, but also to evaluate both the effectiveness of department policies and procedures and the ability of division staff to communicate those policies and procedures to each TxDOT district. The development of TxTAP allows TxDOT to clearly determine if it is making progress and to identify those areas of the state that may need to improve their traffic control devices.

4.2 Discussion

4.2.1 Topic 1: Inspection Practices

1. Brian: “TxTAP ratings began in 2001; there were several iterations in developing the current system. At first we looked more at striping and rumble strips, but found there was overlap with the TxMAP system so we got rid of the overlap. We try to keep our district evaluations to one overnight trip now.”
2. MoDOT: “Is TxTAP the only evaluation done by your group?”

3. Brian: “We do quick, public perception evaluations and also conduct smaller traffic evaluations, but we try to look at every districts.”
4. Brian: “Signs: We inspect the approach signs to ensure they are at an adequate distance from the intersection; junction signing is one of the most important; departure signing—tells the motorist that they are on the right path and what is the speed limit.”
5. MoDOT: “Everything you do is from the vehicle?”
6. Brian: “It depends on the item; we get out of the vehicle to look at the sign sheeting and the stickers that are on the back; most of the items are scored from driver’s perspective. We take a lot of pictures to let the districts see what we’re scoring; to back up what we’re saying.”
7. Brian: “Scoring criteria: 5—meets current standards; then we start taking off points if there are any problems. Our grading system has changed—we used to start with the 3, we then had upgrades, but we decided that if a district meets the minimum, that’s a 5 then we start deducting from that point. We now start at ‘meets the minimum’ because of budget problems. We look at pavement markings required for roads posted at over 35 mph; for signal faces we check orientation—we have both horizontal and vertical orientations of signals; pedestrian elements—burning, working, pushbuttons working; stop bars and crosswalks—we make sure all elements are in good shape.”

4.2.2 Topic 2: Work Zone

8. “Regarding Work zone speed limits—we make sure speed zones are established when they are needed and that they are not established when unnecessary. Work zone signs—it’s hard to maintain signing in a work zone. We look at conflicting or confusing striping especially where striping has had to be removed by the contractor.”
9. NCDOT: “Do you look at temporary signing?”
10. Brian: “Yes we do check temporary signing and we’re required to move them when they aren’t necessary. We also look at Work zone traffic channeling and striping: we make sure it makes sense and commands respect. It’s hard to remove striping without leaving a mark that can be confusing to the motorist. Barricades— we look at the condition and make sure they convey the right message to motorists.”
11. WsDOT: “Do you conduct these evaluations for all construction zones?”
12. Brian: “We focus more on work zones that will be in place long-term. If the project involves short-term maintenance and all that is required are speed signs, the inspection would result in a high rating. Long-term construction projects are more likely to have problems.”

13. WsDOT: “Do you only evaluate construction zones (work zones that are set up by a contractor to do construction or maintenance on a roadway) or do you also evaluate work zones that are set up by state forces to perform maintenance work?”
14. Brian: “To be fair, there is a large amount of work done by State maintenance forces, but usually their work zones are not in place for a long period of time...therefore, they tend to do a better job maintaining their set ups.”

4.2.3 Topic 3: Sign Inventory

15. MoDOT: “Maintenance work zones are usually better than construction zones because the DOT puts more effort into it. I saw a lot of construction on way down, and there were a lot of problems. We try to do a ten-year cycle of shooting the sign (for reflectivity).”
16. Brian: “We had a workshop for sign inspections; we require a minimum of two inspections per year, one has to be at night.”
17. MoDOT: “Do you have a sign inventory system?”
18. Brian: “We have too many signs to develop an inventory system.”
19. KDOT: “Same in Kansas; too many signs.”
20. WsDOT: “We have (contractors) who track our inventory; we do night check once every two years.”
21. MoDOT: “For striping, do you use a laser lux?”
22. Brian: “On 5-year performance based specifications, we take a retro-reflectivity reading the first year and every year after that.”
23. CALTRANS: “For all these ratings, how much have you redirected to areas that need more funding?”
24. Brian: “The district has to redirect their priorities; they manage the funds and are accountable for the conditions.”
25. Tammy: “A district may get a score of 100, but if their percentage of the system is small, they don’t really affect the overall state rating. We need to be pushing money to districts with low levels of service.”
26. CALTRANS: “Do you evaluate the entire state as one (average) number. There may be a few districts that get a score of 100, but that won’t have much of an impact on the entire state.”
27. Tammy: “We fund for inventory (lane miles) and condition. Pavement is a different story; (regardless of condition) a district will still get funds based on their inventory.”

28. Brian: “We have certain items we look at; we know how many center-line miles a district has. We know how much striping is needed (per mile) determine a length of striping for different Levels of Service. Based on the length of striping we can calculate the cost and recommend a required amount of money. However, the final allocation all comes down to how maintenance personnel allocate actual funds based on legislative appropriation.”

4.2.4 Topic 4: Priority and Level of Service

29. CALTRANS: “So does your maintenance staff have to meet all performance measures or are they only required to meet specific measures?”

30. Toribio: “We estimated a funding need to make all necessary repairs based on different Levels of Service considering replacement cycles. We’ve determined that \$1.7 billion is needed to fund a ‘tolerable’ Level of Service; however, we are funded at about half that estimate. For certain traffic items we’re funding an ‘acceptable’ LOS but we don’t have enough funding to target specific items.”

31. CALTRANS: “You don’t have a priority system? If you can’t fund (or have sufficient personnel to get to) all activities, which activities are ok to slip? I wouldn’t think you’re requiring maintenance staff to meet all (30) performance measure targets?”

32. Toribio: “The priority is pavement, that’s it.”

33. CALTRANS: “But what about maintenance staff who aren’t working on the pavement? They don’t have a set priority or is it just ‘pavements’?”

34. Tammy: “It’s the pavement. Regarding other work, much of it is contracted.”

35. CALTRANS: “But even if the work is contracted, you still have to meet a certain Level of Service?”

36. Tammy: “We have two budgets: one has to be spent on contracts, one spent in-house.”

37. CALTRANS: “That’s like a union.”

38. Lynn: “The difference is that we can spend it on the items we want to spend it on.”

39. Toribio: “Mowing, guard rails, crack poring, is almost totally contracted.”

40. KDOT: “We took pavements away from our maintenance staff; shoulders too (we tend to do mill and inlays) so now maintenance staff is focused more on signs. Safety is always first priority, litter is down on level four.”

41. CALTRANS: “Maintenance staff mainly focuses on emergency items; they don’t have to worry about the pavement.”

42. Toribio: “We’re the opposite; our people do pavement, the rest is contracted.”
43. CALTRANS: “But how do you say to the maintenance people, “This is the priority?”
44. Toribio: “We haven’t broken it down like that.”
45. NCDOT: “We’re having this same struggle. We want to break it down to the top priorities but the maintenance engineers want to look at all forty.”
46. CALTRANS: “All this data, but there isn’t enough funding for all of the items we are surveying, that’s why I broke it down to just five priorities.”
47. Toribio: “We’ve talked about the fact that a lot of districts have lost in-house expertise for certain types of operations due to contracted work. We’ve discussed this with the districts during our peer reviews—we stressed developing in-house expertise since we may not be able to rely on contract funds in the future.”
48. Toribio: “We’ve also talked about developing the industry and increasing number of contractors available by creating a need.”
49. CALTRANS: “I want to know what changes you have made by doing all this LOS research. Are you actually using the information to make changes in your operations or are you just reporting the information?”
50. Lonnie: “We have budget driven priorities—safety is pre-eminent; pavement and bridges are a priority and items like leaning signs...but we don’t have a measurement to drive the system.”
51. “We’ve made adjustments, but the budget is really driving what we’re doing; so we’re using the reporting system to show how (bad) conditions are, that’s why the focus is on safety—we don’t have a measurement saying that we’re not meeting specific areas, that’s a good point.”
52. Jeff: “Do you have different Levels of Service, including definitions, for each item you measure?”
53. WsDOT: “We do. We have priorities set for all 34 of our maintenance items—guard rail, mowing, sweeping are contracted out. We set safety 1st—litter is level 4.”
54. NCDOT: “We have 35 to 40 maintenance items—Lacey Love (NC Director of Asset Management) focuses on 5 items; but maintenance folks want to focus on all 40.”
55. Jeff: “So we can synthesize all of that information.”

4.2.5 Other Discussions

56. CALTRANS: “We are so data driven. You also need to consider where your tort liability is. Guardrail is a tort liability issue so we do maintenance using in-house forces.”
57. KDOT: “Cable barrier systems are a maintenance headache.”
58. Lynn: “Regarding safety issues, signs etc. we have good in house institutional knowledge—a peer review can’t find 100% of the problems.”
59. CALTRANS: “Have you considered moving contract dollars to another districts and doing striping in-house? “ *[Implied meaning—would a district consider doing striping in house in order to move contract dollars to another district if that helped conditions statewide? —MRM]*
60. CALTRANS: “You have to 1) Develop a Plan, 2) Check the Plan, 3) Perform the (planned) Actions and then 4) Measure (the results). Have you every directed a district to move contract dollars to another district (*in order to meet the Plan Objectives —MRM*)?”
61. Toribio: “We generally don’t move resources based on Level of Service.”

Chapter 5. Pavement Management Information System (PMIS) Overview

5.1 Topic 1: What is PMIS?

5.1.1 Presentation Key Points

The primary purpose of Pavement Management Information Systems (PMIS) is to improve the overall condition of Texas pavements within given funding by using longer-lasting treatments applied at the right place and at the right time. PMIS development began in May 1990 in response to a federal mandate that every state have a Pavement Management System in place by February 1993. PMIS was an expansion of the existing Pavement Evaluation System (PES), which began in September 1982. PMS used 2-mile rating sections instead of the 0.5-mile sections now used in PMIS.

PMIS describes current pavement condition and trends, locates areas with problems, identifies types of problems (such as distress, ride, and rut), and estimates general Preventive Maintenance (PM) and Rehabilitation (Rehab) needs. PMIS also has models for predicting future condition, but they are based on very general assumptions of how long treatments last.

5.1.2 Peer Discussion

Jeffrey Seiders presented that TxDOT targets to maintain 90% of the statewide “Good” or better pavement conditions with PMIS Condition Score of 70 or above. Since the goal was set, there was an initial percentage improvement, but then a percentage dropoff because of the decreased amount of budget for pavement maintenance. The PMIS Condition Score is calculated differently depending on the route; conditions actually increased during the last year due to the peer reviews pushing “pennies to the pavements.” TxDOT had a 1% increase in statewide pavement Condition Score.

5.2 Topic 2: Data Collection

5.2.1 Presentation Key Points

The PMIS annual data collection process is summarized in Table 5.1.

Table 5.1: Annual Data Collection Process of PMIS

No.	Time	Process
1	August	Build PMIS database for new fiscal year
2	September – December	Rate pavement distress
3	September – February	Measure ride and rut data
4	March	Finish up ride and rut data
5	April	Begin analysis and reporting
6	April – August	Skid measurements
7	July – August	Train raters for new fiscal year

5.2.2 Peer Discussion

1. Jeffrey Seiders said that visual distress is rated by contracted workers. Moving to looking like Kansas, working with Rick Miller, TxDOT is moving to do automated distress rating for cracking by looking at 3D tools and very excited about moving to more repeatable data.
2. One peer member asked how much PMIS scores are discounted by patching. Jeffrey Seiders answered that TxDOT probably will not make changes to the PMIS distress score due to patches until automated visual distress measurement equipment is implemented.
3. Dennis Cooley said that TxDOT is evaluating profiler lasers with a larger footprint and plan to move away from single-point lasers. Jeffrey Seiders agreed single point lasers do give different results compared to lasers that use a larger foot-print; this is especially true when comparing data collected on pavements such as PFCs or seal coats, with data collected for dense graded mixes.
4. Jennifer Brandenburg asked how TxDOT collects HPMS (FHWA Highway Performance Monitoring System) data. She wondered if TxDOT gathers enough data during the PMIS data collection cycle to meet HPMS requirements.

5.3 Topic 3: Distress and Ride Measurement

5.3.1 Presentation Key Points

The pavement distress is visually measured by contracted raters. The ride and rut data is measured by the TxDOT Profiler/Rutbar system, which operates at a highway speed. Data is collected at approximate 0.1-in. intervals, which is summarized every 0.1 miles. Both profile and rut data is collected on a 100% sample of TxDOT-maintained highways each year between September and February. Skid measurements are conducted by District skid equipment operators. Data is collected annually on approximately 50% of the IH system and 25% of non-IH highway systems. In addition, project-level Falling Weight Deflectometer (FWD) tests are conducted by District FWD operators for deflection measurements of specific projects as needed.

TxDOT Construction Division (CST) certifies contract raters for distress data, processes invoices for distress ratings, repairs and calibrates ride and rut equipment, certifies ride and rut equipment operators, and analyzes and reports data. Districts audit distress ratings, approve invoices for distress ratings, and operate ride and rut equipment.

5.3.2 Peer Discussion

5. Jeffrey Seiders told the panel that TxDOT is engaged in efforts to create a nationwide standard method for evaluating distresses, just as every DOT utilizes the International Roughness Index (IRI). He added that TxDOT currently can no longer afford grind down good roads for ride quality improvement and now must focus only on roads that are structurally unsound.

6. Roy Rissky of KDOT pointed out that rough pavement is the first thing the traveling public notices, and ride is therefore often how the public evaluates a state's roads. He suggested that even though the conventional theory is that a smooth pavement will last longer, roads with low speed limits are usually not as affected by ride as those with higher speeds.
7. Jim Carney of MoDOT stated that ride has a very significant effect on his state's condition score. They have set a rating of "good" at 100 IRI for major roadways (although they a different measure has been established for minor roadways with less than 400 ADT) [*and they currently have 86% at that level—unsure of this wording — MRM*].
8. Jeffrey Seiders responded that the main priority should be ensuring that every DOT's rating system and definitions are consistent so that states can communicate with one another. He also said that for the roads that have high traffic in urban areas, even though ratings show those roads need work, TxDOT is not improving them because they can use them in more important areas.
9. Toribio Garza asked whether TxDOT's scores would get better or worse if we follow the same scale used by MoDOT.
10. German Claros answered that none of the measurements are the same, as nothing is established yet as a standard in Highway Performance Monitoring Systems (HPMS), not even roughness.
11. Toribio Garza asked the group whether TxDOT is rating themselves more harshly than other states.
12. Jeffrey Seiders replied that such a comparison is difficult to make because our standards are so different. For instance, TxDOT uses an "acceptable/unacceptable" rating for ride, while other states use numerical or other systems.
13. Pavement maintenance practice is also different. Jim Carney indicated that TxDOT has a lot of chip seal that makes ride worse, but seals pavement. MoDOT does not really do the chip seal on major roadways up to 2,500 ADT. Roy Rissky said KDOT do chip seals up to 10,000 ADT [average daily traffic].
14. Steve Takigawa of CALTRANS responded, saying that the differences in measuring and rating systems have caused problems in California, as the public and the legislature often ask how CALTRANS compares to other state DOTs on specific measurements. Mr. Takigawa said that he can never provide them with that comparison data, which often affects the public perception of CALTRANS.
15. Toribio Garza replied that TxDOT has had problems similar to those reported by Mr. Takigawa, along with the similar issues generated every time a formula is altered or rating changes significantly because of implementation of better technology. Mr. Garza pointed out any time we tweak what we do based on better technology and when TxDOT improves technology but the scores drop, the legislature expresses concern about the

credibility of the pavement management system. In other words, TxDOT's credibility may be harmed simply because the legislature and the public do not always understand the processes by which condition scores are calculated.

16. Jim Carney of MoDOT agreed with Mr. Garza, saying that Missouri has had similar problems. Missouri worked to get their major routes in good condition, but their minor routes are now in bad condition. However, the measurement has been tweaked two or three times and road rallies did not really help out. They just decided to work on pavement smooth, back off on mowing, signing, and striping. They found out that their mowing and striping conditions were okay. But they found out that they needed to work on ride. The public judges a roadway by the 'seat of the pants' (by how rough the ride is).
17. Jennifer Brandenburg of NCDOT added that standardizing the measurement and rating systems will be very difficult, as everyone wants the standardized system to utilize the practices they currently use; no one wants to alter their current practices, so standardizing will be a challenge. Jeffrey Seiders suggested that all of the people attending the workshop should focus on making standardization a priority.

5.4 Topic 4: Applications and Ongoing Efforts for System Improvement

5.4.1 Presentation Key Points

PMIS tracks condition of Texas pavements over time; evaluates the current statewide pavement condition; provides information to help allocate PM and Rehab budgets; provides information to help allocate part of the Routine Maintenance (RM) budget; provides information to help Districts select PM and rehab projects, and helps Districts evaluate effectiveness of designs, treatments, materials, and specifications.

There are three PMIS tools for District use. First is the PMIS Mainframe database that contains data collected over the past 20 years and provides PMIS reporting and analysis tools with 0.5-mile summary and 0.1-mile detail data. Second, PMIS MapZapper makes maps of PMIS data, runs basic PMIS reports, and is used to evaluate and optimize selection of distress treatments to maximize pavement condition scores. Last, ProView Lite views right-of-way images and displays graphs of ride, rut, and other PMIS data.

TxDOT has undertaken efforts to move the PMIS database from the mainframe to a web-based application using Oracle. There are also plans to move PMIS MapZapper to a web-based system, to provide enhanced support of the TxDOT 4-year pavement management plan, support TxDOT performance measures, and update analytic portions of PMIS including pavement condition score prediction capabilities.

5.4.2 Peer Discussion

18. One of peer state members asked if TxDOT can estimate how long the treatments last.
19. Jim Carney of MoDOT asked which part of the TxDOT organization handles the ARAN [Automatic Road Analyzer] and the PMIS.

20. Toribio Garza replied that TxDOT's construction division handles pavements and materials, although these activities used to be located in the maintenance division.
21. Eric Pitts added that Georgia has its HPMS in planning.
22. Jennifer Brandenburg stated that North Carolina has an asset management division, and the PMIS was moved from planning to maintenance.
23. Roy Rissky told the panel that in Kansas, the materials and research division runs the PMS.
24. Lastly, David Bierschbach informed the other participants that Washington's PMS is operated out of the materials lab.

Chapter 6. Maintenance Funding Allocation Process and Formulas

6.1 Introduction

The TxDOT Administration balances the needs in all areas of the department and develops the department's Legislative Appropriation Request (LAR). The LAR is submitted to the legislature in accordance with Legislative Budget Board (LBB) procedures. When the legislature passes an appropriation bill for the biennium, the Maintenance Division uses various funding formulas to determine each district's proposed budget.

These formulas are based upon applicable factors for each activity. Factors include inventory of physical components and condition of those components. The following items are examples of these factors:

1. The routine maintenance district funding allocation considers regional rainfall, pavement condition (failures and ride quality), the number of lane miles, average daily traffic, and daily truck vehicle-miles. The formulas rely on accurate inventory and pavement evaluation data.
2. For preventative maintenance, the lane miles statewide were classified by their ADT, and yearly cycles were established based on ADT group and yearly rainfall. District flexible pavement lane-miles with ADTs of less than 500 will receive a seal coat using an 8 (≥ 35 in./yr), 9 (20–35 in./yr), and 10 (<20 in./yr) year cycle. District flexible pavement lane-miles with ADTs of 500 or greater but less than 10,000 will receive a seal coat using a 6 (≥ 35 in./yr), 7 (20–35 in./yr), and 8 (<20 in./yr) year cycle. District flexible pavement lane-miles with ADTs of 10,000 or greater will receive an overlay using a 10 (≥ 35 in./yr), 12 (20–35 in./yr), and 14 (<20 in./yr) year cycle. District concrete lane-miles will receive funding based on individual district lane miles of concrete pavements.
3. The Rehabilitation funding district funding allocation considers the district three-year average lane-mile with deep distresses (32.5%), the vehicle miles traveled (20%), the total equivalent single axle loads (ESALs) (32.5%), and the rate of improvement of individual district (15%).

After receiving funds from the TxDOT administration, the district allocates funds to each maintenance section. The allocation of funds is coordinated with the district maintenance, the area offices, and the district maintenance sections.

TxDOT is currently investigating the possibility of moving from a single-tier pavement condition management system to a multi-tier system. In response to a funding shortage, the TxDOT administration directed TxDOT personnel and university researchers to examine alternate pavement condition goal systems and an improved funding allocation approach that preserves the state pavement network under a constrained budget. A single-tier system can work very well if the resources are sufficient to cover the entire network. However, when resources are constrained, hard decisions must be made regarding which element(s) of the pavement network should be given first priority and which the last. This process is usually accomplished by

establishing a multi-tier system based on the relative importance of the pavement sections in the network, where the resources are focused on the pavement system or tier(s) that are deemed the most important.

6.2 Discussion

6.2.1 Topic 1: Funding Allocation Practices

Level of maintenance is related to ADT and climatic conditions; greater rainfall reduces the seal coat or overlay cycle. Typically, for high rainfall areas, the lower treatment cycles (years between treatments) are used. However, district engineers make decisions based on the needs of their district; certain directives won't work across the entire state.

1. MoDOT: "What size aggregate are you using?" Shot rate is more important than aggregate size" (unknown who responded).
2. Toribio: "About 70–75% of our system has seal coats."
3. Tammy: "We are doing research to find out differences in noise levels [and aggregate size] over time."
4. MoDOT: "We use typically 3/8" or 1/4" top size aggregate and we're trying to find lifetime; what you're saying is that performance is more related to the amount of rain than aggregate size?"
5. CALTRANS: "We have a 10-year State Highway Operations Protection Plan (SHOPP) cycle. The Plan is based on a 4-year cycle, some areas would get more; safety and emergency response are funded separately. Each maintenance area is funded [*using a different set of criteria—MRM*]. There is no 'traditional amount' that each Maintenance Area receives; it's based on the SHOPP Committee and the Hwy protection plan committee."
6. CALTRANS: "Metro districts tend to get most of the funding. Rural areas may get no rehab projects or maybe only 1."
7. Toribio: "What's the minimum budget needed to maintain your current pavement system?"
8. CALTRANS: "Right now we're trying to get a good pavement condition survey—we have separate budget items for rehabilitation and maintenance."
9. CALTRANS: "On TxDOT rehab projects does this include treatments to the pavement only, nothing else? What else can be included in a project? [e.g., safety end treat structures, add guardrail, lengthen culverts etc.]."
10. Tammy: "Rehab projects are listed in the 4-year Plan as light, medium, or heavy rehab [depending on the pavement treatment level]."

11. CALTRANS: “Most of the projects would be just the pavement, or guardrail, etc?”
12. Tammy: “These are turnkey projects [so a pavement rehab may also include culvert widening, safety end treatments and guardrail].”
13. CALTRANS: “Do your rehab projects include structures?”
14. Lonnie Gregorcyk: “The rehab projects are all-inclusive, not just pavement items.”
15. CALTRANS: “Has a district ever needed more funding than their allocation and requested / received more funding?”
16. Tammy: “Funding can be reallocated if necessary based on need. Districts don’t have to spend the money on items in the same way the allocation formula determined. [Districts can spend pavement maintenance funds on non-pavement related activities.] ”
17. Tammy: “In 2006 we allocated \$875 million for rehabs and \$285 million for maintenance. That was how the money was directed to be spent from Austin.”
18. Tammy: “The funding formulae are set up to give a ‘tolerable’ Level of Service. However we are funded below the tolerable level.”
19. Lonnie: “We allocate a large proportion of funds to IH 35, but the projects are more related to mobility. There are some rehabilitation projects and we’ve had some projects funded using bond money from Prop. 12.”
20. KDOT: “We manage our preservation dollars as a statewide program.”
21. Jeff: “Do you resurface 10% of your pavement system each year?”
22. KDOT: “Actually, a little more, about 12%. We resurface about 1200 miles each year which is distributed across the state; some areas don’t get a lot of money because their roads just last longer (for example in south Kansas). The districts make project selections and the funding need and regionally allocations are determined centrally.
23. KDOT: “We spend \$145 million on non-Interstates and \$56 million on Interstate maintenance annually. Our total budget is \$450 million which doesn’t include salaries. We use 2” hot in place recycling and do some cold in place recycling. That costs us about \$95,000 to \$100,000 per mile 24’ wide.”
24. WsDOT: “We also prioritize projects statewide. Previously we allocated funds regionally based on need. Now we are sharing resources across regions if one region ends up needing more funding.”

25. KDOT's Roy Rissky: "We share resources across regional boundaries too; inspectors for example move between regions. It's cheaper (than hiring more inspectors) they may just have to drive across the district boundary."
26. CALTRANS: "We use workload leveling too."
27. Dennis Cooley: "We have a problem sharing construction inspection forces across district lines—we would have to pay per diem."
28. KDOT: "We try to use own forces first, but it's cheaper in long run to pay per diem than to use 'on-call' consultants. We can also give [them?] the whole project if we want to."
29. KDOT: "It's difficult [to implement a preservation program], but over time, we've spent a lot less [time or money?] on pavement resurfacing because of prevention. Preservation applies the right action on the right road at the right time—using this strategy you may not get as many projects, but the system still gets what's needed. It's cheaper once you got the system structure built up—then you can keep doing the lighter work, the seals and things, keep from having to rebuild the roads."
30. CALTRANS: "We do more rehabilitation and less preservation. Regions that don't get rehab money are doing preservation treatments. Some of our big projects are planned on a 10-year cycle but it takes 12–15 yrs for environmental process."
31. CALTRANS: "We spent \$9 million for a new Pavement Management Information System and recouped \$20 million in 2 years through damage claims. Using PMIS we were able to get reimbursements on damage claims and recoup our costs quickly. We can't collect on anything less than \$500—the money collected goes back to the district that recouped the claim."
32. Toribio: "Steve, CALTRANS paid for (PMIS) system based on damage claims?"
33. CALTRANS: "It's helped a lot."

6.2.2 Topic 2: Emergency Funds

34. CALTRANS: "We have set aside a fund for emergency repair, and if we run out, money is taken from projects; we allocate \$70 million per year and we've had actual needs of \$300 million a year for a few years; a lot of projects were placed on hold. We have statewide priority, though, not district priority."
35. KDOT: "We also have an emergency repair budget which provides funds for a contractor to respond to immediate needs. We set aside emergency funds—\$300–\$400 million with \$70 million held in reserve. Emergency funding is prioritized statewide."

6.2.3 Topic 3: Level of Service

The Maintenance Funding allocation formulas were reviewed in committee; there are so many unknowns. It's difficult to adjust the maintenance formulas in a way that will allocate the right amount to each area every time. After reviewing our current funding allocation methods it was

decided not to change our procedures. We go back to see if what was allocated statewide is about what was actually spent statewide. We use this as a check to determine if the formulas are working—comparing actual expenditures to allocations.

36. NCDOT: “Do you do the comparison on a statewide basis or by district?”

37. Tammy: “We look at it by statewide level. PMIS data provides information about failures and ride; but we don’t have a Level of Service—we fund at the function code level. We have individual Levels of Service for mowing, litter, guardrail etc. and an overall Level of Service. The guardrail level of service is 75—Litter is 78.”

