THE UNIVERSITY OF TEXAS AT AUSTIN ✦ COCKRELL SCHOOL OF ENGINEERING

TEXAS PAVEMENT PRESERVATION CENTER
Newsletter

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Peer State Review of TxDOT Maintenance Practices

TPPC Board of Directors

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Our Mission

The mission of the TPPC, in joint collaboration with the Center for Transportation Research (CTR) of the University of Texas at Austin and the Texas Transportation Institute (TTI) of Texas A&M University, is to promote the use of pavement preservation strategies to provide the highest level of service to the traveling public at the lowest cost. The executive sponsor for the TPPC is the Texas Department of Transportation (TxDOT).

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Past and Upcoming Events

TPPC Microsurfacing Courses

Microsurfacing training courses will be offered by the TPPC. The course is designed for engineers and inspectors and is entitled "Guidelines on the use of Microsurfacing." The course recapitulates the pavement preservation concepts, specifically with reference to microsurfacing. It focuses on proper mix design selection and application of microsurfacing. TxDOT's experience with microsurfacing is also discussed. This course also includes discussion on the use and applications of cape seals.

TPPC Seal Coat Training Courses

Seal Coat training courses will continue to be offered by the TPPC. The course designed for inspectors, entitled "Seal Coat Inspection and Applications," focused on proper inspection methods and the equipment used during chip seal construction. The other, "Seal Coat Planning and Design," instructed engineers on planning, designing, and constructing chip seals.

For more information on the Seal Coat and Microsurfacing courses, please contact Dr. Yetkin Yildirim, P.E. at yetkin@mail.utexas.edu or (512) 232-3084.

The PEER State Review Project

TxDOT's sponsored Peer State Review Project was an effort to get an unbiased opinion on the State's maintenance practices from knowledgeable experts in the field. The goals of this project were to provide TxDOT with an unbiased assessment of its maintenance practices, identify potential areas for improvement and understand best practices used in other states and evaluate their applicability