38. NCDOT: “Do you tie your funding allocations to NIS [?] We aren’t managing at the level of detail we want to be; we allocate money to the Divisions and then identify the LOS they need to target.”

39. Dennis Cooley: “What does a (litter Level of Service of) 71 mean to the Public?”

40. CALTRANS: “It means a ‘C’. (But) does it look like it needs to be picked up?”

41. Toribio: “So, what if you decide to bring litter up to 75, do you fund it accordingly—determine how much it will cost, then get it done?”

42. CALTRANS: “Yes—we do the analysis and determine that it will take 400 more people and that \$20 million will need to be redirected: what will slip now? If that’s the goal, we take a little off each service area.”

43. (Unknown): “The real issue is if we’ve got a statewide score of 71 we get too many complaints. But the public needs to know that if they expect a 75, it’s going to cost \$10 million more plus ‘x’ additional employees.”

44. Lynn Passmore: “If you use a statewide average it doesn’t mean everyone will get bumped up (more funding an improved conditions).”

45. CALTRANS: “That’s correct; you have to make sure everyone is spending their allocation.”

46. Tammy: “You don’t mandate that they spend a certain amount in every area, just the five areas you’ve targeted?”

47. Cal: “Yes.”

48. Toribio: “Would you approach it the same way if you had complete funding?”

49. CALTRANS: “Yes.”

50. NCDOT: “We don’t control it that tightly, we look at divisions (districts), we figure out their conditions, they are responsible for doing what they need to do (with their funding allocation).”
51. NCDOT: “We hold the divisions (districts) accountable for how they spend the money that is allocated to them. They are responsible. We run curves by district—they can run their own scenarios to determine how much bang they get for the buck. We don’t allocate funding by Level of Service yet.”
52. Tammy: “That’s the approach we use, but we don’t fund districts based on LOS.”
53. NCDOT: “We don’t fund based on LOS either, but we want to eventually— we want to consider lane-miles, ADT, population, and other factors [when we set LOS].”
54. NCDOT: “We rate 35–40 maintenance areas; we evaluate the actual LOS and compare to the ideal LOS. We then use PMS to determine how much it will cost to achieve the ideal LOS conditions.”
55. NCDOT: “We use a number scale for LOS targets.”
56. WsDOT: “We use a Letter scale. Every maintenance item is related to a Level of Service measure.
57. CALTRANS: “We use numbers.”
58. Jeff: “We need to obtain your LOS definitions to use as a benchmark.”
59. CALTRANS: “We use 5-yr. goals; we monitor how much we’re spending, increase it each year; that way we gradually increase the LOS.”
60. Toribio: “Every component has an LOS number?”
61. CALTRANS: “Yes, and I have 20 zones—and one level for statewide. I can evaluate what each zone will cost to increase in LOS.”
62. CALTRANS: “We can also determine how much effort and inventory it takes or will take. We can ask a district ‘Why is it taking you more effort to increase the LOS?’”
63. Toribio: “Who created (adopted) your LOS measures [legislature or DOT]?”
64. CALTRANS: “CALTRANS developed them for our program, we wanted LOS.”

6.2.4 Topic 4 Corridor Management

65. Toribio: “Do you develop a plan for corridors?”
66. NCDOT: “Strategic Corridors don’t necessarily tie to Tiers. Is there a Corridor Plan within your Multi-Tier goals for Texas?” *[For example, a corridor may be Tier 1 in one*

district, but Tier 2 or 3 in another district due to drop in ADT or other factor...nevertheless the entire route is an important corridor for the state—MRM]

67. CALTRANS: “Corridors work best for Level of Service management.”
68. GDOT: “We focus on corridors at the state level and ensure that the condition of a corridor does not change across district lines.”
69. Jeff: “Is the condition score on that corridor higher than on surrounding roads?”
70. CALTRANS: “It’s best to fund by corridors; even for litter: pick up (litter at the same LOS) for the whole corridor that way no one along that entire corridor will complain. We also look at corridors across districts—in particular funding by corridor (rather than by district.”
71. CALTRANS: “Do you categorize your (funding or work activities) into what’s discretionary and nondiscretionary?”
72. Tammy: “Districts determine how to allocate the funds. The funds are allocated in two budgets; the district manages these budgets through their accounting system to determine how to pay for work depending on the type (and who is performing the work).”
73. Cal: “So discretionary is really only materials?”
74. Tammy: “Our 105 maintenance budget was about 50/50—materials and labor; each district has a funding allocation.”
75. KS: “What do you do with buildings? Are building maintenance funds included in the 105 maintenance budget too?”
76. Tammy: “No, not in the money we allocate to districts, regions take care of maintenance and repair of building.”
77. Toribio: “We have about 2,500 building structures, which are funded at about \$50 million.”

6.2.5 Topic 5: GPS and Crew Monitoring Systems

78. CALTRANS: “We spent \$11 million (last year) we are neglecting buildings. How do you allocate fuel?”
79. Tammy: “It’s included in the funding allocation formula and is handled by the districts.”
80. CALTRANS: “We are focused on saving money at the section level by buying bulk fuel; we monitor how people drive using cameras; we use GPS to check speeds—whether the person is idling or not idling; every (state employee) person has a fuel card.”

81. CALTRANS: “In San Diego we use cameras and a mercury ball—this is used to check if a person stops suddenly; we check whether a person is speeding—we’ve used the cameras to record when someone’s been hit from behind; we caught people on tape stealing items from inside a car; does it affect employee morale? We’ve turned it around and now employees ask if they can get an incentive for getting no triggers?”
82. Jeff: “We use GPS data; it helps us cleanse our data, if you’re going to slow or too fast (profiler operations—or helps in determining if the data collection vehicle was operating in the wrong direction).”
83. WsDOT: “GPS saves our employees having to put in data on where they have been, good for safety in mountain areas.”

Chapter 7. Maintenance Contracts

7.1 Topic 1: General Contracting Practices

7.1.1 Presentation Key Points

Introduction

TxDOT accomplishes its maintenance mission by effectively supplementing its work force with routine maintenance contracts, preventive maintenance contracts, purchase of service (service purchase orders), interagency contracts (contracts between TxDOT and other state agencies), state use program agreements, and emergency contracts.

TxDOT requires that all contracts proposed by the department for the improvement of a highway on the state highway system be submitted for competitive bids. The definition of “highway improvements” includes construction, reconstruction, and maintenance. TxDOT also requires that a minimum of 50% of maintenance be provided by a contractor, but “only if the department determines that a function of comparable quality and quantity can be purchased or performed at a savings by using private sector contracts.” The following list gives the guidelines for contracted work.

Routine Maintenance

Contracts are developed as routine maintenance contracts through the Construction Maintenance Contract System and may be locally let if estimated to cost less than \$300,000.

Preventive Maintenance

Contracts are normally programmed through the Transportation Planning and Programming Division as contracted preventive maintenance projects.

Major Maintenance

Contracts are developed using the Design Division 2-R standards and are normally programmed through the Transportation Planning and Programming Division as major maintenance program projects.

TxDOT began outsourcing maintenance in the 1970s with mowing contracts. TxDOT now processes approximately 1,400 maintenance contracts a year. The average contract is approximately \$90,000, and several contracts exceed \$1 million. The average duration is 1 year with variation from 45 days to 2 years. The district engineer has the authority to let, award or reject, and execute contracts estimated under \$300,000, which accounts for about 75% of the contracts.

State-let contracts are submitted to the Maintenance Division (MNT). The contract is reviewed, proposals are sent to prospective bidders, and the project is let. Bids are tabulated and recommendations for awards or rejections are sent to the Texas Transportation Commission. The Construction Division (CST) reviews all bid documentation and then sends a letter of “Award of Contract” to the low bidder, requiring the low bidder to execute the contract and return it with a

Payment and/or Performance Bond within 15 calendar days. Upon receiving a positive response from the contractor, CST will review the documentation and execute the contracts through MNT.

Routine Maintenance Contracts

TxDOT lets out approximately 1,400 contracts for routine maintenance per year. The routine maintenance work contracts consist of the following kinds:

- 1) Basic routine maintenance contracts
- 2) Comprehensive/bundled bid contracts
- 3) Asset management contracts
- 4) Performance-based contracts

Based on these contract categories, the districts have let out contracts to suit their needs (as follows):

1) Waco District:

This district has had a long history of performance-based asset management contracts for IH 35 through the entire district. The Waco District is beginning the third generation of this type of contract on IH 35 through the Waco District. The original five-year contract costing \$20.2 million began in July 1999, was re-let in August 2004 for another five years, at a cost of \$29.4 million, and then re-let again in August 2010, resulting in the award of the present contract to Texas Tree and Landscape Contracting for \$19.6 million.

2) Dallas District:

In July 1999, the Dallas District let a five-year asset management contract costing \$11.3 million for IH 20; this contract was not re-let in later years. In 2009, the district awarded a five-year performance-based asset management contract for pavement marking maintenance within Dallas County to Highway Technologies Inc., for a cost of \$20.3 million. Additionally, the Dallas District awarded a five-year comprehensive bid item contract for routine maintenance of roadways within East Dallas County to Gibson & Associates Inc., for a cost of \$19.6 million and a five-year comprehensive bid item contract for routine maintenance of roadways within West Dallas County to Highway Technologies Inc., for a cost of 18.2 million.

3) Houston District:

Since 2002, the Houston District has performed maintenance on many of their high-traffic roadways through the use of comprehensive contracts that include numerous bid items for typical maintenance functions. These are call-out contracts wherein district management identifies the need and issues a work order to the contractor; the district remains in control of the assets. Having a contractor perform this maintenance work allows TxDOT personnel to greatly reduce their exposure to the hazards of working on high-traffic roadways. Presently, the Houston District has three one-year contracts of this type, totaling \$7.2 million. They have two additional contracts to be let in November 2010, for an estimated \$2.7 million.

4) San Antonio District:

The San Antonio District has experience with performance-based contracting, beginning with a contract awarded in 2005 and terminated in 2006. This district presently has a five-year pavement markings performance-based contract that began in 2006 for a cost of \$23.4 million awarded to Flasher Equipment. Additionally, in January 2010, the San Antonio District awarded a comprehensive general maintenance contract for the western portion of the district to K-bar Services Inc., for a cost of \$6.2 million, and in February 2010, the district awarded a comprehensive general maintenance contract for the Eastern portion of the district to Anderson Columbia Co. Inc., for a cost of \$7.6.

5) Yoakum District:

In September 2005, the Yoakum District awarded a two-year performance-based contract for roadside maintenance to Texas Tree and Landscape for \$2.5 million. This contract ended in September 2008, after one renewal period. In March 2009, the district awarded a two-year roadside maintenance contract for several counties to P-Ville Inc., for \$1.5 million.

7.1.2 Peer Discussion

1. Jennifer Brandenburg from North Carolina commented that performance-based contracts have traditionally been ineffective in her state, and her state DOT has even had to end such contracts in the past because they were not achieving good results.
2. Jim Carney from Missouri stated that his state uses contractors for most of their litter pick-up. Bob Blackwell responded that Texas uses contractors for similar functions, such as mowing and janitorial. He explained that Texas pays these contracted workers what is considered to be fair-market value.
3. Mr. Carney responded that MoDOT also purchased several litter-picking machines, but that the machines create a lot of hay. They have two models, and the one that is pulled behind a pick-up truck works well, but the model that travels on the roadside creates problems.
4. Mr. Blackwell then replied that TxDOT has tested the litter-picking machines in San Antonio, and they seemed to work fairly well there.
5. Steve Takigawa was curious about the typical durations of general routine contracts in Texas.
6. Bob Blackwell responded that Texas utilizes a variety of different lengths, depending on the job being contracted.
7. Mr. Takigawa then inquired about the financial aspects of the contracts.
8. Ms. Sims explained that Texas utilizes cash budgets, and that money cannot be transferred from year to year.

9. Mr. Takigawa stated that California has encountered problems in the past because their funds also cannot be carried over into the next year. Occasionally, the money they intended to spend was lost because the project could not be completed in time.
10. Ms. Sims replied that TxDOT generally comes within 1% of their budget; although some people spend less than was allotted to them, other spend more, and so the spending balances itself out.
11. Steve Takigawa suggested that such a system may reward districts that consistently overspend.
12. Toribio Garza explained that TxDOT attempts to mitigate the problem through monthly meetings and examining funding decisions at the end of the fiscal year.
13. Mr. Gregorcyk added that TxDOT tries to balance the budget within a region.
14. Ms. Sims explained that, traditionally, if a district went over budget, they were penalized that amount in the next year. She was unsure if that practice was still in effect, however.
15. Kansas's Roy Rissky stated that his state allows pavement preservation money to roll over into the next fiscal year.
16. Mr. Takigawa then explained that he typically funds at 80%, and if any money is left over, he can move it back. Mr. Rissky said that he does the same.
17. At one point during the presentation, MoDOT's Jim Carney asked if most of the contractors used by TxDOT are from Texas.
18. Lonnie Gregorcyk responded that most of them have been local, as most of the outside bidders did not do very well in the past.
19. Ms. Brandenburg added that TxDOT is a low-bid state.
20. Washington's David Bierschbach wondered how TxDOT can contract out 50% of their maintenance money without laying off personnel.
21. Mr. Blackwell replied that Texas has been contracting out their work for so long, that the current number of in-house personnel is what is needed for the other 50%.
22. Mr. Takigawa asked if TxDOT ever loses workers to the private contractors. Ms. Sims explained that TxDOT workers rarely go to the private sector, but the department does lose employees to the oil fields.

7.2 Topic 2: Asset Management

7.2.1 Presentation Key Points

In May 2003, TxDOT began utilizing performance-based asset management contracting to assess the maintenance needs of TxDOT's 80 safety rest areas. The original contracts were awarded for

a two-year term, and were renewable in May 2005, extending through May 2007. The contracts were re-let in April 2007 for a two-year period from May 2007 to May 2009 and were renewed in May 2009 for an additional two-year term through May 2011. TxDOT presently has nine performance-based asset management contracts for rest areas for a two-year cost of \$27.1 million.

7.2.2 Peer Discussion

General

23. Bob Blackwell told the assembled group that some of TxDOT's successful asset management programs are in the Waco and Dallas Districts.
24. Jim Carney asked what the asset management programs include, and Mr. Blackwell explained that they include mowing, signs, and potholes repairs.
25. Jim Carney then wondered if TxDOT had reduced the number of activities the asset management programs would cover in order to reduce repair costs; Mr. Blackwell responded in the affirmative. Mr. Blackwell then explained the practice of using asset-management contracts in the Dallas District to reduce the number of TxDOT personnel being exposed to dangerous high-traffic areas. He stated that Dallas contracts the majority of their metro work to avoid putting TxDOT personnel in danger and to reduce full-time equivalents (FTEs) for the district. These contracts do require more inspection than would otherwise be necessary, and the inspection must be done to different standards.
26. David Bierschbach of Washington wondered if this contracting has created layoffs. Mr. Blackwell replied that it has not. Ms. Brandenburg interjected that increased contracting has resulted in layoffs in other states, citing Virginia as an example.

Mowing

27. Lonnie Gregorcyk explained TxDOT's mowing practices to the group. He described the state-mandated herbicide levels and the close observation TxDOT practices to ensure these levels are not exceeded.
28. California's Steve Takigawa asked if the herbicide levels were set by TxDOT. Mr. Blackwell reiterated that the state legislature sets those levels, not the DOT. Mr. Gregorcyk went on to explain that the contractors do total vegetation, including treating weeds and removing limbs.
29. Jim Carney wondered if Texas utilizes growth restrictors. Mr. Gregorcyk replied that the state tries to control the seed base and to use spot treatments instead of growth restrictors.

Rest Areas

30. During a discussion of the contracts used at rest areas, Tammy Sims stressed the marked difference between the state of the rest areas before the performance-based contracts and

after the contracts took effect. She explained that prior to the current contracts, she received two to three letters every week complaining about the poor condition of the rest areas; now she rarely gets letters pertaining to the rest areas, and she receives some letters that are actually complimentary.

31. Jim Carney was interested to learn TxDOT's method of keeping the newspaper vendors from setting up unsightly stands at the rest areas. Mr. Blackwell explained that Texas has legislation preventing vendors from doing so.

Guardrails

32. Steve Takigawa was also curious about the procedure for repairing a guardrail. He asked whether or not the maintenance supervisor selects the guardrail contractors. Toribio Garza responded that the responsibility is usually assigned to a maintenance section. Ms. Sims stated that guardrails (?) are usually a three-month long process. Lynn Passmore explained that if the cost is under \$300,000, the process is much faster, as it can be done with local contracts.
33. Jim Carney inquired as to the typical turn-around time from the guardrail damage occurring to the repairs being completed. Lowell Choate replied that it takes about 72 hours to begin the repair. Mr. Takigawa responded that California's contracts take approximately nine months.

7.3 Topic 3: Comprehensive Development Agreements

7.3.1 Presentation Key Points

Another unique method TxDOT utilizes to address the needs of the travelling public is the use of long term Comprehension Development Agreements (CDAs). These private/public partnerships facilitate not only the financing, design, and accelerated construction of added capacity to the state's roadway system, but also the operation and maintenance of these roadways for the contract term, thereby removing their burden from TxDOT.

7.3.2 Peer Discussion

34. During the portion of the presentation dedicated to CDAs, Bob Blackwell stated that although Texas has been criticized for over-achieving in the selection of the developers used for these agreements, the decision process used in their selection is extremely open.
35. Jeffrey Seiders added that TxDOT has performance standards the contractors must meet, as well as hand-back requirements and 50-year concessions. Mr. Blackwell agreed that TxDOT sets the standards very high and very far in advance.
36. California's Mr. Takigawa then asked if the litter contractors have a set amount they must pick up in a set period of time. Mr. Blackwell responded in the affirmative.

37. Steve Takigawa then expressed concern over the lack of such specific goals for Texas's in-house work forces. Mr. Seiders agreed that TxDOT should begin creating such specific goals.
38. Steve Takigawa went on to inquire as to how the levels are set for the contractors if no in-house precedents exist. Mr. Seiders responded that TxDOT entered into discussions with the proposed bidders and took distress measurements.
39. Steve Takigawa then asked about the mowing standards. Mr. Seiders replied that the mowing standards may be superior to those in other areas because they were set during a time of increased funding.

Chapter 8. Four-Year Pavement Management Plan

8.1 Introduction

Rider 55 of TxDOT's Legislative Appropriations Bill requires that, prior to the beginning of each fiscal year, the department shall provide the LBB and the governor with a detailed plan for the use of the state's transportation funds. This plan must include a district-by-district analysis of the pavement condition score targets and the expected impact the proposed maintenance spending will have on the pavement scores in each district. Therefore, each district has developed a four-year pavement project expenditure plan based on anticipated budgets. The plan includes estimated construction costs for each project and certain business costs including overhead and operational expenses. The roadside expenditures continue to be evaluated in order to find the correct balance with LOS expectations. Traffic operational expenses are more predictable and are used to maintain existing systems (ITS, signals, illumination, etc.). The pavement expenditures include work performed either with in-house forces and state-owned materials or through routine maintenance contracts. Direct benefits of the four-year plan for districts include the ability to strategically plan routine and preventive maintenance work using a proactive approach rather than on a reactive, long-term basis.

The 25 individual district plans are combined to create the statewide four-year Pavement Management Plan. The statewide plan provides the information necessary to predict pavement conditions based on a specified funding level and specific project program of work. An analysis of the planned program of work results in a report that summarizes the number of lane miles each district plans to treat with either PM or light, medium, or heavy rehabilitation. The report also provides a prediction of the impact these treatments is expected to have on future pavement conditions. Maintenance is composed of routine, preventive, and rehabilitation treatments. These pavement condition projections also allow districts to evaluate their plan and adjust to maximize results.

Pavement Routine Maintenance includes but is not limited to the following:

- Sealing cracks
- Maintaining pavement edge
- Patching
- Leveling-up
- Maintaining blade-overlays
- Placing strip, fog, and slurry seals

Preventive Maintenance includes:

- Seal coats (chip seals)
- Thin Overlays ($\leq 2''$ ACP)
- Micro-surfacing treatments

Rehabilitation includes:

- Placing thick structural overlays (> 3" ACP)
- Rebuilding the pavement structure

8.2 Discussion

8.2.1 Topic 1: Public Reporting

1. KDOT: Is the 4-year plan a rolling four years?
2. Mario: We add a fourth year every year and adjust the other years.
3. KDOT: Using PMS, we pick one and two year projects, and then we add a fourth year every year.
4. Lonnie: Do you publish your Plan?
5. KDOT: The Plan is available if somebody requests it, but we don't put it out on web. The report is large and includes large, long-range projects, projects are scheduled for years into the future, out to 20 years. Regarding maintenance, we pick projects every year, we do publish maintenance projects online that are scheduled for next year.
6. Mario: We were doing that, this was the first time we had four years planned, but only two years will be shown on the internet. One big benefit is that projects for the first two years are fairly certain that gives the maintenance supervisors a much better idea of which roads they need to prepare for next year's construction/seal coat season.
7. GDOT: The public knows some work that we plan to do based on the STIP. Our 4-year plan is about to be published as well; but it still is based on lump-sum funding. We have a footnote that 4-year plan is may change as conditions change.
8. NCDOT: we don't publish chip seal or the resurfacing program. We put together a 5, 10, and 20 yr. plan—these plans address big construction projects.
9. GDOT: One problem in developing the 4-year plan was district response to changing the plan. 'What if we don't want to do that project now?'
10. Toribio: The general public doesn't understand the fact that the 4-year plan can change.
11. KDOT: I don't think we could develop a 4-year plan because of our freeze/thaw cycle—a road may look great one year then it falls apart because of weather.
12. GDOT: We have that same problem.
13. WsDOT: We have a 2, 6, and 20 year plan; these are preservation projects, we make our projects available about a year ahead for the public.

14. Mario: We settled on 2 years—we are confident with releasing the first two years. Most districts have a pavement engineer or design engineer who leads development of the plan.
15. Jeff: Usually the Pavement Engineer is also the PMIS manager.
16. Mario: Developing the Plan is quite a bit of work for the Transportation Planning and Design Engineer. Districts really need to look at the plan critically, discuss scope and limits of the projects. Originally the Plan was a huge spreadsheet list of projects; when we mapped the projects the Plan becomes easier to understand.
17. Toribio: Districts have different ideas about what type of work is rehabilitation and when a rehab project was needed—when to do what.
18. CALTRANS: As a supervisor, how do you know based on a map that the money is being spent as intended? How do you track that the contracts are being carried out?
19. Lonnie: We submit a one-year letting plan, if a District is not meeting the letting schedule, we have to report why.
20. Jeff: We can also put data into our PMIS and then look conditions next year.
21. KDOT: Each district has its own letting?
22. Mario: No, lettings are conducted on a statewide basis.

8.2.2 Topic 2: Project Monitoring

23. CALTRANS: We have a yearly contract of the projects that will be done, each month we review the status of every project for every district. We report the status to the director and if a project is behind schedule we get a call from the Director.
24. Tammy: We report letting status quarterly.
25. CALTRANS: Our planners and engineers are held accountable for the project lettings and their pay is based on whether or not they're meeting the criteria. We present the project letting plan to the legislature; our project goal is 100%, and we're at like 99.99%, last year we missed one project letting out of 800 projects.
26. Mario: The letting schedule drives the [plan]; meeting the letting goal is the key.
27. CALTRANS: We let between 3,600 to 3,700 lane miles for \$220 million [*works out to be about \$60,000 per lane mile—MRM*].

8.2.3 Topic 3: Chip Seal

28. MoDOT: Salt deterioration is from top-down in our state (due to de-icing activities during the winter); in TX, salt from the bottom up.

29. KDOT: We pay about \$25,000 per center line mile for chip seals (26' wide) we pay about \$70,000 a center line mile for an overlay (30' wide). [*This works out to be about \$4 / SY for an overlay—at \$70 per ton for hot mix this would work out to be a 1" overlay—MRM*]
30. Mario: About 75% of our statewide FY 2010–2013 plan are chip seals.
31. Dennis: We place seals on roads with 20,000 ADT.
32. KDOT's Roy Rissky: We've place seals with polymer modified oils on roads with up to 75,000 ADT in some sections.
33. CALTRANS: We haven't done chip seals in the past; everyone wants an overlay.
34. KDOT: Do you place fog seals over seal coats?
35. David Bierschbach: We are starting to fog seal chip seals.
36. KDOT: Some [DOTs] do it as routine maintenance—it looks black [makes the surface look new and sealed] and people are happier.
37. CALTRANS: However, if you do a fog seal badly, then it gets a bad name, and nobody is willing to try it again.
38. Dennis Cooley: We are using routine maintenance to do base repairs on very poor roads [*to hold them until a rehabilitation can be programmed—MRM*]
39. Mario: We've pushed the envelope with chip seals in the past few years, maybe more than we should have, but it's cost-effective.
40. KDOT: If you put your seal on at the right time, you don't get cracks. Back in the 80s we did a large number of overlays, as long as you're trying to develop pavement structural strength you can't really do chip seals, you need overlays.
41. CALTRANS: It sounds like your DOTs use more uniform processes for selecting pavement treatments. We have a broad range of treatments that are being selected—based primarily on experience. Why aren't we just picking the best treatment? We have 30 diff types of pavement treatments: why not just pick the best treatment?
42. Mario: We've done uniformity work on our pavement design process considering traffic levels and other factors. We have also looked at design factors for seal coats; we've talked about the alternatives— there is an effort to have uniformity in treatment selection.
43. Dennis: We've used light weight aggregate (Arclite—out of Oklahoma) for low volume roads. We found it works better and have fewer complaints about windshield breakage. We are doing the majority of our seal coats on 'Good' or better pavements.

44. GDOT: No light-weight aggregate for us, they ran me out of the office for suggesting it.

45. MoDOT: Do you use Nova chip?

46. Toribio: Very little—Nova chip is very expensive; chip seal is our bread and butter

8.2.4 Topic 4: Staff Education and Communication

47. CALTRANS: What about succession planning? How do you train your staff?

48. Tammy: We are starting that training now. We also have supervisor training.

49. CALTRANS: We developed training for leadership—our staff has had to handle very challenging times we don't train them how to do their jobs—but why they are doing their jobs.

50. Toribio: During peer reviews, we get into details of how projects are selected. We also talk about working together as a team. We get down the level of 'Whose job it is to remove a dead dog? Is it maintenance's job?' We instill the message that it's everyone's job [to remove the dog] if you're there—it's your job; everyone should be working together rather than dividing up job responsibilities. That has been very helpful, and much appreciated.

51. CALTRANS: Our Director talks to everyone, and I do too—it helps to have 'face time' with your employees.

52. Toribio: We've asked the District Engineer 'When was the last time a certain maintenance supervisor came to your office? Sometimes we go the answer 'I've never seen him.' So we've made some big changes.

53. Neal: We also have crew-leader training.

54. CALTRANS: We also have crew-leader training; we have an Academy—it's a week long; starts with top down, all the way to the lead worker.

55. Dennis: Ages ago, in the Tyler District we had a maintenance management program. We set up criteria to be considered for the training; participants took college courses, there were job rotations and so on; the program worked very well. However, the Civil Rights Division advised the district that the program had to be open to everybody—it couldn't be based on selections.

Chapter 9. District Maintenance Operations

9.1 Topic 1: District Maintenance Practices

9.1.1 Presentation Key Points

Texas has 254 counties and 25 TxDOT Districts. The Austin District consists of 11 counties and maintains 9,489 square miles and 9,208 line miles. The Austin District has 5 Area Offices. The district's population was about 1,064,474 in 1996 and 1,768,636 in 2008. There are 1,889 on-system and 1,468 off-system bridges in the Austin area. TxDOT manages roadway pavement, roadsides, traffic operations, and emergency operations to maintain public safety and satisfaction and to preserve the state's capital investments in the pavement.

9.1.2 Peer Discussion

Line Stripe

1. Jennifer Brandenburg said that in North Carolina, roadways with a width of 18 feet or less do not have any line stripe, and roadways with less than 400 ADT have only a center line stripe.
2. The DOTs in Kansas and California stripe every road, including both edges and center lines, because of safety issues.
3. David Bierschbach said that Washington State does not have (the equivalent of) FM roads; we have state routes only. He was surprised to see roadways (during the Road Rally) that did not have lane edge lines.

Road Width

4. Roy Rissky of KDOT pointed out that Texas has a large number of 30-foot-wide roadways even for country roads, and some low volume roads have large shoulders. Kansas's system primarily consists of 30 ft base widths.
5. Jennifer Brandenburg of NCDOT stated that such shoulders are not typical in North Carolina.
6. David Bierschbach said that Washington's minimum lane width is 11 ft; total paved width 22' with 24' of base minimum. Typically on a state route we have 28–32 ft base width.

Chip Seals

7. Toribio Garza said about 70% of the Texas road system has chip seal pavement, and Texas pays about \$600 (likely misunderstood—perhaps \$12,000–\$15,000 at today's prices) per lane mile.

8. Texas utilizes chip seals much more than is common in some other states; Jim Carney of MoDOT reported that Missouri only has 20% of the road system covered in chip seals.
9. David Bierschbach said that Washington State has gotten away from crack sealing and agreed that chip seals can extend pavement life with a low maintenance cost. He added that chip seals in Washington are lighter colored than those he observed in Texas. Those were spot seals using pre-coated aggregate.
10. Roy Rissky mentioned that crack sealing can become wasteful if there are too many cracks, and chip seals can also deteriorate ride quality. KDOT grouts cracks before sealing to increase the cost-effectiveness of the treatment, although this grouting increases the time spent performing the maintenance operation. KDOT also uses hot pour for crack sealing.
11. Eric Pitts of GDOT informed the panel that Georgia does all crack sealing in-house. Georgia has some chip seals, but they do not prefer them because bleeding on chip seals can reduce skid resistance.
12. Steve Takigawa of CALTRANS reported that material engineers in California prefer overlays to chip seals; chip seals are used very little in California.
13. Roy Rissky pointed out road in Texas has more transverse cracks than longitudinal cracks.
(?)

Roadside and Mowing

14. Roy Rissky suggested that TxDOT has a need for better roadside management, specifically better mowing, to prevent drivers from having a limited field of view. KDOT uses haying contracts; but not on the Interstate and not in the median.
15. TxDOT also allows haying.
16. Jim Carney reported that MoDOT mows about two to four times a year.
17. Eric Pitts informed the panel that GDOT has frequent complains about even short grasses.
18. David Bierschbach stated that WsDOT does not receive many complaints about mowing.
19. Steve Takigawa told the group that CALTRANS concentrates more on roadside maintenance activities, including mowing (union system) and guiderail and pump station repairs (in-house), than on pavement maintenance. CALTRANS faces several problems while performing pavement maintenance activities, such as short time limits for road maintenance projects like crack sealing and a limited number of maintenance crews. Mr. Takigawa added that a common mowing practice in California is to carry an eye-wash station behind every mower.
20. David Bierschbach said Washington State is very green. They are against using herbicides.

Emergency Response

21. Both Texas and Missouri experience a large amount of flooding and often have flooded road segments.
22. Steve Takigawa reported that CALTRANS has many cameras on their roads, the feeds of which can be viewed on the internet to monitor road hazards, storms, and hurricanes. The camera recordings in Texas can be viewed on cable television.
23. Lowell Choate presented that the Austin District has worked cooperatively with EMS, Fire and police to create the Combined Transportation Emergency Communications Center (CTECC). The Center provides for centralized control/response management. The Center provides work stations and large screen displays showing traffic conditions at key points around the city.
24. Lowell Choate said that Districts work together to address emergency situations such as hurricane response and cleanup. TxDOT also respond to hazardous material spills; debris removal, flooding and accidents.
25. Lowell Choate said that working through TTI, TxDOT has developed the Austin Incident Management (AIM High) process. TxDOT reviews accidents, conducts debriefings regarding incident response, and has meetings with those who are on the frontline of emergency response.
26. Regarding to the question “Do you track incident response times?” by Steve Takigawa, Lowell Choate answered that incident response time is tracked, and the clearance goal after an incident (time between the incident and the re-opening of the road) is less than two hours in Texas. TxDOT also works to provide access through the incident scene using hose ramps and other techniques.
27. Steve Takigawa and David Bierschbach said clearance goal is 90 minutes in California and Washington.

9.2 Topic 2: Maintenance Plans

9.2.1 Presentation Key Points

The current budget of the TxDOT Austin District is \$13,389,056 for Planning, Design, and Management (Strategy 1010), \$30,738,677 for Construction Routine Maintenance (Strategy 144), \$27,292,945 for Routine Maintenance (Strategy 105), and \$30,811,087 for Right-of-Way Acquisition (Strategy 102). Under construction in the Austin District are 103 projects (\$547 million). The letting amount of the district was \$247 million in FY 2007, \$614 million in FY 2008, and \$337 million in FY 2010.

The Austin District maintains a four-year comprehensive pavement management plan, and the plan combines funding from all funding strategies. The Plan provides a central point for comparing projects; evaluating current pavement conditions; reviewing priorities; and eliminating project overlap.

In March of each year, the district office estimates anticipated funds for the four following fiscal years. General direction is given to AEs (Area Engineers) and Maintenance Section Supervisors (MSS) to review roadways and submit candidate projects for the updated four-year pavement plan. Current PMIS data is available at this time. The DOC (Director of Construction) discusses needs (trends and contractual issues) with AEs, and the DOM (Director of Maintenance) discusses specific needs (pavement preservation strategies) with MSSs. All committees (DOC, DOP, DOM, and the Pavement Engineer) review the PMIS data and the previous PM project performance data and discuss the overall district strategy along with specific concerns. The AE develops candidates with input from the MSS and a matrix based on pavement age, condition score, skid score, and ADT.

9.2.2 Peer Discussion

28. Regarding to the question “What are Area Engineers responsible for?” by Jim Carney, Lowell Choate answered that TxDOT Area Engineers are responsible for planning, designing, and supervising construction in their areas.
29. Dennis Cooley said that TxDOT is about to go into the next legislative session. The District has an FTE allocation, but turnover is high in Maintenance. We need to get our open FTE slots filled. Due to reallocation of work load, the number of Construction and Design positions may be reduced.
30. Terry McCoy said the Austin District has a lot of construction work to do until 2012 after that the District is going to need to find a place for folks to go. Maintenance is the likely place. The District does not draw hard lines between Design, Construction, or Maintenance (with our Tech positions) which is efficient.
31. Jim Carney said MoDOT’s Maintenance program falls off after 2012 also; \$2.1Billion to \$590 Million statewide.
32. TxDOT conducts more routine maintenance contracts in urban areas than other peer States.

9.3 Topic 3: Staffing and Salary

9.3.1 Presentation Key Points

TxDOT has 25 Districts and Austin District has five Area offices with 518 employees. Maintenance Division is under the supervision of Assistant Executive Director for Field District Operations.

9.3.2 Peer Discussion

Staffing

33. Steve Takigawa asked if the Austin District has a lot of turnover. Terry McCoy answered they are stable in Design and the turnover is in Maintenance.

34. Steve Takigawa said they have problems filling positions. They use the Post & Bid system, which is based on worker seniority. They have had instances in which there have been 115 position moves, but only one vacancy filled.
35. Toribio Garza said TxDOT has a lot of turnover in West Texas and in rural communities. They are moving to urban areas.
36. Terry McCoy pointed out the Austin District has five Area Offices. The District moves folks around to meet the work load but it is hard to move some positions due to the travel distances involved. The District has one Area office that is west, one east, and one that is centrally located around IH 35.
37. One of the peer state members asked what percentage of TxDOT maintenance folks come from the construction inspection staff.
38. Terry McCoy said the District manages several maintenance contracts—sweeping; metal beam guard fence repair. The District generally uses contract staff where the District does not want to use TxDOT staff due to safety concerns.
39. TxDOT has good crew allocation practices by assigning idle construction workers in maintenance projects.

Salary

40. David Bierschbach asked if TxDOT has a problem with salaries between engineering and maintenance.
41. Toribio Garza answered that engineers are paid more and the reality is that some folks are paid much more to do the same level of work. However, the flip side is ‘which is worse; lower pay or no job at all?’ Maintenance personnel enjoy their work.
42. Toribio Garza said that TxDOT generally pays more for engineering personnel than maintenance personnel.
43. The peer state participants and TxDOT agreed that salaries for maintenance personnel should be increased to encourage experienced personnel to stay in maintenance positions regardless of budgetary issues. Possible incentives for maintenance personnel could include the development of expanded job families and higher pay groups.

9.4 Topic 4: Training

9.4.1 Presentation Key Points

TxDOT offers 90 formal employee training courses and equipment demonstrations, and each employee is expected to be engaged in 5 training programs each year. TxDOT holds a half-day “Roadeo” at the district level, which is a statewide competition between equipment drivers that tests their operation skills. Everyone who operates equipment can participate in the competition unless they are known to behave poorly in competitive situations. There are also non-competitive

testing sections for employees who want to test their operation skills but who do not wish to compete against their colleagues.

9.4.2 Peer Discussion

44. Jim Carney said MoDOT has a Snow Academy.

45. Jennifer Brandenburg stated that NCDOT also holds a statewide competition.

46. Steve Takigawa added that in California, their competition could only be done off state time, which essentially ended the competition.

47. Jim Carney said if an operator has not had an accident in 4 years, they aren't required to participate in training program in Missouri.

9.5 Topic 5: Maintenance Equipment: BOMAG

9.5.1 Presentation Key Points

Paul Mehawk presented that in the past the District leased 2 BOMAGs and the District have a six to seven man crew that does reconstruction work on about 10 miles of roadway per year. The district plans to buy a BOMAG in March, 2011.

Paul Mehawk explained the District found that trying to rework a road with a Gradall or maintainer is not efficient; especially if the District is trying to do miles of road that is rutted or cracked up. In this case, the BOMAG operation can save money.

Paul Mehawk also emphasized that the BOMAG operation has helped deal with problems like subgrade shrinkage and pavement edge dropoffs. It helped the District improve low road scores. The District did an internet search to obtain information about BOMAG operations and also spent a week in the Yoakum District to observe their BOMAG operators.

Paul Mehawk described detailed BOMAG operations. The District can do about 2,500 ft per day with a BOMAG. The District operates BOMAG on the existing pavement; add cement and water, mix and then compact with a sheep's foot and pneumatic tire roller. After rolling the surface, a maintainer is used to blade the crown in order to get a tight surface. The operators shoot MC 800 at 0.25 gal AC/SY, then apply Grade 5 rock and finish off with 0.42–0.44 Gal AC/SY and Grade 4 chip seal. The District operates BOMAG about 7–8 inches deep and stay inside the base crown.

9.5.2 Peer Discussion

48. The peer state participants were very impressed by the fact that TxDOT operates BOMAG maintenance equipment year-round almost without equipment down time.

49. Regarding to the question "How much down time do you have?" from Roy Rissky, Paul Mehawk answered there is a down time due to rain, but in another way, rain helps settle the road down.

50. Jim Carney asked why the District does not use lime or fly ash and Toribio Garza answered that TxDOT does not like to use lime because they have found it usually cracks within about 6 months. Thus they prefer cement with Type 'C' fly ash
51. BOMAG is not much preferred for partial depth cracking. Full depth repair would be a better option for this case.
52. Brainstorming with AE and District maintenance offices on ways to streamline operations is important.
53. The operation crews tend to get motivated by seeing the output of the operations.

Chapter 10. The Road Rally

10.1 Objectives of the Road Rally

The objective of the Road Rally was to cross-reference or benchmark TxDOT's maintenance practices against equivalent practices at selected peer states. As described earlier, six peer states were invited to evaluate a number of one-mile pavement sections. The peer states invited were California, Georgia, Kansas, Missouri, North Carolina, and Washington. It should be emphasized that the objective of the rally was not to grade or score TxDOT's road network but rather to determine whether the selected pavement sections were meeting acceptable standards of service as perceived by the invited personnel of the peer states.

The sections evaluated were not selected using a random sampling scheme because of the time limitation of the rally. The pavement sections were selected such that the sample contained a wide range of conditions including sections in very good conditions as well as sections in immediate need of maintenance. It was also important to sample sections within each facility type; therefore, the sample contained section from the interstate (IH), national (US) and state (SH) system as well as numerous Farm-to-Market (FM) roads.

10.2 Characteristics of the Road Rally

To address the objective stated above, 34 sections were selected in the Austin District. All sections were selected in the proximity of Austin due to time limitations. The goal was to evaluate the sections within approximately four hours.

Some of the most interesting areas of the Austin District were selected to show some of the challenges that the District has to face to maintain their road network. Some of these challenges include the presence of sulfates in the soil, active clays, and significant amounts of agricultural traffic that can circulate on some of these roads with axle loads above specified limits. Figure 10.1 shows the location and the route of the Road Rally.



(a) Location



(b) Route

Figure 10.1: General Location of the Road Rally and Route Followed

10.3 Sampling Groups and Evaluation Principles

A total of 24 people (hereafter referred to as “evaluators”) evaluated the 34 pavement sections. These evaluators have different backgrounds and experiences; therefore, they were grouped into five different sampling groups.

The first group was formed by the invited visitors from the six different states mentioned above. This group is referred to, in this chapter and in the figures, as the *Peer* Group. The second group consisted of TxDOT personnel with significant expertise in pavements from the Austin District, the Maintenance Division (MNT) and the Construction Division (CST), which are not members of the PMC. This group is referred to as the *Expert* Group. The third group consisted of the members of the PMC and is referred to as the *PMC* Group. The fourth group consisted of all other participants of the Road Rally that did not belong to any of the previous groups. This group is referred to as the *Other* Group. This was a very diverse group with different backgrounds so it could also be considered as the road user group. Finally, a fifth group was formed by combining all TxDOT personnel. This group is referred to as the *TxDOT* Group. Therefore, the TxDOT Group is the sum of the Expert, PMC, and Other groups.

10.4 Ratings per Individual and per Sampling Group

Before analyzing the ratings of the individual sections, it is prudent to have a look at the evaluators and at the sampling groups to determine whether there are any significant differences at the aggregated level.

Figure 10.2 shows the average of all ratings for all sections by each evaluator. The results from the Peer Group are presented first, followed by the Expert, PMC, and Other Group, respectively. It is apparent from the figure that the Peer and the PMC groups tend to rate the sections lower than the other groups. It is also apparent that the Expert Group tend to rate the sections higher and the Other Group is the group showing the largest variability in the results. This was expected since the Other Group consists of TxDOT personnel of very different backgrounds.

In order to test whether the differences of the aggregated ratings are significantly different amongst the various groups, a series of t-tests were conducted. The results of these tests are presented in Table 10.1. The test were conducted at level α of 5% (probability of Type I error). The null hypothesis (H_0) in all cases was that the average ratings of the two groups being considered are equal. If the statistical test rejects H_0 , we can conclude that there is a statistically significant difference between the average ratings of the two groups. The null hypothesis is rejected when the t-statistic from the sample is greater than the critical t-value.

Table 10.1: Test of Hypotheses Comparing the Various Groups

Groups	t-statistic	t-critical	Outcome	Comment
Peer vs. TxDOT	-1.54	-2.07	Cannot Reject H_0	No significant difference
Peer vs. Expert	-5.10	-2.26	Reject H_0	Significant difference
Peer vs. PMC	-0.35	-2.26	Cannot Reject H_0	No significant difference
Peer vs. Other	-1.09	-2.18	Cannot Reject H_0	No significant difference

The results show that there is only a significant difference between the Peer and the Expert Groups. It can also be seen in the table that all t-statistics are negative, which indicates that the Peer Group rated the sections lower (on average) than any of the other groups.

Figures 10.3 to 10.6 show similar results but for each of the attributes rated separately. The results are given for the Pavement, Traffic Operation, Roadside, and Overall rating, in Figures 10.3, 10.4, 10.5, and 10.6, respectively.

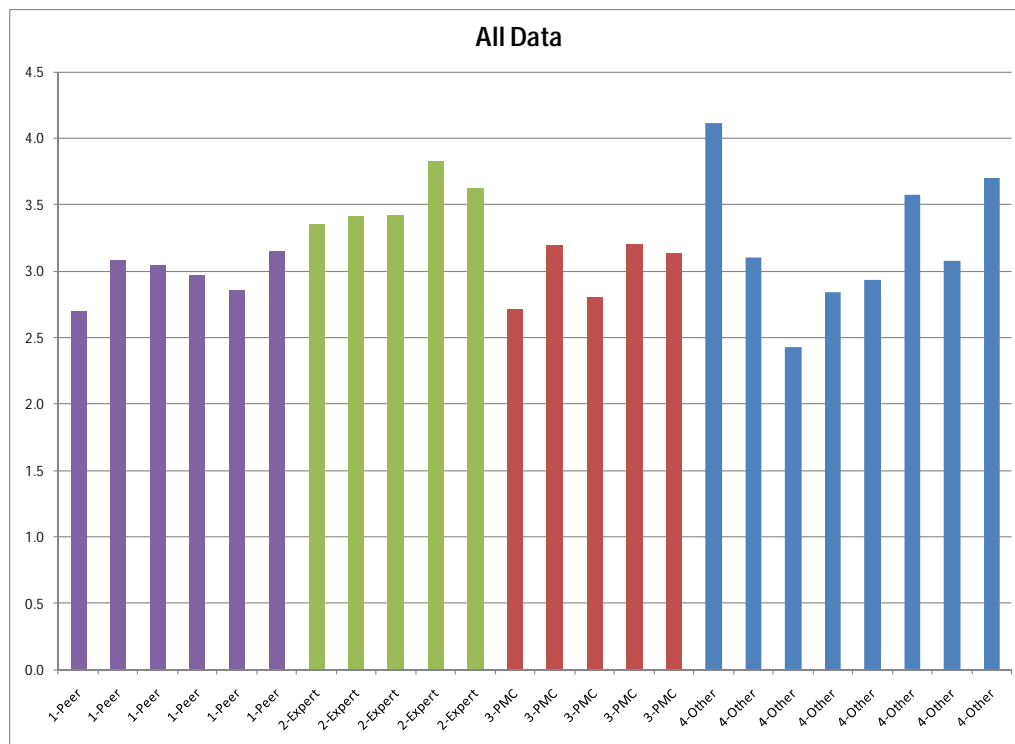


Figure 10.2: Aggregated Evaluation of All Sections

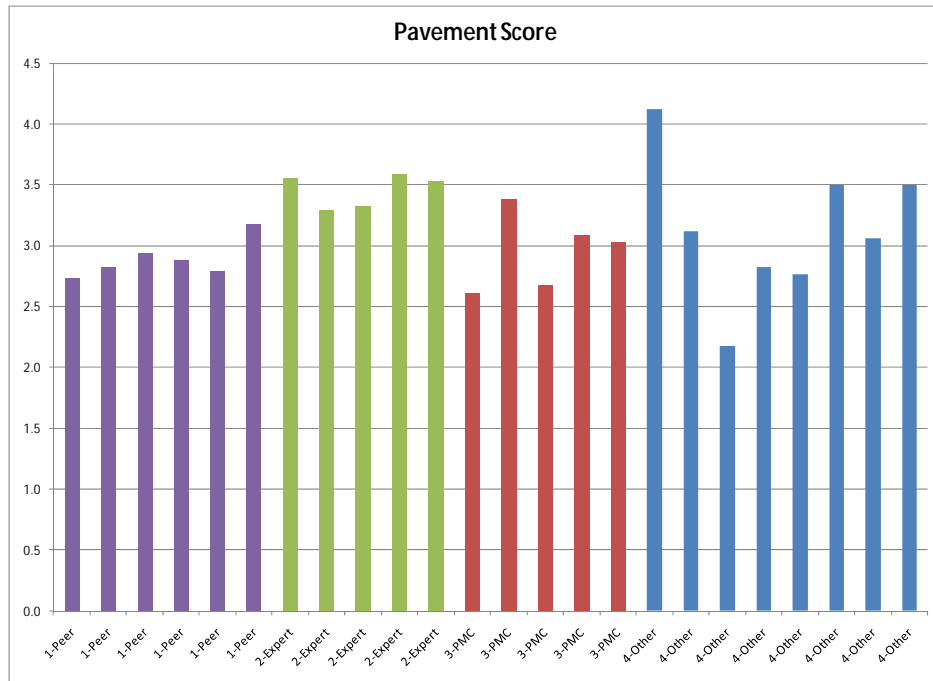


Figure 10.3: Pavement Score of All Sections (per individual)

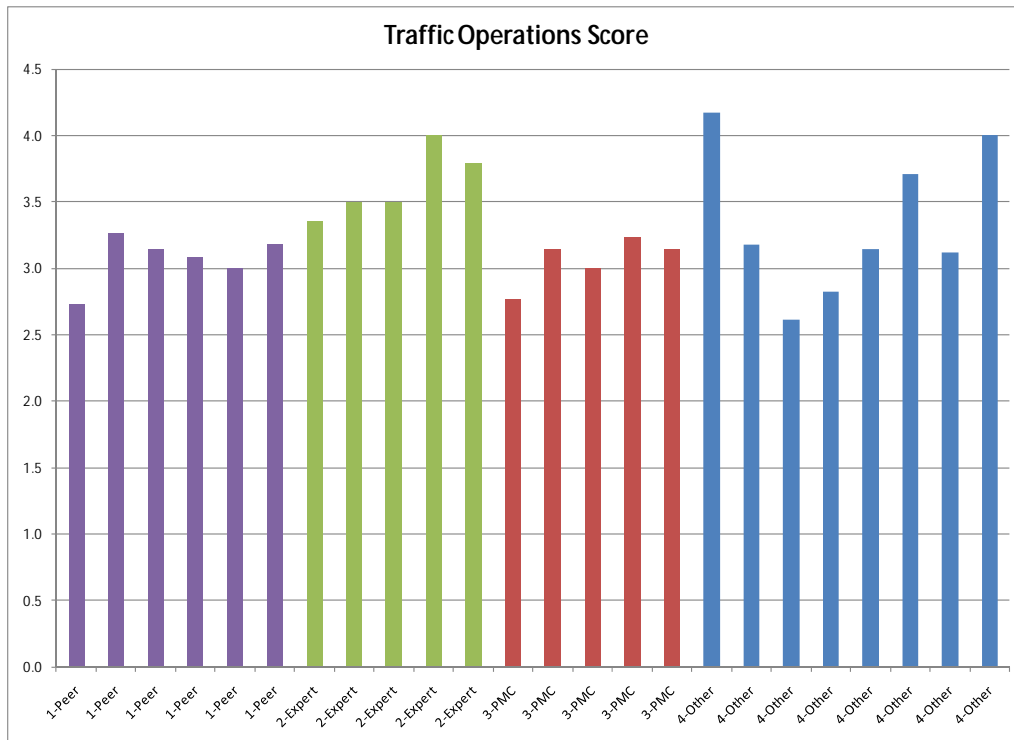


Figure 10.4: Traffic Score of All Sections

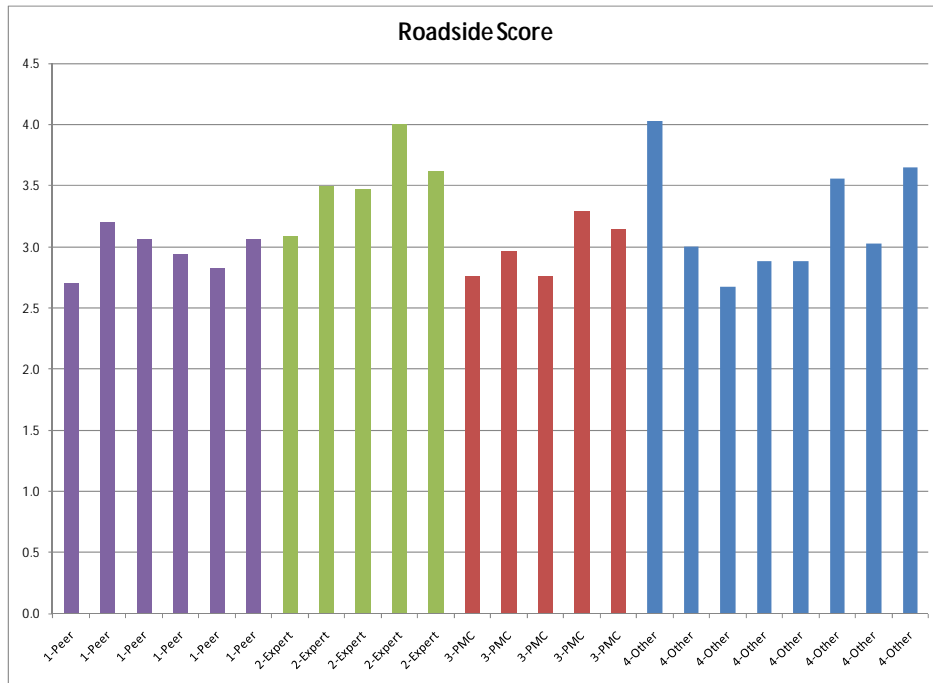


Figure 10.5: Roadside Score of All Sections (per individual)

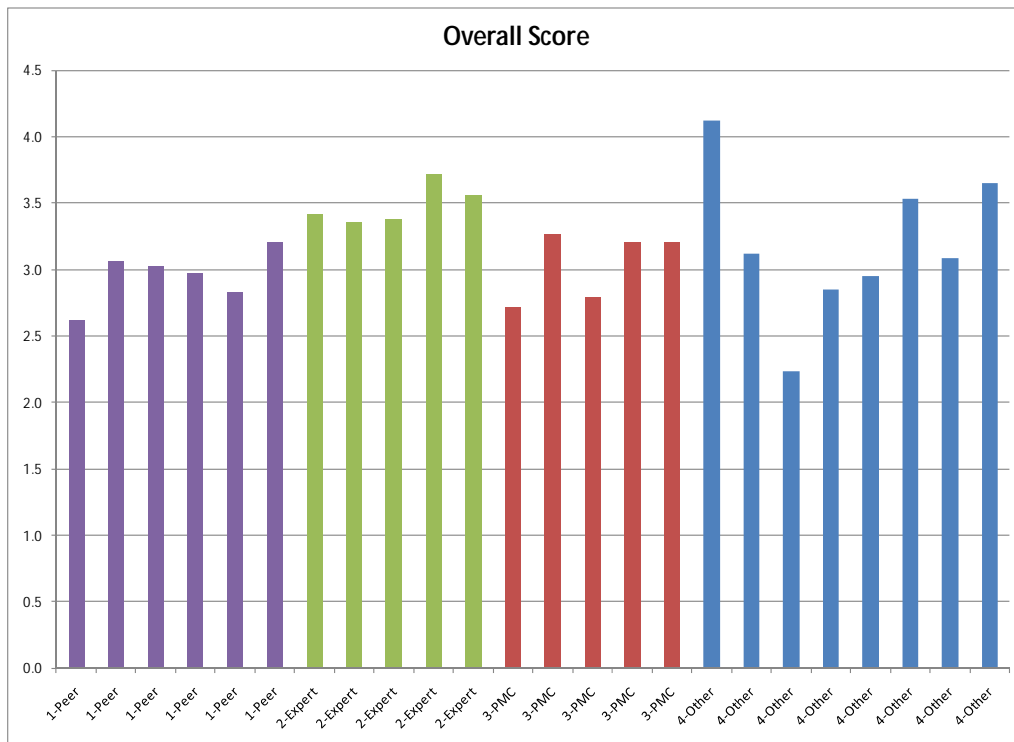


Figure 10.6: Overall Score of All Sections (per individual)

Figure 10.7 shows the ratings for each of the attributes evaluated (i.e., Pavement, Traffic Operation, Roadside and Overall) for all the sections per individual. It can be observed that the Pavement rating tend to be the lower for most sections, while in some sections, the Roadside rating is the lower rated attribute. On the other hand, Traffic Operation seems to be the attribute receiving the higher ratings for most sections.

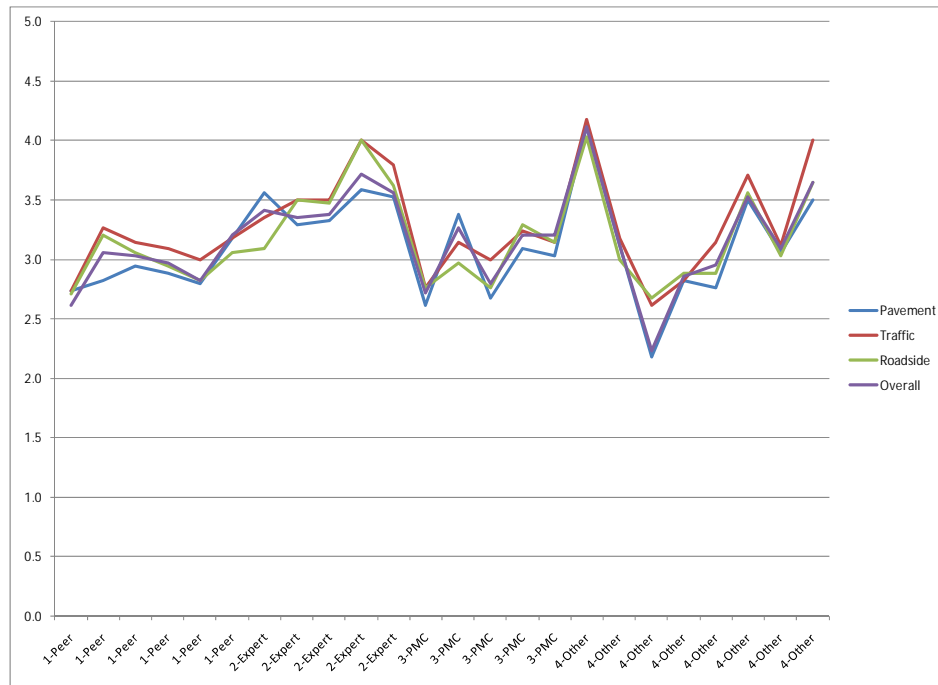


Figure 10.7: All Scores of All Sections (per individual)

10.5 Ratings per Section

In this section of the report, the ratings are presented per pavement section. Sections are displayed in order of increasing “Overall” rating. This is done to determine whether potential differences in the ratings are systematic and whether these potential systematic differences vary according the condition of the sections evaluated. Figure 10.8 shows that there is not a systematic difference according to the condition of the pavement section. That is, the variability of the results is almost the same independently of the rating of the sections.

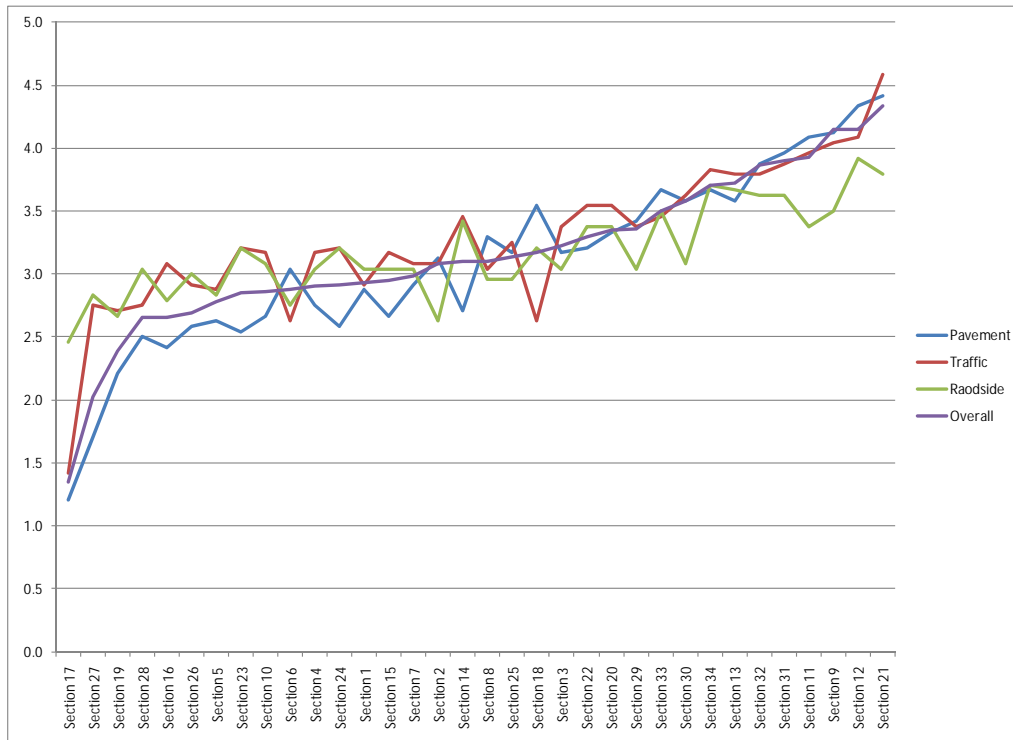


Figure 10.8: Aggregated Rating of All Sections (Overall Score)

Figures 10.9 to 10.12 show the comparative results between the ratings from the Peer Group and all other sampling groups. The results are presented per attribute, that is, the comparison of the Pavement, Traffic Operation, Roadside, and Overall ratings are presented in Figure 10.9, 10.10, 10.11, and 10.12, respectively.

It can be observed that for most of the sections evaluated and for all attributes rated as well as for the overall rating, the Peer Group rated the sections consistently lower and the Expert Group consistently higher. This finding supports the results presented in Section 4.

It is also interesting to note that the widest range in results from the lowest to the highest rated section seems to be determined primarily by the Pavement rating (Figure 10.9). On the other hand, the attribute showing the lowest variability, from the lowest to the highest, was the Roadside rating (Figure 10.11).

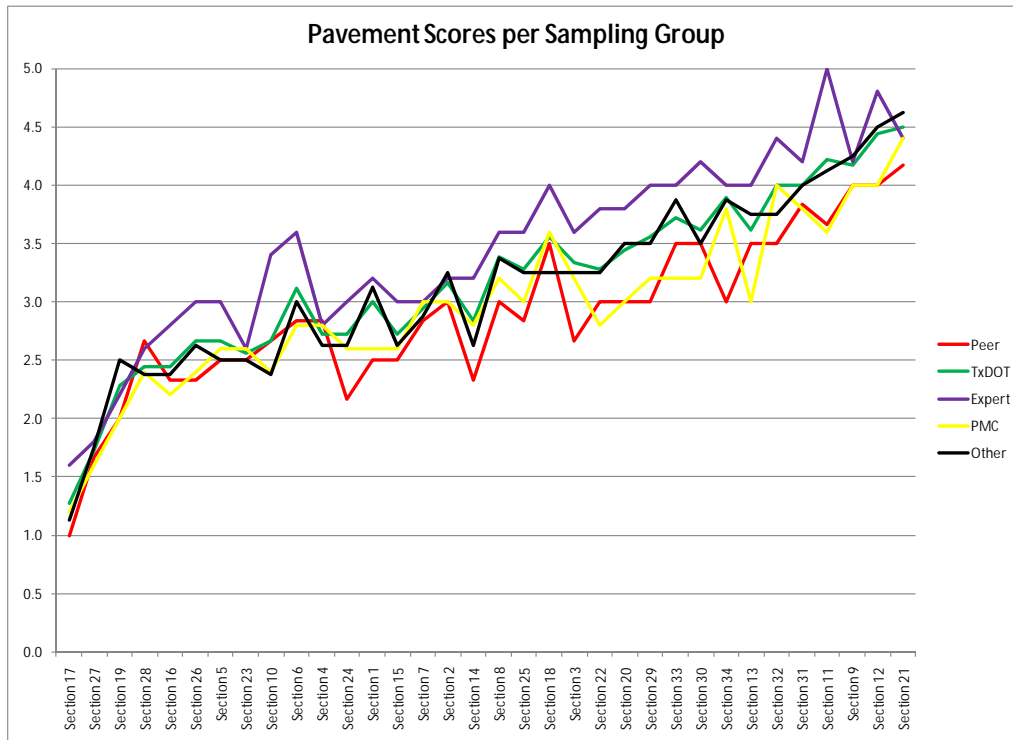


Figure 10.9: Peers versus all Groups (Pavements)

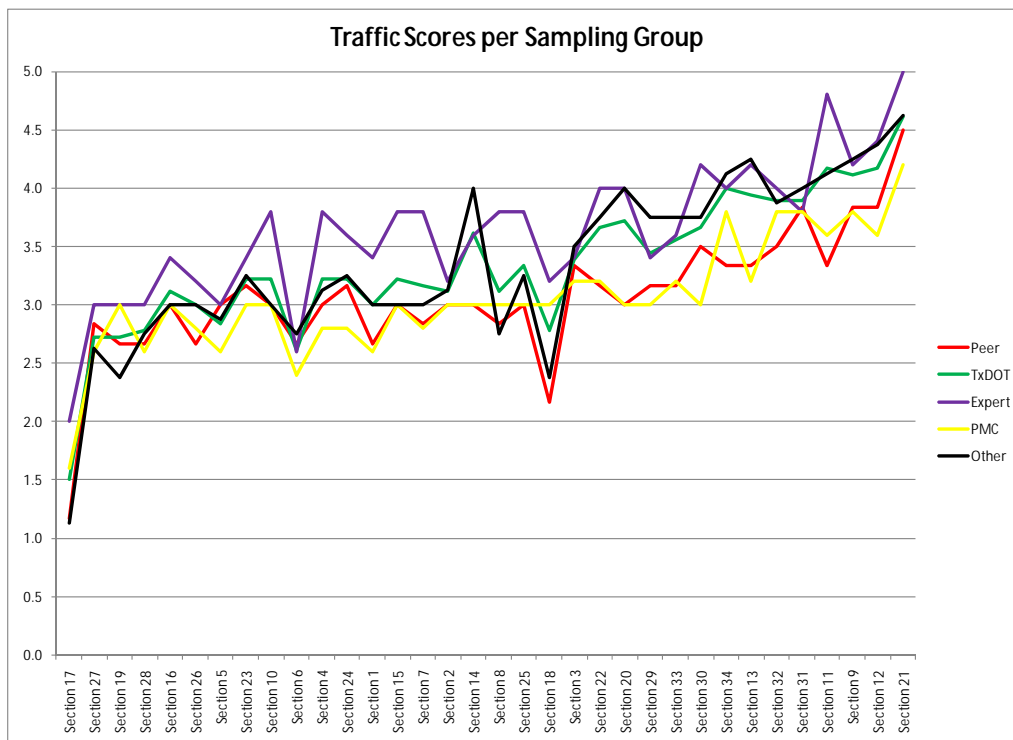


Figure 10.10: Peers versus all Groups (Traffic)

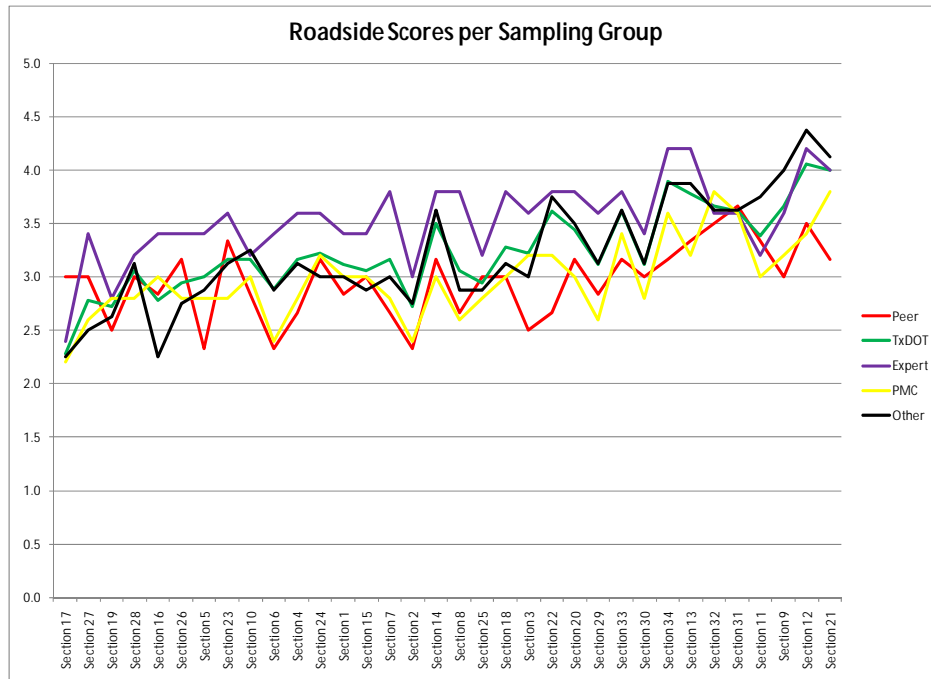


Figure 10.11: Peers versus all Groups (Roadside)

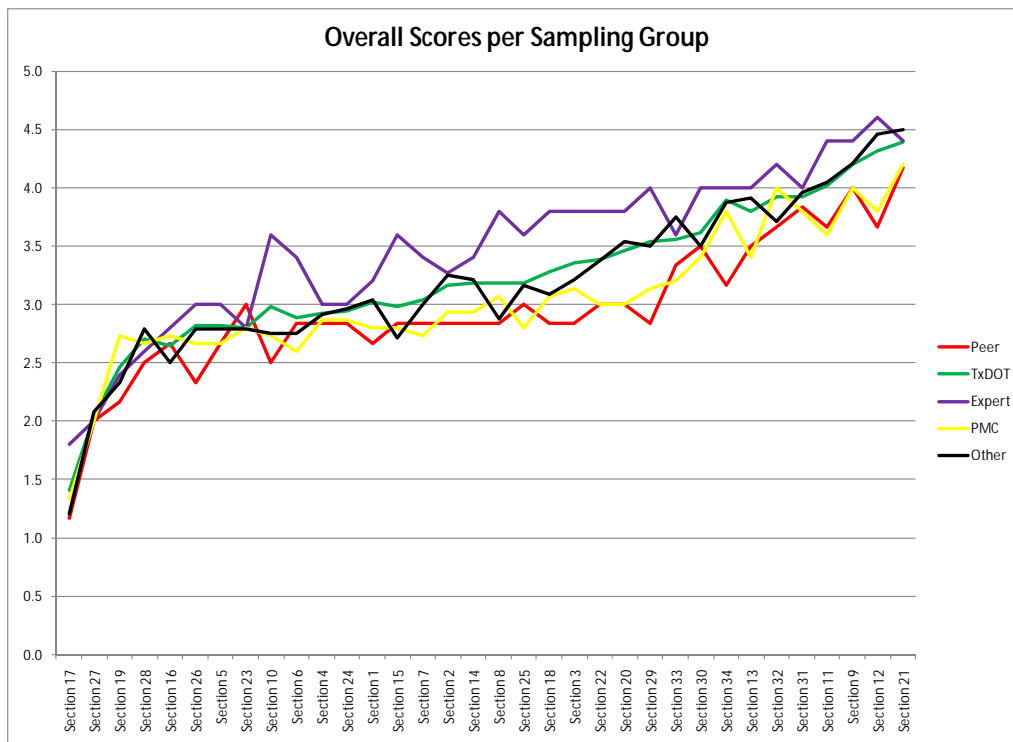


Figure 10.12: Peers versus all Groups (Overall)

The results presented in Figures 10.9 to 10.12 are quite comprehensive but the figures are somewhat crowded with information. For this reason, we disaggregated the information presented in Figure 10.12 and we presented it in Figures 10.13 to 10.16. These figures show the comparison of the ratings of the different sampling groups on a section-by-section basis. The ratings of the Peer Groups are compared with those of the Expert, PMC, Other, and TxDOT Groups in Figures 10.13, 10.14, 10.15 and 10.16, respectively. It should be noted that the group referred to as TxDOT is the aggregation of the Expert, PMC, and Other Groups.

It is apparent from the figures that the ratings of the Peer and PMC Groups are quite similar while the Expert, Other, and TxDOT Groups tends to rate the sections higher than the control group, which is the Peer Group. In order to test these observations, a series of paired t-tests were performed. The results of these statistical tests are presented in Table 10.1.

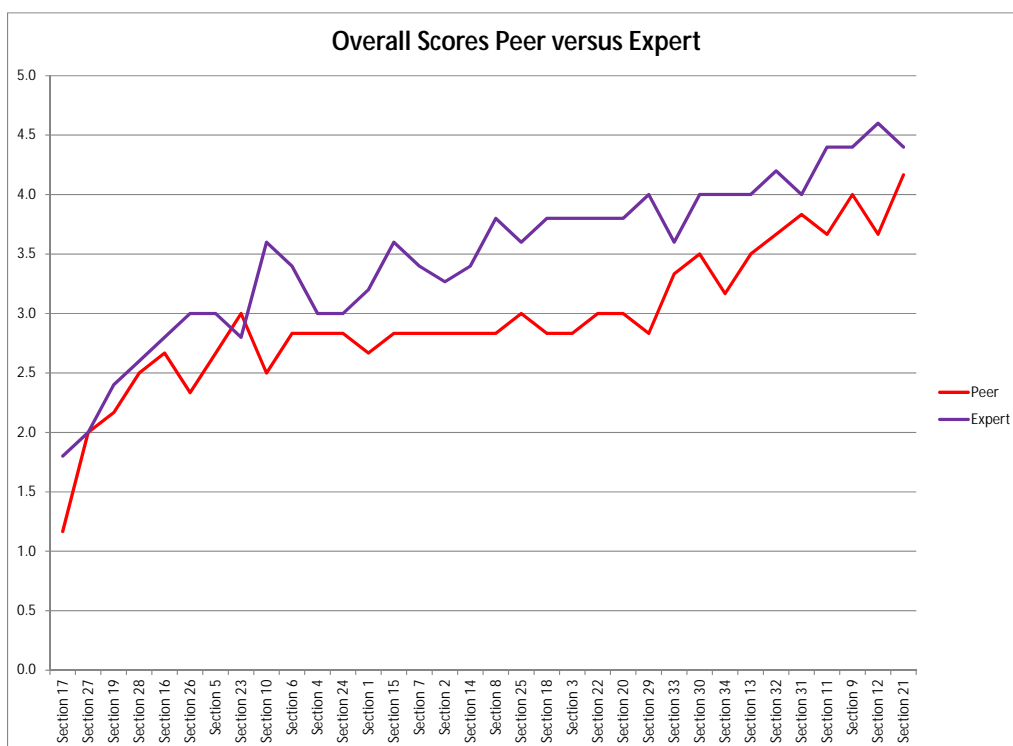


Figure 10.13: Comparison of Overall Scores of Peers vs. Expert Group

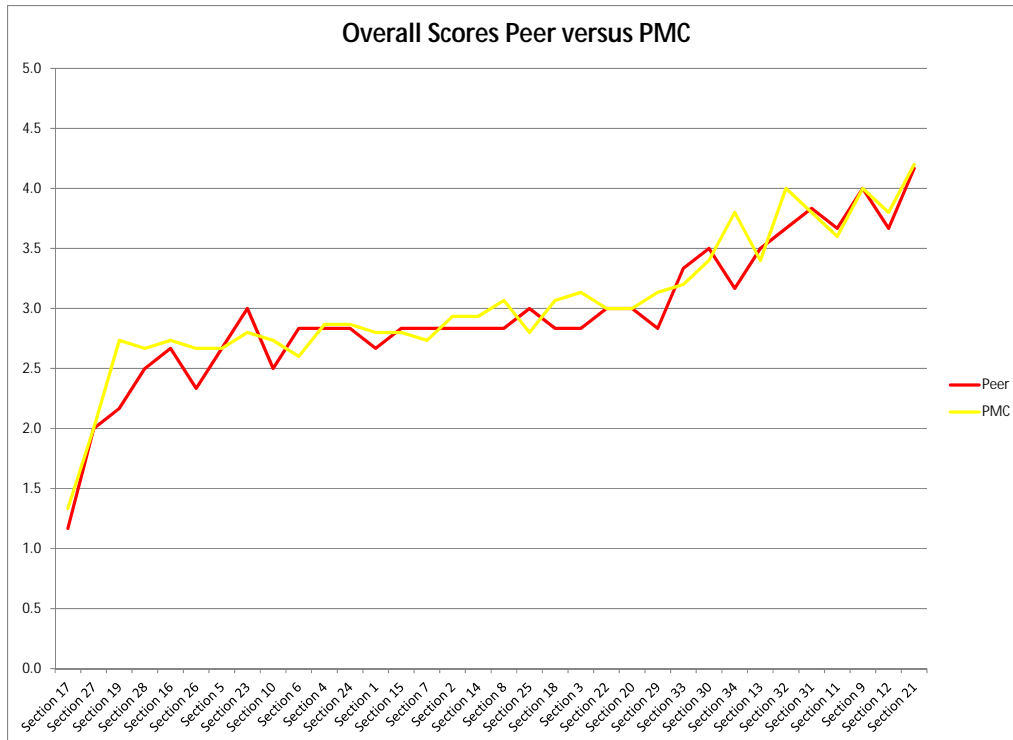


Figure 10.14: Comparison of Overall Scores of Peers vs. PMC Group

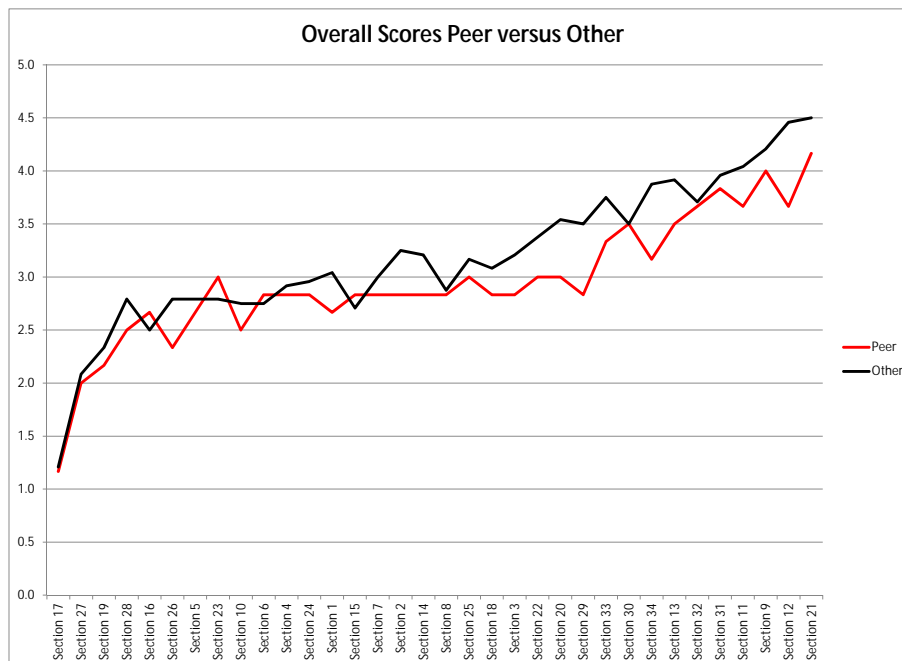


Figure 10.15: Comparison of Overall Scores of Peers vs. Other Group

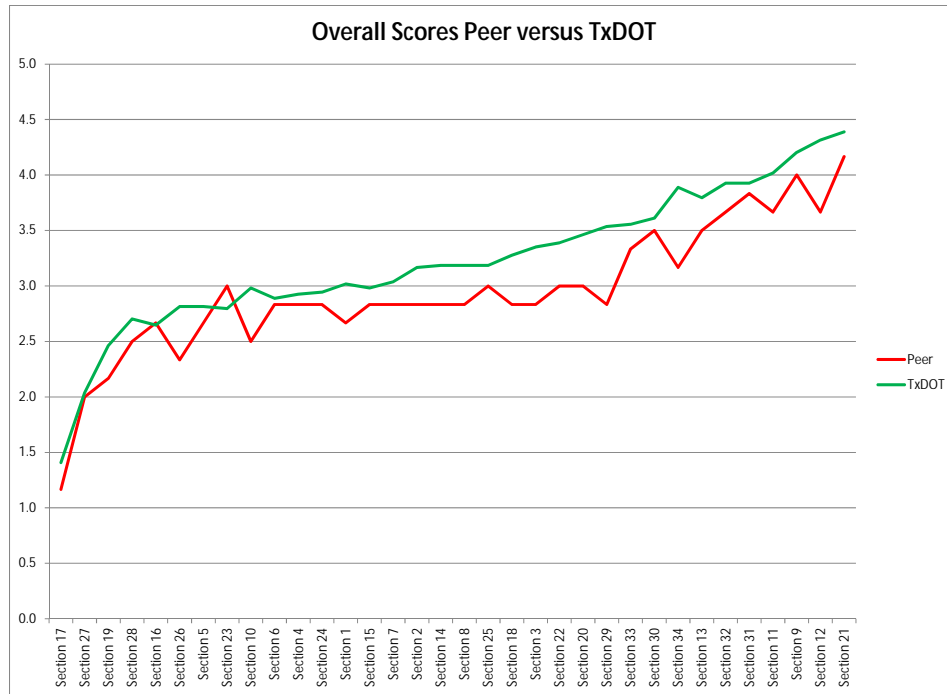


Figure 10.16: Comparison of Overall Scores of Peers vs. TxDOT Group

The pair t-test is an ideal test to compare ratings of the same sections between two different sampling groups. This very robust test does not incorporate any assumption about the distribution of the ratings. It compares the differences in the ratings for each of the sections. A negative difference means that the average rating of the Peer Group is lower than that of the group being compared. The tests were carried out at a significance level $\alpha = 5\%$, the sample size was 34 so the critical t-value is -2.03. The null hypothesis proposes that there is no difference between ratings. Rejecting the null hypothesis implies that the data suggest that the difference is significant. The results of the statistical analyses are presented in Table 10.2.

Table 10.2: Test of Hypotheses Comparing the Peer Group Overall Ratings

Group	Difference	t-statistic	Outcome	Comment
Expert	-0.53	-9.28	Reject H_0	Significant difference
PMC	-0.09	-2.49	Reject H_0	Significant difference
Other	-0.24	-5.83	Reject H_0	Significant difference
TxDOT	-0.28	-7.98	Reject H_0	Significant difference

Table 10.2 shows that in all cases the ratings by the Peer Groups are statistically lower than those of all other sampling groups. This difference is particularly large when comparing with the Expert Group: on average, the Expert Group rated the sections 0.53 points above the Peer Group. This difference is not only statistically significant but it is also quite large.

The differences with the Other and TxDOT Groups are also statistically significant and relatively important. These two groups, on average, rated the sections 0.24 and 0.28 points higher than the Peer Group. The difference in average ratings between the Peer and the PMC Group was also

statistically different but very small, less than 0.1 points. This indicates that the PMC and the Peers rated the sections quite similarly while the Expert and Other Group rated them higher on average. This supports the observations made from the observation of Figures 10.13 to 10.16.

10.6 Data of Individual Section

In this section we present all the ratings of all the attributes for some selected sections. The objective is to determine whether, for each section, there were any important differences in the ratings. We selected the following sections:

- Section 17, which represents the worst section in the sample, that is, the section receiving the lowest overall rating;
- Section 10, which represents the 25th percentile of the sections evaluated—that is, 75% of the sections are in better conditions than Section 10;
- Section 14, which represents the median. Fifty percent of the sections are in better condition and 50% of the sections are in worse condition;
- Section 20, which represents the 75th percentile of the sections evaluated; and
- Section 21, which represents the best section in the sample—that is, the section receiving the highest overall score.

Although there is a wide diversity of evaluators used in this road rally and the limited rating guidelines provided to them, Figures 10.17 to 10.21 show that there is high degree of consistency in the ratings for all sections. This is true for all sections, from the lowest rated section (Section 17, Figure 10.17) to the highest rated section (Section 21, Figure 10.21). For all sections and all attributes rated, the maximum difference between the minimum and maximum rating among the 34 individual evaluators was in general in the order of 2 points. In several cases the maximum difference was 3 points; in three cases, the difference was only 1 point, and in only one case it was up to 4 points.

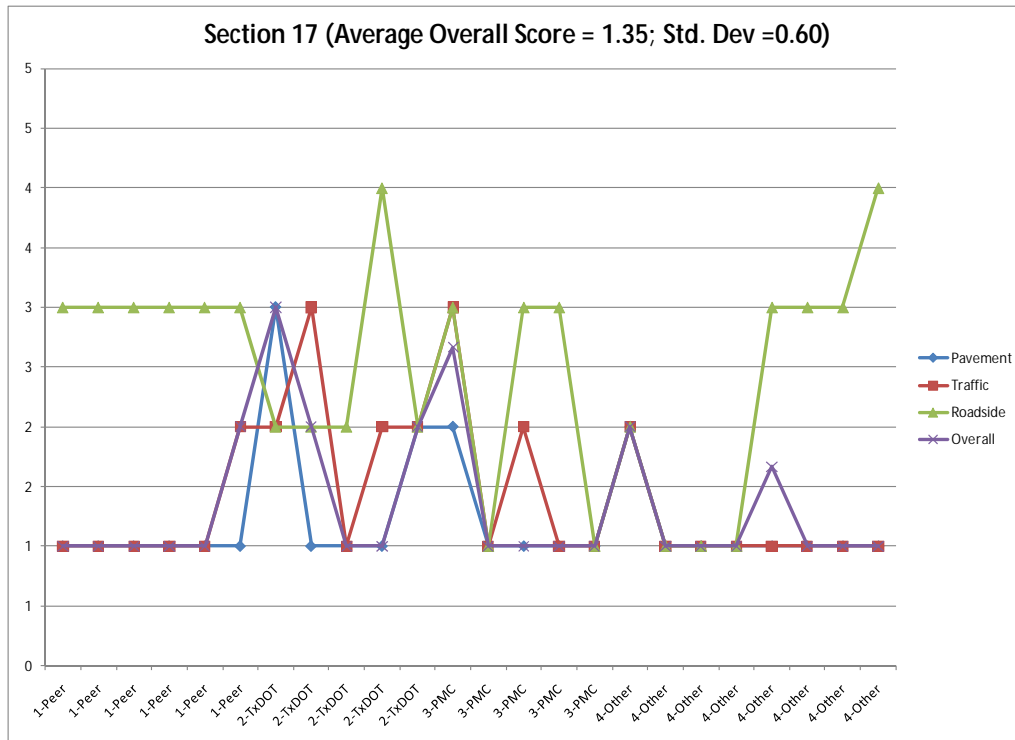


Figure 10.17: All Ratings for Section 17 (lowest)

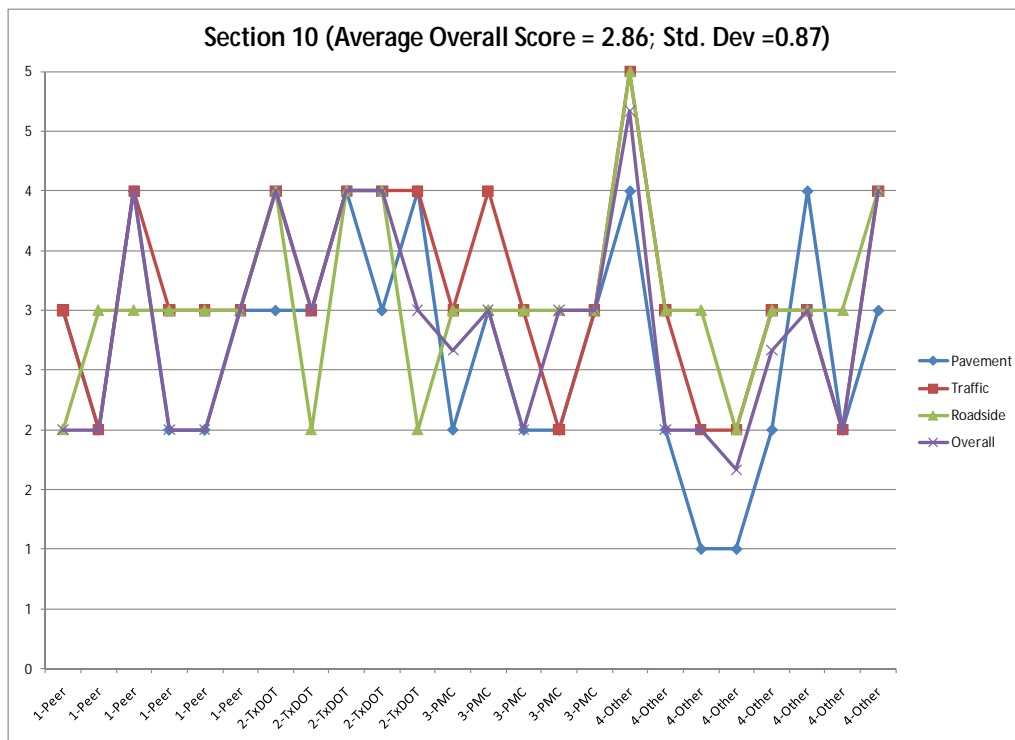


Figure 10.18: All Ratings for Section 10 (25th Percentile)

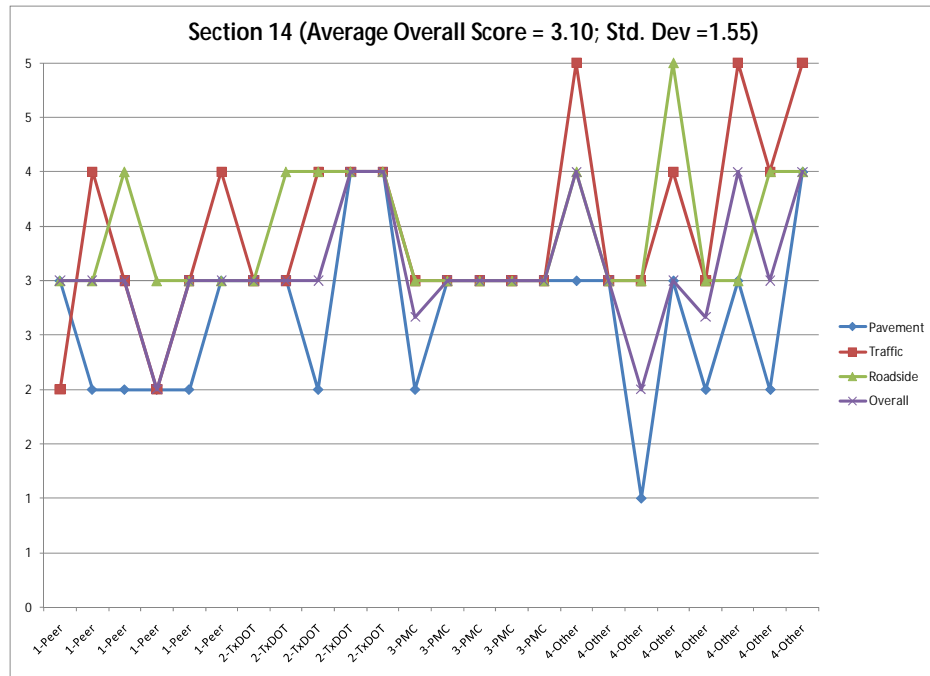


Figure 10.19: All Ratings for Section 14 (50th Percentile)

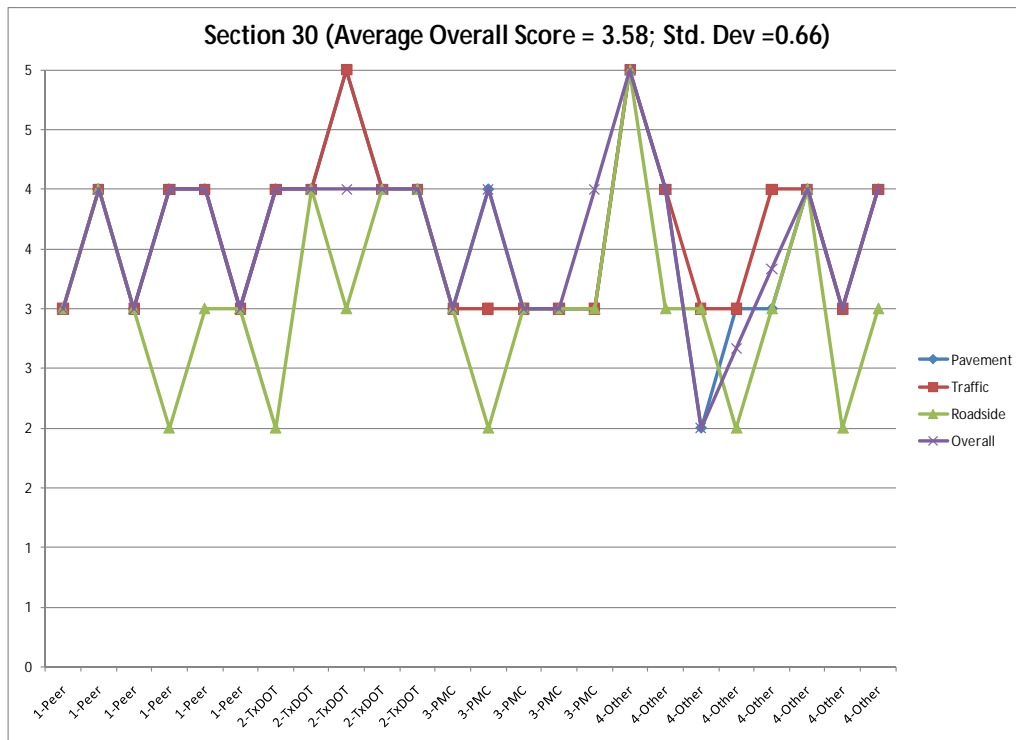


Figure 10.20: All Ratings for Section 30 (75th Percentile)

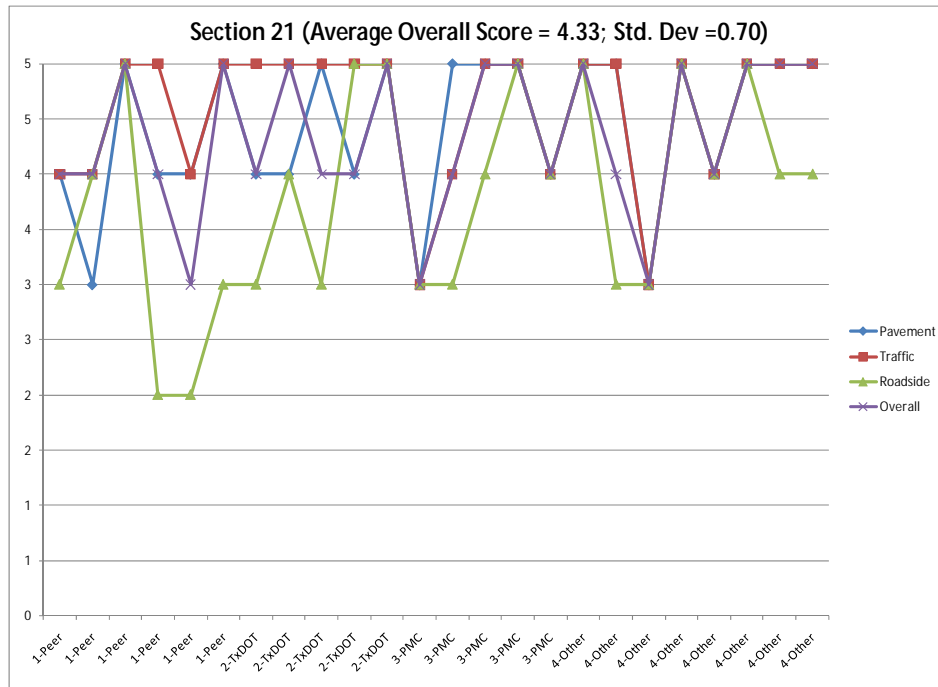


Figure 10.21: All Ratings for Section 21 (highest)

Figure 10.22 shows the distribution of the maximum difference for the 34 sections and the 4 attributes (136 ratings). It can be seen that in almost 60% of the cases the maximum difference was only 2 points between maximum and minimum rating while it was only 3 in about 40% of the cases. These statistics confirm the validity of the Road Rally, the reliability of the evaluators, and the validity of the results.

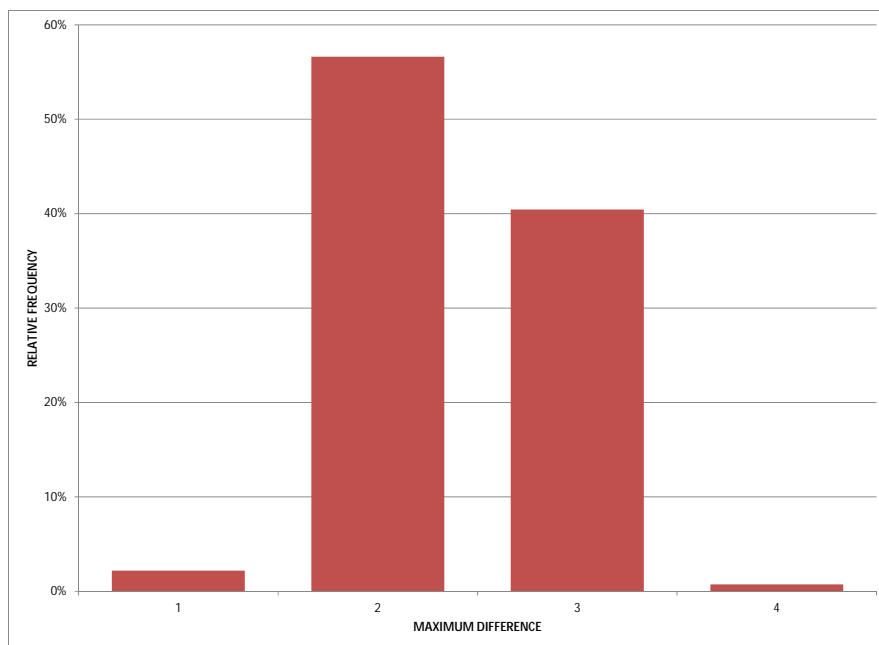


Figure 10.22: Maximum Differences in Ratings

10.7 Comparison with TxMAP Scores

Although the objective of the Road Rally was only to benchmark the maintenance practices in the state, the attributes that were evaluated were consistent with the attributes that are evaluated when TxMAP scores are determined. Furthermore, the evaluation of the pavement sections during a TxMAP evaluation is more specific and systematic, and the sections are evaluated at lower travelling speeds, allowing the raters to have a better look at the various distress types and the conditions of the various attributes evaluated. However, it is interesting to compare the rating obtained during the Road Rally to TxMAP scores.

Figures 10.23 to 10.27 display TxMAP scores for all the sections (in black) with the scores of the individual attributes (i.e. Pavement, Traffic Operation, Roadside and Overall) for each sampling group. The rating given by the Peer, TxDOT, Expert, PMC, and Other Group are given in Figures 10.23, 10.24, 10.25, 10.26, and 10.27, respectively.

A quick look at the figures reveals that the ratings of the Peer and PMC Groups seem to be below TxMAP scores. However, it is interesting to note that the ratings of the TxDOT, Expert and Other Groups seem to overlap with TxMAP scores, indicating that the evaluation of these three groups are consistent with TxMAP scores. This may not be a surprise in the case of the Expert Group because this group consists of pavement experts who are familiar with Texas network and TxDOT rating system. It is surprising, however, that the TxDOT and Other (which could be consider as the road users group) Groups seem to have predicted TxMAP scores quite well too. In order to evaluate the validity of these visual conclusions, a series of statistical analyses were conducted. The results of these analyses are presented in Table 10.3.

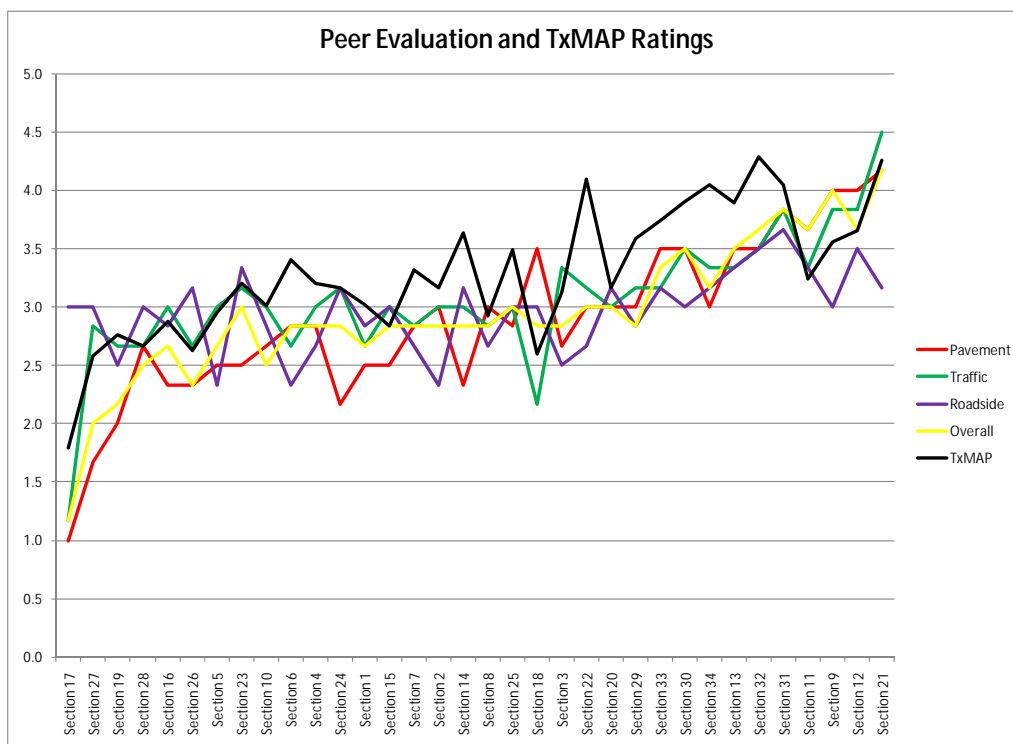


Figure 10.23: Peers Evaluation versus TxMAP Ratings

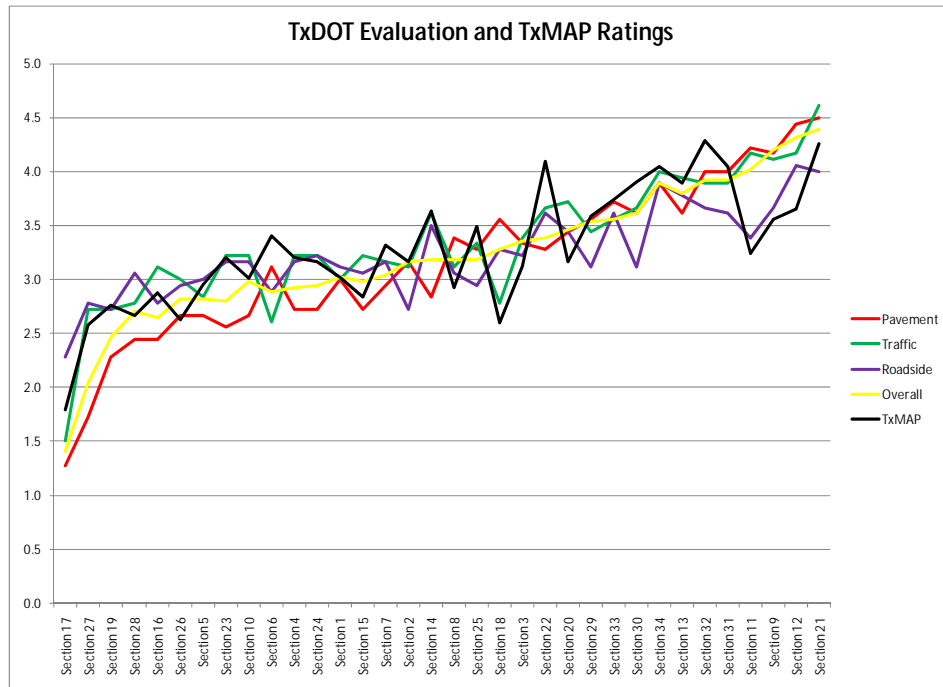


Figure 10.24: TxDOT Evaluation versus TxMAP Ratings

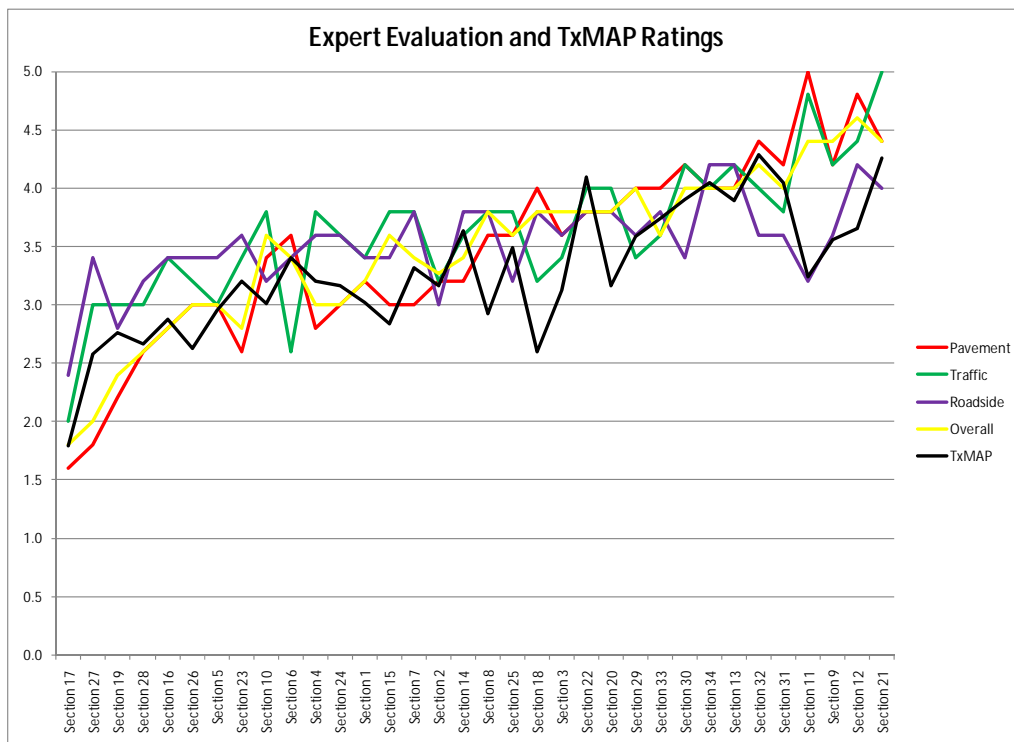


Figure 10.25: Experts Evaluation versus TxMAP Ratings

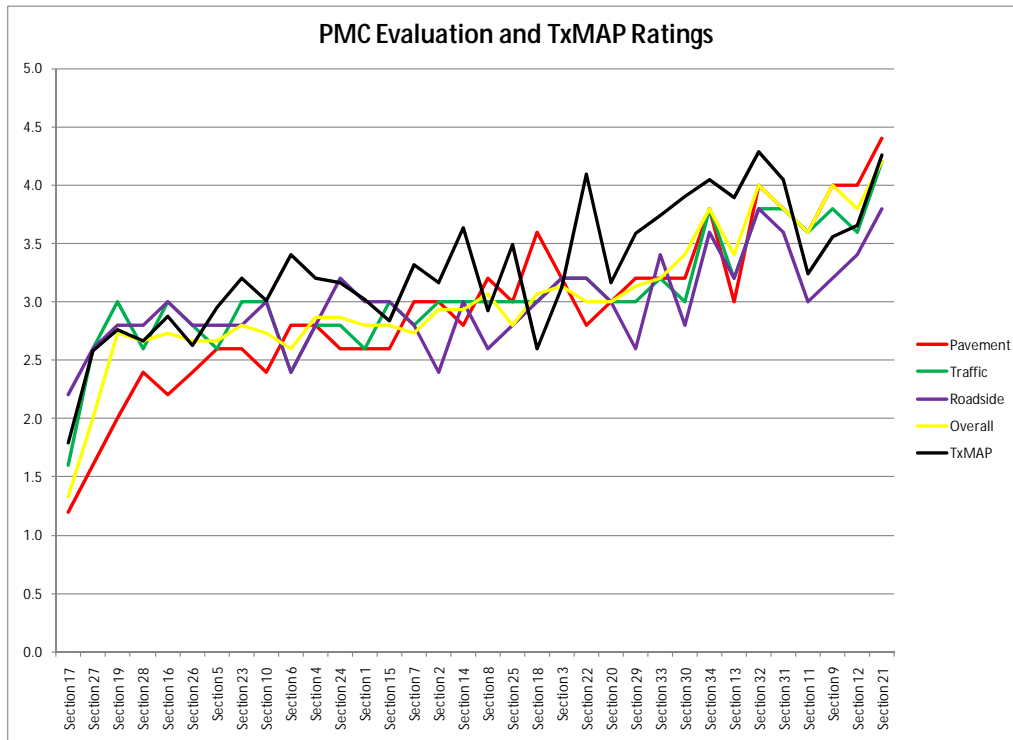


Figure 10.26: PMC Evaluation versus TxMAP Ratings

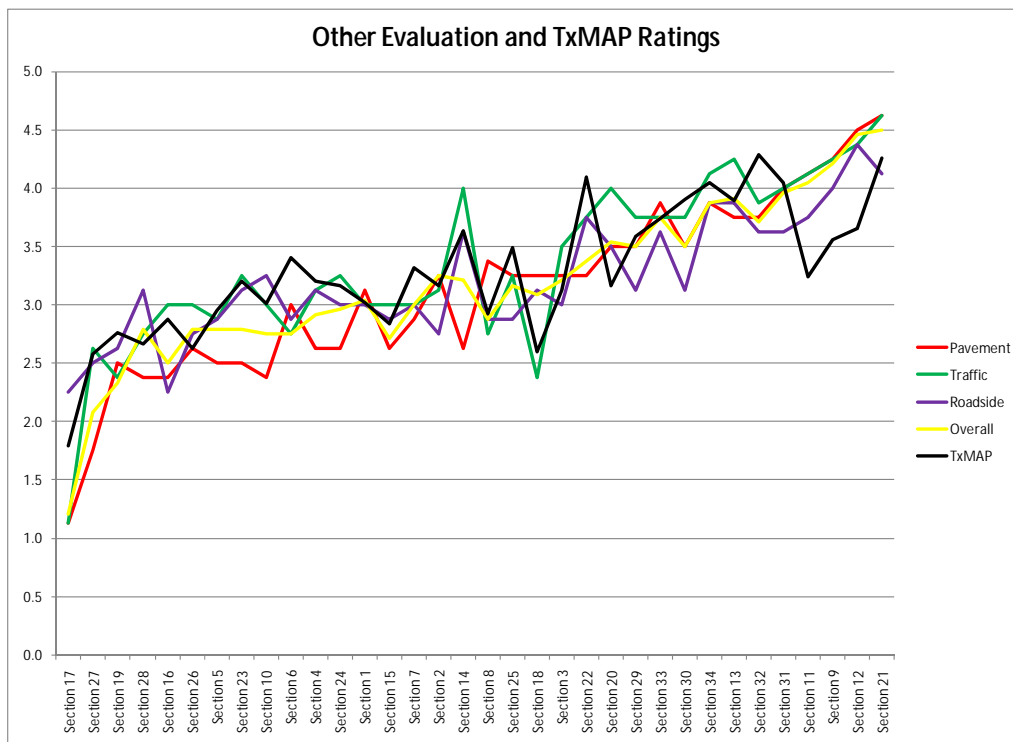


Figure 10.27: Others Evaluation versus TxMAP Ratings

To determine whether any of the ratings of the groups are good predictors of the TxMAP scores of the sections, a series of paired t-test were conducted with the data showed in Figures 10.23 to 10.27. In all cases the Overall ratings of the different sampling groups were compared with TxMAP scores. As before the significance level was 5% so the critical t-value was 2.03. A positive difference indicates that the TxMAP scores are higher, on average, than the ratings of the particular group being tested. The detailed results are presented in Table 10.3.

Table 10.3: Test of Hypotheses Comparing TxMAP Scores with Group Overall Ratings

Group	Difference	t-statistic	Outcome	Comment
Peer	0.34	5.90	Reject H_0	Significant difference
TxDOT	0.06	0.92	Cannot Reject H_0	No significant difference
Expert	-0.20	-2.50	Reject H_0	Significant difference
PMC	0.25	4.21	Reject H_0	Significant difference
Other	0.10	1.42	Cannot Reject H_0	No significant difference

As hypothesized before the testing, the ratings of the sections by the Peer and the PMC Groups are significantly lower than the TxMAP scores of the same sections. The average differences are 0.34 and 0.25 points below TxMAP scores for the Peer and PMC Groups, respectively. On the other hand, the ratings by the TxDOT and Other Groups are not significantly different than TxMAP scores. That means that the ratings of these two groups are good predictors of TxMAP scores. This particularly interesting finding seems to indicate that TxMAP scores correlate very well with the condition of the pavement sections as perceived by the general road user.

It is also interesting to know that the Expert Group was the only group whose ratings of the sections were, on average, above TxMAP scores. The average difference was 0.20 points above TxMAP scores. This difference, although statistically significant, is quite small.

It should be emphasized once again that the objective of the Road Rally was not to capture or to predict TxMAP scores; there are important differences in the way TxMAP scores are calculated and the way in which the Road Rally was conducted. The objective of the Road Rally was benchmarking only. Nevertheless, it is interesting to see that, for some of the sampling groups, the numerical values are quite close.

10.8 Preliminary Conclusions and Recommendations

The Road Rally was conducted as part of a Peer Review of TxDOT's maintenance practices on October 6, 2010. During the rally, 24 individual evaluated 34 pavement sections located east of Austin. Six of the evaluators were invited from six different peer states. The objective of the rally was to benchmark the condition of the selected sections to that of similar sections in the peer states. The rally was successful and the numerical results of the rally are valid as demonstrated by the low variability within each section and the low variability within each sampling group. The remaining 18 evaluators were TxDOT employees of different backgrounds and with different relationships to this project. For this reason, they were grouped into three sampling groups: Expert, PMC, and Other. A fourth sampling group was formed by aggregating these three groups into one. This group was called TxDOT Group.

The ratings of the sections were analyzed per sampling group and per section. In all cases, the Peer Group rated the sections lower than the other sampling groups. The differences in the ratings were most significant when compared with the Expert Group and were the smallest when compared with the PMC Group.

The ratings of the sections were also compared with the corresponding TxMAP scores. It was found that the Other and TxDOT Groups ratings were very good predictors of TxMAP scores.

In summary, the Road Rally revealed that the Peer Group rated the sections lower as compared with TxDOT personnel. The only element probably missing from the rally was the evaluation of the sections by a proper User Group. This group should consist of members of the general public, legislators, and people related to the transportation sector.

Chapter 11. Questionnaire

11.1 Introduction

The Peer State Review of TxDOT Maintenance Practices project is an effort to evaluate the potential for improvement in the existing maintenance program at TxDOT. To this end, TxDOT and CTR brought together a team of experts from other state DOTs and gave them an inside view of the practices at TxDOT. The reviewers were then asked to evaluate the different aspects of TxDOT's maintenance program based on their experience and expertise. Of the several different means through which the reviewers conveyed their opinions, one was a booklet of 15 questions. The researchers at CTR carefully designed this questionnaire to allow the reviewers considerable freedom in providing their opinions and recommendations, while ensuring that their opinions were conveyed objectively. The questions addressed the five following areas of focus:

- Maintenance Planning Process
- Four-year Pavement Management Program Development
- Maintenance Performance and Measurement Reporting
- Funding Allocation (Funding Levels and Allocation Formula)
- Overall Maintenance Operations

The booklet of questions was reviewed and approved by the Project Director and then sent to the peer review participants in August 2010, well before the workshop. The answers to the questions in the booklet were provided at each reviewer's discretion during the course of the workshop. The presentations and activities in the workshop were designed to give the peer state reviewers a comprehensive understanding of TxDOT's maintenance program to help them evaluate and answer the questions. Finally, the booklets were collected at the end of the workshop.

This chapter will summarize both the written and oral responses to the peer review questionnaire. The written data was submitted by each peer reviewer, and the oral data was captured during the Facilitated Consensus Meeting on Ratings. Each section corresponds to one of the five topics addressed by the questionnaire, and each subsection deals with one of the three questions asked about each topic. The final section of this chapter will analyze the results of the questionnaire and provide the peers' final thoughts on TxDOT's practices.

Figure 11.1 represents the averaged multiple choice ratings reported by the peer reviewers for each topic in the questionnaire:

Peer Review of TxDOT Maintenance Program						
Not Effective	Somewhat Effective	Effective			Very Effective	
Maintenance Plannning Process						
4-Year Pavement Management Plan						
Maintenance Performance Measuring and Reporting						
Funding Allocation						
Overall Maintenance Operations						

Figure 11.1: Group Consensus

11.2 Maintenance Planning Process

Question 1: Overall, how would you rate the effectiveness of the TxDOT Maintenance Planning Process? Please circle one:

- A. Very Effective
- B. Effective
- C. Somewhat Effective
- D. Not Effective

Oral Responses:

A rating of “B. Effective” was the general consensus reached during the Facilitated Consensus Meeting on Ratings, although Steve Takigawa of CALTRANS stated that he would rate the process as “C. Somewhat Effective.” He felt that pavement was TxDOT’s only real maintenance priority and that many of the maintenance personnel were probably unsure about their other maintenance goals. He suggested that because the staff puts a considerable amount of time and energy into other maintenance areas, these other maintenance concerns should have the type of clearly defined goals that pavement maintenance currently has.

Written Responses:

The written opinions of the experts are summarized in Figure 11.2.

Maintenance Planning Process				
Not Effective	Somewhat Effective	Effective	Very Effective	
Roy Risky (Kansas)				
Eric Pitts (Georgia)				
Jim Carney (Missouri)				
Jennifer Brandenburg (North Carolina)				
David Bierschbach (Washington)				
Steve Takigawa (California)				

Figure 11.2: Maintenance Planning Process

In response to Question 1, five of the written responses from the peers rated the effectiveness of the TxDOT maintenance planning process as “B. Effective.” Steve Takigawa from California did not answer this section of the questionnaire. His rating of “C. Somewhat Effective” is captured from his oral comments during the workshop.

1. Roy Risky of KDOT appreciated TxDOT’s systematic approach to maintenance based on formulas and actual measured highway system needs. He stated that “Overall I would rate the planning process as ‘B. Effective.’ You seem to have a systematic approach based on formulas and actual measured highway system needs. I still feel you would be better off having a more holistic statewide approach for you funding level and not a total distribution of funds to each district. I think that is fine for salaries, utilities expenses, routine maintenance, but not for contract maintenance dollars. I think the PMIS system condition should drive the projects and distribution of funds. After all you are rated on the entire system for a measure and I think that managing the system on a statewide bases gets you there and keeps you there more consistently.”
2. Eric Pitts of GDOT explained his rating of “B. Effective” by stating that the process seems to be working well overall.
3. Jim Carney of MoDOT responded that the current process is effective because the four-year plan to integrate the construction budget and the maintenance operating budget has yielded a result of about 87% of roads in good condition. He supported TxDOT’s decision to redirect resources from mowing and traffic activities to pavement repair, an initiative that is also part of MoDOT’s five-year plan.
4. Jennifer Brandenburg of NCDOT stated “TxDOT seems to have a well established planning process. The 4-yr pavement plan is very good. You have recognized that you can’t treat all roads equal and that is half the battle. Tier system has been very effective in NC in helping focus on the most important routes. We did have to ensure we had strategic corridors in every area of the state to ensure political support. Using scenarios and “what if” analysis to tell your story is very effective with Legislatures.”

Question 2: In your opinion, what are the two most important strengths and the two most important weaknesses of the TxDOT Maintenance Planning Process?

Strengths:

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the consensus reached was that the two most important strengths of the TxDOT maintenance planning process are:

- (1) excellent communication with the personnel working in the field, and
 - (2) the TxTAP and TxMAP programs because they collect important data every year, build the system's history, and check the performance of the maintenance staff on a regular basis. An additional third strength listed was the focus on pavement management, especially through the use of chip seals.
5. Steve Takigawa of CALTRANS was of the opinion that communication is TxDOT's biggest strength when it comes to maintenance planning; he felt that the most carefully-laid plans, data collection systems, and pavement management programs are all useless if there is a lack of clear communication between those in charge of planning and those in the field.

Written Responses:

- 6. Roy Risky responded that the two most important strengths of the TxDOT maintenance planning process are (1) the PMIS, and (2) the four-year planning process.
- 7. Eric Pitts from GDOT wrote in response to Question 2 of the questionnaire that the main strengths of TxDOT's approach to maintenance planning are (1) the accountability of managers, and (2) the managers' involvement in the planning process.
- 8. According to Jim Carney of KDOT, the two main strengths of TxDOT's maintenance planning process are (1) the emphasis on pavement preservation, especially the use of a seal coat program, and (2) the Central Office-led TxMAP and TxTAP inspection programs, which ensure statewide consistency.
- 9. NCDOT's Jennifer Brandenburg considered the process's two main strengths to be (1) the use of a 2030 Committee to evaluate the needs of the system, which she feels garners support from the industry, and (2) the use of peer reviews, which she considers an optimal method of creating enthusiasm among the district-level personnel. These two activities bring those on the industry side and those working on the district level into the planning process and promote a team effort. She cited TxDOT's recognition of each road's unique condition during the planning process as a third strength.
- 10. David Bierschbach of WsDOT considered the main strength of TxDOT's maintenance planning process to be a focus on the future rather than just the current state of the system.

Weaknesses:

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the peers agreed that the two main weaknesses of TxDOT's maintenance planning process were:

(1) a lack of consideration for performance measures, and

(2) the focus on district-wide needs rather than statewide needs. The relatively low priority given to bridge maintenance in a state with over 50,000 bridges was listed as a third weakness.

11. Additionally, NCDOT's Jennifer Brandenburg stated that although Texas may be moving toward a tier system, the lack of such a system is currently a weakness.

Written Responses:

12. In the written responses, KDOT's Roy Rissky considered TxDOT's two most important maintenance planning weaknesses to be (1) the district-driven approach to pavement preservation, and (2) the lack of recorded pavement histories.
13. GDOT's Eric Pitts wrote that he found the amount of control districts have over how and where funding will be used once it is allocated to be excessive, and he listed this surfeit of flexibility as the main weakness of TxDOT's maintenance planning process.
14. MoDOT's Jim Carney reported that the two main weaknesses of the maintenance planning process were (1) the relatively poor quality of the work-zone devices, and (2) the difficulties in maintaining consistency between districts and areas posed by the current plan to change the mowing width and number of cycles.
15. NCDOT's Jennifer Brandenburg's written response stated that the main weakness of the TxDOT planning process is the length of the four-year plan; she believes the plan to be appropriate for operations like seal coats but too short for bigger construction and rehabilitation projects.

Question 3: If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Maintenance Planning Process?

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the peers indicated that the main improvements should address the three weaknesses listed earlier.

- (1) TxDOT should tie performance measures to the planning process, plan maintenance operations according to the needs of the entire state, and make bridge maintenance a higher priority.

- (2) TxDOT should consider creating a strategic long-range plan that considers more than just pavement concerns. The strategic plan should contain contingency plans, in the event that adequate funding is not received.
16. Mr. Takigawa also thought that the system's current goals are too focused on pavements. He suggested that the other maintenance areas be assigned the type of clearly defined goals that pavement currently enjoys.
17. Roy Risky added that TxDOT has become accustomed to receiving a large amount of funding and should create a plan that will prepare the organization in case that same level of funding is no longer available.
18. Eric Pitts also suggested that TxDOT work to build up the experience of the in-house personnel in case funding for contracted operations is ever decreased.

Written Responses:

19. KDOT's Roy Risky recommended that TxDOT distribute contract preservation based on the needs of the state rather than the needs of individual districts. He suggested a more holistic state-wide approach to pavement maintenance. Because TxDOT takes the entire system into consideration when rating a measure, Mr. Risky recommended that the allocation of funds and pavement maintenance planning decisions be based on the PMIS pavement condition rating rather than a total distribution of funds to each district. He also suggested that TxDOT expand its repertoire of treatments beyond seal coats and overlays, as sometimes more expensive treatments yield better results.
20. Eric Pitts of GDOT suggested that TxDOT shift the focus of its maintenance planning process to the current needs of the system as a whole.
21. Jim Carney of MoDOT wrote that "he did not get to see what your planning process is for Bridge & large culvert maintenance. At MoDOT I am responsible for NBIS bridge inspections and establishing work items for bridge repair and painting."
22. Jennifer Brandenburg of NCDOT proposed incorporating LOS information into the planning process, using condition data to allocate resources, and holding district engineers accountable for LOS. She advocated using a tier system as such a system has been very successful in North Carolina. She stated that having strategic corridors in every section of the state has been instrumental to ensuring political support in North Carolina. Based on these experiences, she recommended that TxDOT use scenarios and hypothetical analyses to communicate information about the district and its needs with the state legislature.
23. David Bierschbach of WsDOT responded that planning should be more closely tied to performance measures.

11.3 Four-year Pavement Management Program Development

Question 1: Overall, how would you rate the effectiveness of the TxDOT 4-Year Pavement Management Program Development process? Please circle one:

- A. Very Effective**
- B. Effective**
- C. Somewhat Effective**
- D. Not Effective**

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, a consensus on this rating was not decided upon, but the peers generally agreed that a rating of “B. Effective” was a compromise between their varied opinions.

- 24. Mr. Risky explained that although the four-year plan seems very effective at the current time, the assessment may be premature.
- 25. Steve Takigawa of CALTRANS rated the process “C. Somewhat Effective” because he felt a higher rating would mean there is no room for improvement.
- 26. Eric Pitts of GDOT stated that involving the districts in the development of the plan was an excellent way to begin the process. He said he believes the program will be effective because it provides a direction for TxDOT as a whole, although he feels that years three and four of the plan are still uncertain entities.

Written Responses:

The written ratings of the Four-year Pavement Management Plan are illustrated in Figure 11.3.

4-Year Pavement Management Plan				
Not Effective	Somewhat Effective	Effective	Very Effective	
Roy Risky (Kansas)				
Eric Pitts (Georgia)				
Jim Carney (Missouri)				
Jennifer Brandenburg (North Carolina)				
David Bierschbach (Washington)				
Steve Takigawa (California)				

Figure 11.3: Four-year Pavement Management Plan

In response to Question 1, two of the peers (Roy Rissky, KDOT; and Jennifer Brandenburg, NCDOT) responded “A. Very Effective” and three (Eric Pitts, GDOT; Jim Carney, MoDOT; and David Bierschbach, WsDOT) responded “B. Effective.” Steve Takigawa of CALTRANS responded, “C. Somewhat Effective.”

27. Mr. Rissky wrote that the Four-year Pavement Management Plan should be very effective in the future, as it will require TxDOT to plan out future maintenance operations while allowing flexibility in the event of changing pavement conditions or levels of funding.
28. Mr. Pitts commented that four-year plans tend to be very good for DOTs. Once the initial planning stages are completed, these plans allow managers to prepare for the future.
29. Mr. Carney appreciated that TxDOT’s district offices have worked together with the central office to develop the plan.
30. Mr. Bierschbach explained his rating of “B. Effective” by writing that the Four-year Plan has a strong research and data collection program.
31. Mr. Takigawa wrote that he had rated the plan as only “C. Somewhat Effective” because he believes TxDOT should use deterioration curves developed from good cross-section measurements and consistent pavement condition measurements, rather than just relying on assumptions. He also expressed confusion over the measurements used to trigger preventative maintenance treatments. Mr. Takigawa felt the program was somewhat effective, however, as a consideration of long-term goals is a positive move for TxDOT. He also felt the plan communicates roles and responsibilities to the field.

Question 2: In your opinion, what are the two most important strengths and the two most important weaknesses of the TxDOT 4-Year Pavement Management Program Development process?

Strengths:

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, this question was omitted.

Written Responses:

In the written responses,

32. Roy Rissky of KDOT listed (1) its ability to provide the districts with a process to follow and manage, and (2) its flexibility in the third and fourth years as the Four-year Pavement Management Program’s two major strengths.
33. Jim Carney of MoDOT considered the program’s two primary strengths to be (1) the coordination between maintenance contracts with in-house maintenance efforts, as this practice seems to be keeping the roads in Texas in good condition, and (2) the use of well-maintained cost records to support the budget. Mr. Carney listed the peer exchange

process between districts as a third strength of the program and suggested that the process may be a means of improving performance consistency.

34. David Bierschbach from Washington reported the two main strengths of the program to be (1) the high-priority position the program enjoys in Texas, and (2) the program's ability to increase the understanding of the state's pavement system.
35. Jennifer Brandenburg of NCDOT wrote that the two main strengths of the Four-year Pavement Management Program are (1) the use of contract raters, which eliminates bias, and (2) the use of analysis tools like Mapzapper and ProviewLite, which provide district personnel with visual representations of their plans.
36. California's Steve Takigawa reported that the two main strengths of the program are (1) its ability to communicate roles and responsibilities to the field, and (2) the mapping of the four-year plan. He considered the program's focus on the long-term goals to be an overall strength.

Weaknesses:

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, this question was omitted.

Written Responses:

37. Steve Takigawa of CALTRANS was the only peer reviewer to provide written input on the weaknesses of the program. He listed the top two weaknesses of TxDOT's Four-year Pavement Management Program as (1) the use of visual condition ratings and the opinions of expert staff members to make pavement decisions rather than the use of data and condition surveys or deterioration curves, and (2) the current reporting system's inability to effectively communicate the financial needs of the DOT to legislatures. Additionally, Mr. Takigawa wrote that the lack of deterioration curves and pavement substructure data is another weakness of the program. He was also concerned that some of the mapping represents data that is incorrect or not credible and suggests performing quality checks.

Question 3: If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT 4-Year Pavement Management Program Development process?

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the peers agreed that:

- (1) The first change that should be made to the four-year program is to shift the plan to a statewide focus.

38. Steve Takigawa of CALTRANS advocated planning according to the needs of the state as a whole rather than creating plans based on the amount of inventory in each district.
39. Eric Pitts seconded Mr. Takigawa's suggestion.
- (2) The second most important change TxDOT should make, as per Mr. Pitt's initial suggestion and the peers' consensus, is to increase the amount of flexibility built into the program in the event of an unforeseen occurrence, such as an unusual amount of rain, freezing temperatures, or drought.
 - (3) The peers agreed that the third change TxDOT should make is to follow Mr. Takigawa's recommendation that each person be held accountable for his or her specific goal, as detailed by the four-year plan. The peers agreed that the plan should be broken down into specific goals for each person in TxDOT, and then that person should be held accountable for meeting those goals.
40. Mr. Takigawa also suggested plotting these goals on a map and praised the current mapping of the plan. Additionally, he recommended limiting the amount of control the districts have over the funding they receive; resources should be allocated to specific needs and then used to treat those needs in a manner selected for the four-year plan.
41. Roy Rissky of KDOT also proposed that TxDOT do more to consider ride, as he believes ride is of great importance to the public.

Written Responses:

42. Kansas's Roy Rissky was of the opinion that the program should not be changed until it has been in effect for a longer period of time. He felt that using the program would be the most effective means of discovering its flaws and perfecting it.
43. Georgia's Eric Pitts wrote that the program should provide more flexibility to change projects based on actual conditions. He also stressed that TxDOT should continue making efforts to improve the data for years three and four of the program, as the four-year plan will not be sustainable unless this data is improved.
44. Jennifer Brandenburg of North Carolina said she would not change anything about the program at this time.
45. Washington State's David Bierschbach recommended changing the pavement rating method from one utilizing contract raters to one using in-house staff or technology, as the two latter methods would increase consistency.
46. Steve Takigawa from California suggested using the one-year, five-year, and ten-year cost projections to meet the program's goals. He felt that the current system could do more to communicate the resources required to meet its goals. He also recommended using a tiered approach to pavements. Mr. Takigawa stressed the need for increased tracking and accountability and suggested that each layer of the four-year plan be communicated to the staff member or members responsible for its completion. He wrote

that TxDOT should make a goal of having a deterioration model or curve for every section of pavement in the system and should therefore focus on gathering historical pavement conditions and cross-section data. Finally, Mr. Takigawa suggested researching methods to improve pavement condition ratings and recommended switching to an automated crack measuring system.

11.4 Maintenance Performance Measurement and Reporting

Question 1: Overall, how would you rate the effectiveness of the TxDOT Maintenance Performance and Reporting? Please circle one:

- A. Very Effective**
- B. Effective**
- C. Somewhat Effective**
- D. Not Effective**

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the consensus reached by the peers was a rating of “C. Somewhat Effective.”

- 47. David Bierschbach of WsDOT clarified his rationale for agreeing with the “C. Somewhat Effective” rating by explaining that the measurements used in this process are very effective, but the communication of what those measurements are and what they mean to the legislature and the public needs improvement.
- 48. North Carolina’s Jennifer Brandenburg expressed concern over the lack of consistency between the information reported using three different systems (PMIS, TxMAP, and TxTAP). She stressed the need to compile the information from each system into one consistent message.
- 49. Steve Takigawa from CALTRANS added that the information received from these systems needs to be made actionable. He was concerned that the current system is too focused on collecting and reporting data, rather than using the data collected to make decisions.

Written Responses:

Three reviewers (Eric Pitts, GDOT; Jim Carney, MoDOT; and David Bierschbach, WsDOT) rated TxDOT maintenance and reporting as “B. Effective.” Steve Takigawa of CALTRANS and Jennifer Brandenburg of NCDOT rated the maintenance performance and reporting as “C. Somewhat Effective,” while Kansas’s Roy Rissky considered the system to be “A. Very Effective.” These ratings are reflected in Figure 11.4.

Maintenance Performance Measurement and Reporting				
Not Effective	Somewhat Effective	Effective	Very Effective	
Roy Rissky (Kansas)				
Eric Pitts (Georgia)				
Jim Carney (Missouri)				
Jennifer Brandenburg (North Carolina)				
David Bierschbach (Washington)				
Steve Takigawa (California)				

Figure 11.4: Maintenance Performance Measurement and Reporting

50. Roy Risky of KDOT appreciated the three different tools that are being used for performance measurement, namely PMIS, TxMAP, and TxTAP; however, he reinforced the need to be consistent with the results of the three systems.
51. Jim Carney of MoDOT wrote that TxMAP uses a process very similar to MoDOT's IMQA spring and fall reviews on interstates, which led him to the conclusion that TxDOT's measurement and reporting is effective.
52. North Carolina's Jennifer Brandenburg clarified her rating of "C. Somewhat Effective" by focusing on the problems with TxDOT's rating system. She pointed out that 4,100 samples would not be sufficient to ensure statistically reliable condition ratings at the local level. She questioned the detail level in the TxTAP rating system, indicating that TxDOT may be rating an unnecessarily high number of traffic features and should scale down to reduce redundancy.
53. David Bierschbach of WsDOT wrote that the current process is effective in that it is well understood by the staff.
54. Steve Takigawa of CALTRANS reported that the current performance measurement and reporting system is only somewhat effective because it measures an unnecessary number of activities, which makes it difficult for the field crews to meet all of their goals. He expressed concern over whether or not all of the activities included in the ratings could possibly be funded to a level that would allow the desired ratings to be achieved.

Question 2: In your opinion, what are the two most important strengths and the two most important weaknesses of the TxDOT Maintenance Performance and Reporting?

Strengths:

Oral Responses:

The overall consensus from the peers was that the two main strengths of TxDOT's maintenance performance and reporting are

- (1) the centrally-managed TxMAP and TxTAP systems, and
- (2) the year-round rating practices utilizing consistent raters.

At this point in the session, the peer reviewers and the TxDOT participants discussed the number of samples required to produce an accurate pavement condition rating, and there was some disagreement over this number.

- 55. Jennifer Brandenburg from North Carolina opined that the number of samples currently used in Texas is not sufficient if staff members are going to be held accountable for the ratings gathered. She felt that TxMAP and TxTAP required more samples than they were currently using. Several participants then commented that North Carolina may be taking an excessive number of samples.
- 56. Steve Takigawa of CALTRANS added that the number of samples needed was dependent on how the data was being used; if the samples are used strictly for planning purposes, the data needs to be reliable for the system as a whole, but if it is used for accountability, each group being measured needs enough samples from their area to provide statistically reliable data on their actions.

Written Responses:

- 57. Roy Rissky of KDOT judged the two most important strengths of TxDOT's maintenance performance and reporting to be (1) the strength of TxDOT's historical information, which allows system trends to be discovered and supported by actual data, and (2) the statistical quality of TxDOT's historical data.
- 58. Georgia's Eric Pitts found the most important strength to be the limited number of people performing evaluations, which allows increased control over the data.
- 59. MoDOT's Jim Carney responded that the two most important strengths of this system are (1) the increased level of consistency provided by a large number of samples and the statewide quality control performed by central office staff, and (2) the high quality of the roadway and roadside condition assessments due to TxDOT's one-mile drive-by samples.
- 60. NCDOT's Jennifer Brandenburg found the two most significant strengths of TxDOT's practices to be (1) the increased level of consistency provided by year-round ratings and a small staff, and (2) the use of peers to evaluate other districts and review data. She wrote

that she plans to implement the use of peer reviews in her own programs. Ms. Brandenburg also listed the high level of detail in the sign reports as a third strength.

61. David Bierschbach of WsDOT wrote that the two main strengths are (1) the use of a small group of trained raters to increase the level of consistency, and (2) the practice of giving feedback to the districts immediately after ratings are completed.

Weaknesses:

62. KDOT's Roy Rissky identified the lack of data covering historical actions on the current pavement layers as the main weakness. This lack of data reduces TxDOT's ability to predict future actions using existing pavement performance records.
63. According to Eric Pitts of GDOT, the main strength of the system is also its primary weakness: a limited number of people performing the evaluations allows for increased control over the data, but it also prevents the districts from becoming involved in the process. If the district staff were more involved, they would be more likely to accept the reports produced from the evaluations.
64. Jim Carney of MoDOT reported that the system's main weakness is the drive-by sampling process, which cannot provide a comprehensive review of features like pipe drainage, edge drop-off, or break-away signpost details.
65. Jennifer Brandenburg of NCDOT found the two main weaknesses of TxDOT's maintenance performance and reporting to be (1) the statistical unreliability of the sample size used for TxTAP, and (2) the unnecessary level of detail in the TxTAP evaluations.

Question 3: If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Maintenance Performance and Reporting?

Oral Responses:

66. Georgia's Eric Pitts stated that the ratings would be even stronger in Texas if the central office staff went out with the district staff to produce a collaborative rating, rather than the districts just handing in a report. Collaboration between the two would produce more consistent ratings.
67. Jim Carney of MoDOT suggested that the current weighting of traffic and roadside in TxDOT's PMIS be flipped. Currently, the weighting is 50% to pavement, 20% to traffic, and 30% to roadside; Mr. Carney recommended switching traffic to 30% and roadside to 20%.
68. Steve Takigawa of CALTRANS advised TxDOT to consider how performance measures might be more closely tied to allocations and pavement decisions.
69. Roy Rissky from Kansas stressed the importance of collecting work history data in order to calculate service life for the treatments used. He stated that if TxDOT knew how long past actions have lasted, the maintenance performance would be much improved.

Written Responses:

70. Mr. Risky stressed the importance of recording location-specific information about pavement actions through both district records and coring. This data would enable the system to predict the action that should be taken based on a current condition score and the historical performance of a suggested action.
71. Mr. Pitts highlighted the need for district involvement in the review process, especially in their own areas. When rating others' areas, raters tend to be more critical, but when district personnel rate their own area, they then have an opportunity to objectively compare their performance with that of other districts.
72. Mr. Carney suggested changing the weighting factors in TxDOT's PMIS to 50% for pavement condition, 30% for traffic, and 20% for roadside. His rationale was that, excepting guardrails and guard cables, traffic features affect the safety of motorists more than roadside features, and safety should be the first priority.
73. Ms. Brandenburg suggested that TxDOT increase the sample size and reduce the number of features being rated, especially for TxTAP but possibly also for TxMAP. She added that the data should be used to hold the districts accountable for the condition of the system.
74. Mr. Bierschbach advocated the use of TxMAP to educate the legislature and communicate TxDOT's needs to them so that they will be able to justify increased spending on transportation.
75. Mr. Takigawa found TxDOT's system to be too detailed and suggested defining the top 5 to 10 activities and creating corresponding performance rating goals. He recommended making the priorities of the maintenance program clear. Additionally, Mr. Takigawa recommended using the system to take specific actions based on the results obtained, as any item that is being rated but is not actionable is a wasted resource and should be eliminated. He felt the current system was being used more as a reporting tool than a decision-making tool.

11.5 Funding Allocation (Funding Levels & Allocation Formula)

Question 1: Overall, how would you rate the effectiveness of the TxDOT Funding Allocation (Funding Levels and Allocation formula) process?

- A. Very Effective**
- B. Effective**
- C. Somewhat Effective**
- D. Not Effective**

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the peers reached the consensus of a "C. Somewhat Effective" rating for TxDOT's funding allocation process. Missouri's Jim Carney agreed to the rating with the caveat that TxDOT's process is very good for routine maintenance.

Written Responses:

The written responses to this question were equally divided between “B. Effective” and “C. Somewhat Effective.” Steve Takigawa (CALTRANS), Roy Rissky (Kansas), and Jennifer Brandenburg (North Carolina) rated the TxDOT’s funding allocation process as “C. Somewhat Effective.” Eric Pitts (Georgia), Jim Carney (Missouri), and David Bierschbach (Washington) rated the process as “B. Effective.” These results are represented in Figure 11.5.

Funding Allocation				
Not Effective	Somewhat Effective	Effective	Very Effective	
Roy Rissky (Kansas)				
Eric Pitts (Georgia)				
Jim Carney (Missouri)				
Jennifer Brandenburg (North Carolina)				
David Bierschbach (Washington)				
Steve Takigawa (California)				

Figure 11.5: Funding Allocation

76. Kansas’s Roy Rissky explained that his rating was actually split: although the system has been effective in the past, he believes the current system would be only somewhat effective in the future. According to Mr. Rissky, pavement maintenance systems have a high dependency on the availability of funds. Given the recent downturn in the overall economy, he doubted the effectiveness of TxDOT’s funding allocation system if the funding becomes considerably diminished. He stated that TxDOT may face difficult decisions if additional funding sources are not determined to support the current maintenance plans. He believes TxDOT’s funding allocation process should be switched to a statewide needs-based process to increase efficiency and the effectiveness of the maintenance program.
77. Jennifer Brandenburg’s reasons for rating the funding allocation process “C. Somewhat Effective” were different. She thought the formulae for funding were unnecessarily complex, as they used 56 specific functions in determining funds allocation. As a comparison, she highlighted NCDOT’s use of a more general formula in which funds are allocated throughout the state and the divisions are then accountable for achieving the desired Level of Service. Ms. Brandenburg also suggested TxDOT reduce the amount of control districts have over their own funding; although headquarters funds specific projects judged to be important, districts have the freedom to spend the funding on projects other than those selected by headquarters. She felt that funds should be used on the projects for which they were allocated. Ms. Brandenburg also wrote that using the terms “tolerable” and “desirable” to describe the various levels of service the legislature

could fund is ineffective and misleading. For comparison, she reported that NCDOT releases one figure to the legislature and insists that the department needs that amount of funding to achieve the desired level of service; the legislature is then left to choose a lower level of funding, rather than being given that lower level as an initial option. Ms. Brandenburg feels that the NCDOT system is more politically efficacious because it sends the legislature a strong, clear message of the department's needs.

78. Steve Takigawa of CALTRANS focused on the lack of improvements that the current allocation process aims to achieve in any activities or areas, suggesting that the current budget has not improved upon the previously derived budgets.

79. MoDOT's Jim Carney was interested to see all the district and activity breakdowns.

80. WsDOT's David Bierschbach noted the effectiveness of the current funding allocation approach with regards to the sustainability of the TxDOT maintenance program.

Question 2: In your opinion, what are the two most important strengths and the two most important weaknesses of the TxDOT Funding Allocation (Funding Levels and Allocation formula) process?

Strengths:

Oral Responses:

81. GDOT's Eric Pitts responded that the primary strength of TxDOT's funding allocation process is that the formulas make the process easily repeatable and reportable.

82. Steve Takigawa of CALTRANS stated that the use of a reasonable check to ensure that the districts could actually use the funding they were allocated was an excellent component of the process.

The peer from WsDOT, David Bierschbach, replied that the strength of the program lies in the formulas, as they allow the districts to easily plan.

Written Responses:

83. Roy Rissky of KDOT considered the primary strength of the funding allocation program to be its effectiveness for routine maintenance needs.

84. Eric Pitts of GDOT appreciated the process's repeatable and defensible setup.

85. MoDOT's Jim Carney felt the two main strengths of the funding allocation process to be (1) the separation of preservation cycles by traffic volume and average rainfall, and (2) the high level of detail in the pavement selection criteria.

86. NCDOT's Jennifer Brandenburg listed the separate funding allocation for pavement rehabilitation as the program's main strength.

87. WsDOT's David Bierschbach reported that TxDOT has a well-defined process for funding allocation that will facilitate districts in planning for a consistent budget each year based on inventory.

Weaknesses:

Oral Responses:

88. GDOT's Eric Pitts responded that the main weakness of the funding allocation process is the lack of a state-wide approach.
89. Jennifer Brandenburg of North Carolina found the process's primary weakness to be the lack of connection between funding and pavement condition, and Washington State's David Bierschbach seconded this conclusion.
90. Kansas's Roy Risky felt the main weakness to be the practice of allocating funds without considering the actual needs of the district. He suggested that some districts may be using funds simply because they have been allocated that money, rather than because they truly needed the funds they received more than other districts.

Written Responses:

91. Roy Risky (KDOT) considered the funding allocation process's primary weakness to be the reliance on contracted maintenance, as he believes the amount of funding TxDOT will receive in the future will not be sufficient to fund all of the maintenance needs as contract work.
92. Eric Pitts (GDOT) identified the main weakness of the funding allocation process to be the reliance on historical funding data to distribute funds rather than the current known needs of the system.
93. Jim Carney (MoDOT) considered the two main weaknesses of the process to be (1) the unnecessarily high number of roadside factors included in the formulae, and (2) the lack of emphasis on bridge maintenance.
94. Jennifer Brandenburg (NCDOT) reported that the two primary weaknesses of the process are (1) the complexity involved with funding to the function level, and (2) the lack of connection between the desired LOS and the funding formulas.
95. According to David Bierschbach (WsDOT), the main weakness of the funding allocation process is that pavement maintenance is the only funding area based on system conditions.
96. Steve Takigawa (CALTRANS) listed the two most significant weaknesses of the process as (1) the freedom districts have over how funds are utilized, as currently they can use them for purposes other than the projects for which the funding was designated, and (2) the practice of inventory-based funds allocation, such as TxDOT uses for concrete

funding. Mr. Takigawa stressed the importance of giving funding where it is really needed and then ensuring the funds are used on those identified needs.

Question 3: If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Funding Allocation (Funding Levels and Allocation formula) process?

Oral Responses:

97. During the Facilitated Consensus Meeting on Ratings, the peers generally agreed that the single most important change TxDOT can make to the funding and allocation process is moving from inventory-based funding to condition-based funding.
98. Both David Bierschbach (WsDOT) and Steve Takigawa (CALTRANS) stressed the importance of tying funding allocation to the condition of the roadway and the system.
99. Jennifer Brandenburg from North Carolina, along with Mr. Takigawa, suggested changing the language used to communicate funding requests to the legislature. The general consensus from the peers was that asking for funding for either a “tolerable” or “desirable” LOS is not the most politically effective means of expressing the department’s needs.
100. For comparison, Mr. Takigawa explained that CALTRANS has broken down their reported needs into three categories: safety, service, and security. CALTRANS then provides the legislature with very specific descriptions of how each category’s LOS will fare depending on the amount of funding the department receives. Mr. Takigawa pointed out that everyone’s definition of “tolerable” is different, and therefore, the department should be more precise when asking for funding.
101. Mr. Bierschbach added WsDOT’s approach to the comparison, which is allowing the legislature to choose the LOS for the system, rather than just asking for a certain amount of funding. The legislature then understands what LOS each amount of funding provides and tends to fund to their desired LOS rather than to the bare minimum the department needs.
102. Jim Carney of MoDOT and Mr. Takigawa both expressed concern over whether funding the districts with the lowest condition ratings is essentially rewarding poor decision-making. They suggested making sure that the districts are held accountable for making the improvements for which they are given funding.
103. Mr. Carney also agreed with TxDOT’s Tammy Sims that moving to an automated PMS is an excellent idea and is a course of action MoDOT is currently attempting to take as well.

Written Responses:

104. Based on the feedback from Kansas’s Roy Rissky, the contract pavement funds should be distributed on a statewide needs basis rather than district-by-district.

105. Eric Pitts (GDOT), David Bierschbach (WsDOT), and Jennifer Brandenburg (NCDOT) all suggested factoring the roadway condition data into the funding allocation process to ensure that funds are supplied where they are most needed.
106. Ms. Brandenburg also recommended holding the districts accountable for the LOS in their districts. She also suggested generalizing the formulas instead of tracking features in granular detail.
107. California's Steve Takigawa advised that the allocations be moved from a historical data-based model to a predictive model derived from pavement condition surveys. He further suggested creating a performance-based funding allocation process that considers the priorities of the entire state rather than the current formula-based process. Mr. Takigawa also felt that the maintenance priorities should be clearly defined to enable statewide monitoring. He also recommended developing a strategic plan for the maintenance program.

11.6 Overall Maintenance Operations

Question 1: Overall, how would you rate the effectiveness of TxDOT Maintenance Operations?

- A. Very Effective**
- B. Effective**
- C. Somewhat Effective**
- D. Not Effective**

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the consensus reached on the effectiveness of TxDOT maintenance operations was a rating of "B. Effective."

Written Responses:

The general agreement in the written responses on the effectiveness of TxDOT's overall maintenance operations was a rating of "B. Effective," although Steve Takigawa (CALTRANS) gave a rating of "C. Somewhat Effective" and Jennifer Brandenburg (NCDOT) gave a rating of "A. Very Effective." Roy Rissky (KDOT) gave a split rating of "A. Very Effective/B. Effective." These ratings are illustrated in Figure 11.6.

Overall Maintenance Operations				
Not Effective	Somewhat Effective	Effective	Very Effective	
Roy Risky (Kansas)				
Eric Pitts (Georgia)				
Jim Carney (Missouri)				
Jennifer Brandenburg (North Carolina)				
David Bierschbach (Washington)				
Steve Takigawa (California)				

Figure 11.6: Overall Maintenance Operations

108. Roy Risky of Kansas explained that he gave a split rating of “A. Very Effective/B. Effective” because he believes the effectiveness of the program is subject to the availability of funds. According to Mr. Risky, the system has been very effective in the past but would require considerable changes and adaptability to sustain effectiveness in the face of restricted funding.
109. Jim Carney of Missouri explained that he found the overall maintenance operations to be effective partially because of TxDOT’s efforts to regionalize the 25 districts, which he believes will improve the consistency of the maintenance activities in those regions. He reported that MoDOT has attempted to improve the consistency of their interstate maintenance activities by establishing 6 corridors in lieu of 10 districts and considering regional concepts for bridge maintenance and striping operations.
110. North Carolina’s Jennifer Brandenburg explained that she gave the overall maintenance operations a rating of “A. Very Effective” partially because TxDOT is a model for a lot of the contracting practices at NCDOT, such as the comprehensive contracts they use. During the Road Rally, she was impressed by the good quality of Texas’s roadways and the clean and well-kept condition of the maintenance yard. Ms. Brandenburg also reported that the peer review program seemed a very effective tool for communicating best practices across the organization. She also reported a few general observations about the overall differences between North Carolina and Texas, writing that incentives and disincentives would not work politically in her state, and that TxDOT performs much of the work in-house that NCDOT contracts out.
111. WsDOT’s David Bierschbach appreciated the competency and dedication of the staff in particular and was impressed by the program overall.
112. Steve Takigawa of CALTRANS explained his rating of “C. Somewhat Effective” by listing a few of the noticeable strengths and weaknesses of TxDOT’s maintenance

operations. He wrote that TxDOT's reporting is strong and very thorough and that TxDOT's efforts to communicate with the field staff and develop mid-range plans for the system's pavement are excellent. Despite these strengths, Mr. Takigawa found a lack of flexibility in the program and felt that the funding allocation and decision processes currently in place may be difficult to convert into a performance-based allocation program. He also reported that the overall maintenance operations would be more effective if the department had specific goals for features other than pavement.

Question 2: In your opinion, what are the two most important strengths and the two most important weaknesses of TxDOT Maintenance Operations?

Strengths:

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the peers reached a consensus as to the three main strengths of TxDOT maintenance operations.

- (1) The primary strength, suggested by David Bierschbach of WsDOT and agreed upon by the peers, is TxDOT's knowledgeable staff, composed of people who take pride in their work.
- (2) Next, the peers agreed with Jim Carney of MoDOT that the peer review program was of considerable value and should be continued.
- (3) Finally, Steve Takigawa of CALTRANS spoke for the peers when he stated that TxDOT's willingness to evaluate and improve their program was a significant strength in and of itself.

Written Responses:

113. According to Roy Rissky of KDOT, the two main strengths of TxDOT's maintenance operations are (1) the three maintenance performance measuring and reporting systems, namely, PMIS, TxMAP, and TxTAP, and (2) the four-year pavement management plan.
114. Eric Pitts of GDOT listed the strengths of TxDOT's maintenance program as (1) the ability to supplement the workforce with contract work, and (2) the commitment to pavement preservation.
115. Jim Carney of MoDOT considered the maintenance operations' main strengths to be (1) the roadway pavement conditions, (2) the chip seal program, and (3) the minimal amount of brush and undesirable vegetation on the roadsides. He also reported that he enjoyed the presentation on full-depth recycling with Bomag.
116. For Jennifer Brandenburg of NCDOT, the strengths of the program overall lie in (1) the peer review process for exchange of best practices and knowledge, and (2) the contracting methods.

117. David Bierschbach of WsDOT found the two main strengths of the maintenance operations to be (1) how well the staff understands the program, and (2) the enhanced accountability brought about by the peer review process.
118. According to Steve Takigawa of CALTRANS, the main strengths of the program are (1) the willingness of the department to seek new, more efficient and effective methods, and (2) the knowledgeable staff. Mr. Takigawa listed the staff's close connection and communication with the central offices as a third strength.

Weaknesses:

Oral Responses:

The peers also reached a consensus on the two main weaknesses of TxDOT's maintenance operations.

- (1) The first weakness, proposed by Jennifer Brandenburg of NCDOT and agreed to by all, was the allocation of funding by district rather than condition.
- (2) Mr. Takigawa (CALTRANS) commented that the program should strive to be more reactive than it currently is, as many of the department's decisions are based on historical and cultural factors rather than the real needs of the system.
- (3) Mr. Takigawa commended TxDOT for making pavement a priority but suggested that the other features of the system be studied and anticipated in a similar way.

Written Responses:

119. The most important weaknesses of the system, according to Roy Rissky of KDOT, are (1) the lack of historical layer data on the pavement sections, and (2) the district-driven pavement preservation funding process.
120. Eric Pitts of GDOT found the primary weakness of TxDOT's maintenance operations to be the high number of activities contracted out, which could potentially result in lost expertise among the in-house staff.
121. Jim Carney of MoDOT reported that the two main weaknesses of the operations are (1) the mowing height, and (2) an excessive number of crack seals. Mr. Carney felt that the mowing height of 30 inches was possibly too high. By contrast, MoDOT begins mowing when 50% of the roadside reaches 18 inches in height. Mr. Carney also explained that Missouri's chief engineer discourages excessive crack sealing and suggests placing more spot chip seals instead.
122. Jennifer Brandenburg of NCDOT also listed mowing as one of the primary weaknesses of TxDOT's maintenance operations. She explained that two to three mowing cycles per year would not be effective in North Carolina. She felt that TxDOT's system advocates self- performance of functions that might be better suited to contractors.

123. According to Steve Takigawa of CALTRANS, the main weakness of TxDOT's maintenance operations is the lack of a consistent strategic plan for the maintenance program. He felt that the main goals for all maintenance operations should be clearly defined.

Question 3: If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Maintenance Operations?

Oral Responses:

During the Facilitated Consensus Meeting on Ratings, the peers unanimously agreed that they had covered their suggestions for improvement in their previous responses.

Written Responses:

124. Roy Rissky of KDOT suggested working toward a statewide pavement preservation plan and collecting historical data on pavement treatments through district records or pavement analysis.
125. Eric Pitts of GDOT recommended contracting out more activities, which would allow the in-house staff to focus on preservation. He also advised examining the amount of experience being logged in contracted areas.
126. Jim Carney of MoDOT encouraged the continuation of the district peer exchanges, which he feels promotes consistency and the sharing of best practices.
127. Jennifer Brandenburg of NCDOT suggested giving the districts more flexibility in their contracting by increasing the small contract amount from \$300,000. She felt that TxDOT should review which functions are performed in-house and which are contracted out.
128. David Bierschbach of WsDOT advised seeking new, more effective ways of communicating performance measures and their meanings to the legislature and the public.
129. Steve Takigawa of CALTRANS recommended switching from a program based on "historical maintenance" to a more "action-oriented" maintenance program. He also suggested that TxDOT develop a means of holding the districts accountable for their maintenance allocation.

11.7 Conclusions

This section will provide the peers' final comments TxDOT's practices as a whole, along with an analysis of their responses to each section of the questionnaire.

11.7.1 Maintenance Planning Process

In general, the peers seemed to find the maintenance planning process to be effective overall. They considered TxDOT's focus on pavement maintenance a strength of the program; however,

they expressed that the other types of maintenance activities should also have clearly defined goals. In particular, bridge maintenance stood out as an area that could receive more attention. The peers felt that TxDOT's use of various software and information systems, including TxMAP, TxTAP, and the PMIS, was a positive feature of the program. The high involvement of TxDOT's staff, especially through peer reviews, was particularly praised by the peers.

The most commonly criticized aspect of TxDOT's maintenance planning process was the lack of a statewide plan. The peers all agreed that TxDOT should consider the statewide needs of the system rather than plan for the needs of each individual district. A related criticism was that TxDOT does not do enough to incorporate performance measures or LOS into the maintenance planning process. This critique was not unanimous, however, as at least one peer felt that TxDOT effectively uses condition ratings to make plans. Another related observation was that TxDOT allows the districts too much control over the use of the funding allocated to them. The peers also suggested that the maintenance planning process does not yield enough contingency plans. Additionally, they felt that TxDOT should focus on compiling pavement histories. Finally, at least one peer suggested moving to a tiered system.

11.7.2 Four-year Pavement Management Program Development

The peers seemed to generally approve of TxDOT's Four-year Pavement Management Program, and the comments were positive overall. Once again, the peers recognized TxDOT's ability to involve the entire organization in the planning process, and they especially appreciated the use of peer reviews and the heavy involvement of the district managers during the development of the four-year plan. The peers also praised TxDOT's use of technology, remarking on the analysis tools and mapping techniques utilized in this plan. They seemed to feel that the four-year plan struck a good balance between contracted and in-house work, particularly noting the use of contracted raters to establish relatively bias-free condition ratings. At least one peer, however, suggested the opposite: switching to in-house raters or technology would improve the consistency of the ratings. The peers felt that the flexibility written into years three and four of the plan was a strength; they also reported, however, that the data for these years should be improved. Additionally, the peers felt that the four-year plan allows for improved communication between TxDOT headquarters and the district managers, the state legislature, and the public, although at least one peer believed that the plan is not currently being used effectively in this capacity.

In discussing the four-year plan, the peers once again reported that the focus on planning for the needs of each district rather than the state as a whole is ineffective and inefficient. They recommended taking a holistic, statewide approach to planning. Also once again, the peers felt that districts were given too much control and should be required to follow the four-year plan. They also suggested increasing accountability to ensure the goals of the plan are being met. The peer reviewers advocated creating more specific goals, which would provide the districts with a more thorough understanding of their responsibilities in those goals and allow TxDOT's central offices to easily assess whether or not each district was fulfilling its responsibilities. At least one peer felt that these clearly-defined goals would also facilitate TxDOT's communication of their resource needs with the legislature and the public. The peers also recommended raising the amount of flexibility provided by the four-year plan, as the plan may have to change to

accommodate unforeseen circumstances. Finally, at least one peer reiterated the need for a tiered system.

11.7.3 Maintenance Performance Measurement and Reporting

The peers' evaluation of TxDOT's maintenance performance measurement and reporting was generally mixed, and many of the peers had conflicting views of TxDOT's practices in this area. They agreed that the practice of performing year-round ratings was very effective, and they felt that TxDOT's use of a consistent, small staff of raters was one of the strengths of the program. At least one peer, however, stated that the limited number of raters could also have a negative effect, in that it precludes collaboration and the involvement of the districts. Overall, the peer reviewers seemed to suggest that TxDOT maintain a small rating staff while increasing the variety of areas from which the raters are pulled. At least one peer, however, felt that the use of peer reviews in the rating process helped create a collaborative environment. Another peer praised TxDOT for giving the districts immediate feedback after the ratings were completed. Although the peers commended TxDOT's assessments for their quality, they also suggested that the drive-by system may not provide a comprehensive review of several roadside features, such as pipe drainage.

The peers tended to agree that TxDOT should improve their methods of communicating performance measures and their significance to the legislature and the public. Several of the peers felt that the use of three information systems, namely the PMIS, TxMAP, and TxTAP, creates an inconsistent message, although they agreed that these systems are effective tools. They suggested synthesizing the results of these systems before reporting the information provided. They also recommended using the data gathered from these systems not just for reporting but for better decision-making and increased accountability. The peers also suggested reconsidering the number of samples taken, which may be too few to be statistically accurate, as well as the number of features measured and activities included in the PMIS, which may be too detailed. At least one peer, however, felt that the large number of samples TxDOT currently takes is one of the program's virtues. A further recommendation was to compile more of the pavement's historical data, either through district records or coring. Finally, at least one peer felt that the PMIS should give less consideration to roadside and more to traffic, as traffic generally has a larger impact than roadside on public safety.

11.7.4 Funding Allocation (Funding Levels and Allocation Formula)

As a whole, the peers seemed to feel that TxDOT's funding allocation practices were fairly effective but could use improvement. The peers suggested that although the practices were effective in the past, they may not be effective during leaner times. At least one of the peers considered TxDOT's funding allocation to be excellent for routine maintenance. Several of the peers appreciated the well-developed, repeatable formulas, although they agreed that the formulas should be simplified by including fewer roadside and traffic features. At least one peer commended TxDOT for performing a reasonable check to ensure that the districts could actually use the amount of funding allocated to them. Finally, the peers also praised the separation of pavement rehabilitation into its own category and the separation of preservation cycles by traffic volume and average rainfall.

The peers tended to agree that the current funding allocation process is not as efficient as it could be. Their primary suggestion was to fund based on condition and LOS rather than historical funding practices or inventory. They noted that pavement maintenance was the only type of maintenance for which funding was tied to condition level. Several of the peers pointed out that funding to LOS or condition ratings can sometimes reward the districts performing at the lowest level. Therefore, the districts should be held accountable for their LOS. To enable this accountability, the peers recommended creating very specific maintenance priorities and goals for each district. Furthermore, the peers agreed that the districts should have less control over their own funding, as the funding they receive should be designated for specific projects. If the districts do not complete the projects TxDOT's central offices select for funding, the energy and resources spent collecting and analyzing data for project selection will be wasted. In general, the peers felt that funding should be based on a holistic approach that considers the needs of the entire state instead of simply allocating funds to each district based on its level of inventory. Once the funding is allocated where it is most needed, TxDOT should ensure that the districts use their funds to address those identified needs.

The peers also suggested changing the language TxDOT uses to communicate their funding needs to the state legislature. They felt that asking for funding for either a "tolerable" or a "desirable" LOS is misleading and generally ineffective. They recommended changing this rhetoric to something less open for interpretation. A few additional suggestions were to reduce the amount of contract work and to focus on bridge maintenance.

11.7.5 Overall Maintenance Operations

In general, the peers seemed to feel that TxDOT's overall maintenance operations were strong. Several peers praised the high quality of the roadways in Texas, and at least one peer recognized the good condition of the roadsides. They all agreed that TxDOT's staff was excellent and described TxDOT's personnel as "competent," "dedicated," and "knowledgeable." The peers felt that the communication between the field staff and the central offices was excellent. Furthermore, they commended TxDOT for using peer reviews and district peer exchanges and for constantly seeking to evaluate their practices and improve upon them. Some of the peers felt that reporting was a strong feature of the program and particularly noted the PMIS, TxMAP, TxTAP, and the four-year plan. At least one peer appreciated TxDOT's attempts to regionalize the 25 districts. The peers also praised TxDOT's focus on pavement preservation, but at least one peer felt that the DOT's other maintenance functions could use the same clearly-defined goals currently given for pavement activities.

Several of the peers commented on TxDOT's contracting methods. They seemed to agree that TxDOT uses a good variety of contract types, but that the functions being contracted should be reviewed. Some of the peers felt that TxDOT should contract out more, while others thought that heavy contracting could result in a loss of expertise among the in-house staff. At least one peer suggested increasing the amount of flexibility given to the districts' contracting restrictions.

The peers also recommended reviewing the mowing practices: one peer felt that the mowing height was inappropriate and another disliked the use of two to three mowing cycles per year. The visiting peers also reiterated their previous suggestion that TxDOT focus on building pavement histories.

Once again, the most common criticism from the peers referred to TxDOT's practice of allocating funding on a district-by-district basis instead of using a statewide condition-based system. The peers stressed the importance of making decisions that will address the actual needs of the state as a whole.

11.8 Final Comments

At the end of the Facilitated Consensus Meeting on Ratings, Toribio Garza posed a final question to the peers, asking them to come up with one last suggestion that would help TxDOT. The responses from the peers are summarized in this section.

130. Roy Rissky of KDOT recommended that TxDOT create statewide commitment to the condition of Texas's roads by formulating a statewide plan instead of making plans for each individual district. Mr. Rissky felt that no single district should stand out from the others; instead the goal should be to make the entire state stand out from the rest of the country. Mr. Rissky suggested eliminating any sense of competition between the districts by stressing that they are all working for a common goal. He stated his belief that the districts receiving less funding would be supportive of that allocation decision if they understood that the funding was addressing the most significant needs of the state. Mr. Rissky felt that if everyone's goal is to give the whole state of Texas the best roads possible, everyone will be willing to make sacrifices in order to reach that goal.
131. Eric Pitts of GDOT stressed the importance of accountability. He recommended that TxDOT hold each person accountable for his or her responsibilities. Mr. Pitts advocated that the flow of accountability be extended to the lowest level staff.
132. Steve Takigawa of CALTRANS stated that a DOT's staff is its most valuable asset. He emphasized the importance of fostering the staff's trust and support. Mr. Takigawa suggested continuing programs that demonstrate TxDOT's commitment to its staff, such as the peer reviews. He asserted that staff members will be more dedicated to the goals of the department if they feel that they are important components of the team. Mr. Takigawa recommended focusing on practicing good leadership and communication and on concentrating on the people who comprise TxDOT. He added that he would rate TxDOT's staff as "very effective" and that he felt proud just watching the staff members in the field. He stated that he would be happy to have any of TxDOT's staff serving on his own team. Toribio Garza responded to Mr. Takigawa, agreeing that the key to a successful DOT is communicating to the lowest level staff members that their work is vital to the department.
133. Jim Carney of MoDOT suggested that TxDOT focus on the financial aspect of its programs. He recommended focusing on the top 10 or 20 activities TxDOT's contractors prefer performing. Mr. Carney reported that MoDOT's budget is not controlled or approved by the state legislature, and that TxDOT should ensure that, in the event the construction program loses funding, the legislature is made to realize that the state's DOT should be in control of how transportation funds are used.

134. David Biersbach from WsDOT asserted that TxDOT should use their data to drive their decisions. He reported that Washington's PMS has enabled his DOT to lower the lifecycle costs of the entire state's pavements. Jeff Seiders responded to Mr. Biersbach's comment, stating that TxDOT lacks work history and pavement layer data and that TxDOT must capture that data if it is to have an effective PMS. Mr. Biersbach agreed and replied that TxDOT has the resources, capabilities, and desire to accomplish that goal.
135. Jennifer Brandenburg praised TxDOT's current maintenance quality assurance (MQA) program and suggested adding that data into a management system to generate work-accomplish data. She suggested that such a course of action could mitigate the need for extensive work history and pavement layer data. She also reiterated the need for increased accountability.
136. Finally, Mr. Takigawa suggested that TxDOT be patient, as developing an effective PMS is a long process. Mr. Biersbach agreed, stating that his DOT has been developing their PMS for 15 years, and the process is not complete.

The Facilitated Consensus Meeting on Ratings then drew to a close.

Appendix A: Information Summary

Texas Highway Network and Maintenance Program

The Texas Department of Transportation (TxDOT) oversees the preservation, repair and restoration of over 195,000 lane-miles of state-maintained highways. The current statewide pavement condition goal, set by the Texas Transportation Commission in 2002, is to achieve 90 percent of lane-miles in “Good” or better condition by 2012. This is a single-tier, “one size fits all” goal: a lane-mile of high-traffic, metro, Interstate Highway has the same impact on Condition Score as a lane-mile of low-traffic, rural, Farm-to-Market road. In fiscal year 2008, the Department awarded 779 construction and major maintenance contracts totaling \$3.4 billion, and 973 routine maintenance contracts totaling \$279 million.

The Maintenance Division provides general program oversight and policies, while operations are conducted at the district level. TxDOT maintenance employees work in each of the 25 districts, primarily at the district offices or at one of the 251 maintenance sections, which are geographically situated to balance the number of lane miles of oversight. Each district office oversees 2 – 8 Area Offices which, in turn, oversee several maintenance sections. Work is categorized into three areas: routine, preventive and major maintenance. All three categories may be performed with state forces or by contract; however, most preventive and major maintenance work is contracted. When addressing planning and budgeting, the following areas are considered in determining the type of work activity:

- Travel way
- Shoulder and side approaches
- Roadside
- Drainage
- Structures
- Traffic Operations (signs, striping, signals etc.)
- Emergency Operations

Each district develops long-range strategies and one-year maintenance work plans to implement those strategies. The one-year plan is developed after the respective district maintenance budget has been determined. The plan is based on a historical analysis of the amount of work performed and the resulting Levels of Service. In addition, the Maintenance Management Information System (MMIS) provides detailed statistics on highway maintenance activities to accomplish the following:

- provide data on work load and cost of maintenance activities to support budgeting and planning efforts,
- provide a tool for analyzing maintenance activities so that production efficiency can be improved,
- help identify sections of highway which qualify for rehabilitation,
- document the work accomplished to support the department's legislative budget requests,
- provide data to compare costs of maintenance activities performed under contract with those performed by state forces.

TxDOT Maintenance Funding Allocation Process and Formulas

The TxDOT administration balances the needs in all areas of the department and develops the Department's Legislative Appropriation Request (LAR). The LAR is submitted to the legislature in accordance with Legislative Budget Board (LBB) procedures. When the legislature passes an appropriation bill for the biennium, the Maintenance Division uses various funding formulas to determine each district's proposed budget.

These formulas are based upon applicable factors for each activity. Factors include inventory of physical components and condition of those components. The following items are examples of these factors:

1. The routine maintenance district funding allocation considers regional rainfall, pavement condition (failures and ride quality), the number of lane miles, average daily traffic, and daily truck vehicle-miles. The formulas rely on accurate inventory and pavement evaluation data.
2. For preventative maintenance, the lane miles statewide were classified by their ADT and yearly cycles were established based on ADT group and yearly rainfall. District flexible pavement lane-miles with ADTs of less than 500 will receive a seal coat using an 8 (≥ 35 in/Yr), 9 (20-35 In/Yr), and 10 (<20 In/Yr) year cycle. District flexible pavement lane-miles with ADTs of 500 or greater but less than 10,000 will receive a seal coat using a 6 (≥ 35 In/Yr), 7(20-35 In/Yr), and 8 (<20 In/Yr) year cycle. District flexible pavement lane-miles with ADTs of 10,000 or greater will receive an overlay using a 10(≥ 35 In/Yr), 12 (20-35 In/Yr), and 14 (<20 In/Yr) year cycle. District concrete lane-miles will receive funding based on individual district lane miles of concrete pavement.
3. The Rehabilitation funding district funding allocation considers: The district 3-year average lane-mile with deep distresses (32.5%), the vehicle miles traveled (20%), the total equivalent single axle loads (ESALs) (32.5%) and the rate of improvement of individual district (15%).

After receiving funds from the TxDOT Administration, the district allocates funds to each maintenance section. The allocation of funds is coordinated with the district Maintenance, the Area Offices and the district maintenance sections.

TxDOT is currently investigating the possibility of moving from a single-tier pavement condition management system to a multi-tier system. In response to a funding shortage, the Administration directed TxDOT personnel and University researchers to examine alternate pavement condition goal systems and an improved funding allocation approach that preserves the State pavement network under a constrained budget. A single-tier system can work very well if the resources are sufficient to cover the entire network. However, when resources are constrained, hard decisions must be made regarding which element(s) of the pavement network should be given first priority and which the last. This process is usually accomplished by establishing a multi-tier system based on the relative importance of the pavement sections in the network, where the resources are focused on the pavement system or Tier(s) that are deemed most important.

Texas Condition Assessment Program (TxCAP)

Texas Department of Transportation (TxDOT) has established four systems to measure road inventory conditions:

1. The Pavement Management Information System (PMIS) is an automated system for storing, retrieving, analyzing, and reporting pavement condition information. It can be used to retrieve and analyze pavement information to compare maintenance and rehabilitation treatment alternatives, monitor current pavement conditions, and estimate total pavement needs. PMIS contains pavement evaluation data on all major pavement types used in Texas, including asphalt surfaced pavement, continuously reinforced concrete pavement and jointed concrete pavement. PMIS data is used to determine the statewide “Good” or better pavement condition score. These types of data include:
 - visual distress data - describes surface defects (rut – automated, other distress – manual)
 - ride quality data - measures pavement roughness using the TxDOT Profiler rut bar van.
 - skid resistance data - measures surface friction using the TxDOT Skid Truck.
 - deflection data - measures the structural strength of a pavement section (not mandatory)
2. The Texas Maintenance Assessment Program (TxMAP) is a manual, visual condition survey that documents the overall maintenance condition of the state highway system. The TxDOT executive administration sets the annual goal of an overall condition score of 80. TxMAP inspections consist of the evaluation of 10 percent of the Interstate Highway System and 5 percent of all other highways on the state system. For each one-mile section of highway, TxMAP raters assess twenty-three elements separated into three highway components: pavements, traffic operations and roadside. The program categorizes each element and assigns a weighted multiplier to each element as follows: pavements (50%), traffic operations (25%), and roadside (25%).
3. The Texas Traffic Assessment Program (TxTAP) TxDOT to evaluate the department's progress in the consistency, quality, and uniformity of traffic control devices on the state highway system. The TxDOT Traffic Operations Division conducts the annual evaluation of the various types of traffic control devices in each of TxDOT's 25 field districts. Each district review consists of 20-30 randomly selected segments on the state highway system, 5-16 signalized intersections, 3-4 work zones, and 2-6 railroad crossings.
4. The Texas Condition Assessment Program (TxCAP) combines information from PMIS, TxMAP, and TxTAP to get an overall picture of state roads. Currently, TxDOT uses TxCAP together with PMIS, TxMAP and TxTAP to measure and compare overall road inventory condition among its 25 Districts, which provide a comprehensive assessment of the Interstate and Non-Interstate highway system.

Four-Year Pavement Management Plan

Rider 55 of TxDOT's Legislative appropriations bill requires that prior to the beginning of each fiscal year, the department shall provide the Legislative Budget Board and the Governor with a detailed plan for the use of these funds which includes, but is not limited to a district by district analysis of pavement condition score targets and how proposed maintenance spending will impact pavement scores in each district.

Therefore, each district has developed a four-year pavement project expenditure plan based on anticipated budgets. The plan includes estimated construction costs for each project and certain business costs including overhead and operational expenses. The roadside expenditures continue to be evaluated in order to find the correct balance with level-of-service expectations. Traffic operational expenses are more predictable and are used to maintain existing systems (ITS, signals, illumination, etc.). The pavement expenditures include work done either with in-house forces and state owned materials or through routine maintenance contracts. Direct benefits of the four year plan for districts is the ability to strategically plan routine and preventive maintenance work in a proactive approach in lieu of a reactive on a longer term basis.

The 25 individual district plans are combined to create the state-wide four-year Pavement Management Plan. The statewide Plan provides the information necessary to predict pavement conditions based on a specified funding level and specific project program of work. An analysis of the Plan program of work results in a report which summarizes the number of lane miles that each district plans to treat with either Preventive Maintenance (PM), Light, Medium or Heavy Rehabilitation. The report also provides a prediction of the impact these treatments is expected to have on future pavement conditions. Maintenance is composed of Routine, Preventive and Rehabilitation treatments. These pavement condition projections also allow districts to evaluate their plan and adjust to maximize results.

Pavement Routine Maintenance includes but is not limited to:

- Sealing cracks
- Pavement edge maintenance
- Patching
- Level-up
- Maintenance blade-overlays
- Strip, Fog and Slurry seals

Preventive Maintenance includes:

- Seal coats (chip seals)
- Thin Overlays ($\leq 2''$ ACP)
- Micro-surfacing

Rehabilitation includes:

- Thick structural overlays ($> 3''$ ACP)
- Rebuilding the pavement structure

Maintenance Contract

The Texas Department of Transportation (TxDOT) accomplishes its maintenance mission by effectively supplementing its work force with routine maintenance contracts, preventive maintenance contracts, purchase of service (service purchase orders), interagency contracts (contracts between TxDOT and other state agencies), state use program agreements and emergency contracts.

TxDOT requires that all contracts proposed by the department for the improvement of a highway on the state highway system should be submitted for competitive bids. The definition of “highway improvements” includes construction, reconstruction, and maintenance. TxDOT also requires that a minimum of 50 percent of maintenance be provided by a contractor, but “only if the department determines that a function of comparable quality and quantity can be purchased or performed at a savings by using private sector contracts.” The following table gives the guidelines for contracted work.

Table: Guidelines for Contracted Work

Routine Maintenance	Preventive Maintenance	Major Maintenance
Contracts are developed as routine maintenance contracts through the Construction Maintenance Contract System and may be locally let if estimated to cost less than \$300,000.	Contracts are normally programmed through the Transportation Planning and Programming Division as contracted preventive maintenance projects.	Contracts are developed using the Design Division 2-R standards and are normally programmed through the Transportation Planning and Programming Division as major maintenance program projects.

TxDOT began outsourcing maintenance in the 1970s with mowing contracts. TxDOT now processes approximately 1,400 maintenance contracts a year. The average contract is approximately \$90,000, and several contracts exceed \$1 million. The average duration is one year with variation from 45 days to two years. The district engineer has the authority to let, award or reject, and execute contracts estimated under \$300,000, which represents about 75 percent of the contracts.

State-let contracts are submitted to the Maintenance Division (MNT). The contract is reviewed, proposals are sent to prospective bidders and the project is let. Bids are tabulated and recommendations for awards or rejections are sent to the Texas Transportation Commission. The Construction Division (CST) reviews all bid documentation and then sends a letter of “Award of Contract” to the low bidder, requiring the low bidder to execute the contract and return it with a Payment and/or Performance Bond within 15 calendar days. Upon receiving a positive response from the contractor, CST will review the documentation and process through MNT to execute the contracts.

Appendix B: Booklet of Questions



Peer State Review of TxDOT Maintenance Practices

TxDOT Project 0-6664

Questionnaire

NAME - _____

October 4 – 7, 2010

Center for Transportation Research
The University of Texas at Austin



Maintenance Planning Process

1. Overall, how would you rate the effectiveness of the TxDOT Maintenance Planning Process? Please **circle** one:

- A. Very Effective
- B. Effective
- C. Somewhat Effective
- D. Not Effective

Please write comments in this space Q1. Maintenance Planning Process Overall Effectiveness

Please write comments in this space Q1. **Maintenance Planning Process**

Overall Effectiveness

2. In your opinion, what are the two most important strengths and the two most important weaknesses of the TxDOT Maintenance Planning Process?

Please write comments in this space Q2. Maintenance Planning Process Strengths and Weaknesses

Please write comments in this space Q2. **Maintenance Planning Process**

Strengths and Weaknesses

3. If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Maintenance Planning Process?

Please write comments in this space Q3. Maintenance Planning Process Changes you would make?

Please write comments in this space Q3. **Maintenance Planning Process**

Changes you would make?

4-Year Pavement Management Program Development

1. Overall, how would you rate the effectiveness of the TxDOT 4-Year Pavement Management Program Development process? Please **circle** one:
- A. Very Effective
 - B. Effective
 - C. Somewhat Effective
 - D. Not Effective

Please write comments in this space Q1. 4-Year Pavement Management Overall Effectiveness Program Development

Please write comments in this space Q1. 4-Year Pavement Management Overall Effectiveness Program Development

Please write comments in this space Q2. **4-Year Pavement Management**

Strengths and Weaknesses

3. If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT 4-Year Pavement Management Program Development process?

Please write comments in this space Q3. 4-Year Pavement Management
Program Development

Changes you would make?

Please write comments in this space Q3. **4-Year Pavement Management
Program Development**

Changes you would make?

Maintenance Performance Measurement and Reporting

1. Overall, how would you rate the effectiveness of the TxDOT Maintenance Performance and Reporting? Please **circle** one:
- A. Very Effective
 - B. Effective
 - C. Somewhat Effective
 - D. Not Effective

Please write comments in this space Q1. Maintenance Performance and Reporting

Overall Effectiveness

Please write comments in this space Q1. **Maintenance Performance and Reporting**

Overall Effectiveness

2. In your opinion, what are the two most important strengths and the two most important weaknesses of the TxDOT Maintenance Performance and Reporting?

Please write comments in this space Q2. Maintenance Performance and Reporting

Strengths and Weaknesses

Please write comments in this space Q2. **Maintenance Performance and Reporting**

Strengths and Weaknesses

3. If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Maintenance Performance and Reporting?

Please write comments in this space Q3. Maintenance Performance and Reporting

Changes you would make?

Please write comments in this space Q3. **Maintenance Performance and Reporting**

Changes you would make?

Funding Allocation

(Funding Levels and Allocation formula)

1. Overall, how would you rate the effectiveness of the TxDOT Funding Allocation (Funding Levels and Allocation formula) process? Please **circle** one:
- A. Very Effective
 - B. Effective
 - C. Somewhat Effective
 - D. Not Effective

Please write comments in this space Q1. Funding Allocation

Overall Effectiveness

Please write comments in this space Q1. **Funding Allocation**

Overall Effectiveness

2. In your opinion, what are the two most important strengths and the two most important weaknesses of the TxDOT Funding Allocation (Funding Levels and Allocation formula) process?

Please write comments in this space Q2. Funding Allocation

Strengths and Weaknesses

Please write comments in this space Q2. **Funding Allocation**

Strengths and Weaknesses

3. If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Funding Allocation (Funding Levels and Allocation formula) process?

Please write comments in this space Q3. Funding Allocation

Changes you would make?

Please write comments in this space Q3. **Funding Allocation**

Changes you would make?

Overall Maintenance Operations

1. Overall, how would you rate the effectiveness of TxDOT Maintenance Operations?

Please **circle** one:

- A. Very Effective
- B. Effective
- C. Somewhat Effective
- D. Not Effective

Please write comments in this space Q1. Maintenance Operations

Overall Effectiveness

Please write comments in this space Q1. **Maintenance Operations**

Overall Effectiveness

2. In your opinion, what are the two most important strengths and the two most important weaknesses of TxDOT Maintenance Operations?

Please write comments in this space Q2. Maintenance Operations

Strengths and Weaknesses

Please write comments in this space Q2. **Maintenance Operations**

Strengths and Weaknesses

3. If you were asked to change the maintenance program, what are the changes you would be making to improve the TxDOT Maintenance Operations?

Please write comments in this space Q3. Maintenance Operations

Changes you would make?

Please write comments in this space Q3. **Maintenance Operations**

Changes you would make?

Appendix C: Workshop Agenda

Peer Review Workshop Agenda
TxDOT – UT/CTR
October 5 – 7, 2010

Tuesday, October 5

Day 1 Workshop at CTR 8:30 am – 6:00 pm

CTR picks up guests at AT&T Center..... 7:30 am

Breakfast at CTR - Meet and Greet 7:45 – 8:30

Welcome Remarks – (Randy Machemehl, Rob H) 8:30 - 8:40

Purpose of the Peer Review (David Casteel) 8:40 – 8:50

David.casteel@txdot.gov 305-9503

Group Introductions (Mike Murphy) 8:50 – 9:00

1) Texas Highway Network and Maintenance Program

(Toribio Garza)

Toribio.garza@txdot.gov 416-3034

Discussion

2) TxMAP, TxTAP and PMIS Overview

(Neal Munn, Brian Stanford, Jeff Seiders)

Neal.munn@txdot.gov 416-3255

Brian.stanford@txdot.gov 416-3122

Jeffrey.seiders@txdot.gov 506-5808

Discussion

Working Lunch at CTR 1:00 – 2:00

3) Maintenance Funding Allocation Process and Formulas

(Tammy Sims)

tammy.sims@txdot.gov

Discussion

4) Maintenance Contracts

(Bob Blackwell)

Robert.blackwell@txdot.gov 416-3113

Discussion

CTR returns Guests to AT&T center to freshen up / change clothes

Group Dinner **(County Line BBQ)**..... 6:00 – 7:30

Wednesday, October 6

Day 2 Workshop at Austin District 6:30 – 7:30

Peers, TxDOT and CTR members - **breakfast at AT&T Center ‘The Carillon’**

Discussion of Rating Form with Q/A
(Jorge Prozzi)

TxDOT Vans pick up Group at AT&T Center

Road Rally – Austin District..... 7:30 – 11:30

Lunch at a restaurant (TBD)..... 11:30 – 12:30

Travel to North Austin Area Office – 1001 Parmer Ln. 12:30 – 1:00

1) Tour / Discuss Maintenance Facilities & Operations

(Lowell Choate)

Lowell.choate@txdot.gov 832-7030

Staffing and Training
Maintenance Equipment display
Profiler / Skid Truck / FWD / GPR display
District Lab

Discussion

Refreshments in District Meeting Room (pastries coffee / soda) no formal Break

2) 4 year Pavement Management Plan

(Mario Jorge)

Mario.jorge@txdot.gov (956) 702-6101

Discussion

Return to AT&T hotel - No dinner plans – Guests free to choose

Thursday, October 7

Day 3 Workshop at CTR 8:00 – 12:00

CTR picks up guests at AT&T Center 7:30 am

Breakfast at CTR..... 7:45 – open

1) Open Discussion – Comments from Peers

2) Facilitated Consensus Meeting on Ratings
(Mike Murphy)

3) Meeting Summary and concluding remarks
(Torbio Garza / Mike Murphy)

Depart for Airport / Hotel 12:00

Appendix D: Rating Form

NAME: _____

VEHICLE: _____

SECTION: 01

D		

front
mid1
mid2
mid3
back

Mark your seat
assignment

Highway: **SL 111**

Travel direction: **south**

Beginning TRM: **438**

Ending TRM: **439**

Pavement Score: (include items such as rutting, cracking, ride, edges, shoulder, failures, etc.)

5	Well above expectations	Comments: _____
4	Above expectations	
3	Meets expectations	_____
2	Below expectations	
1	Well Below Expectations	_____

Traffic Operations Score: (include items such as raised pavement markers, striping, attenuators, delineators, shoulder texturing, etc.)

5	Well above expectations	Comments: _____
4	Above expectations	
3	Meets expectations	_____
2	Below expectations	
1	Well Below Expectations	_____

Roadside Score: (include items such as vegetation management, trees and brush, drainage, sweeping, encroachment, guardrails, guardrail end treatment, mail boxes, etc.)

5	Well above expectations	Comments: _____
4	Above expectations	
3	Meets expectations	_____
2	Below expectations	
1	Well Below Expectations	_____

Overall Score: (rate the section relatively to a similar facility in your state)

5	Well above expectations	Comments: _____
4	Above expectations	
3	Meets expectations	_____
2	Below expectations	
1	Well Below Expectations	_____

Additional comments: _____
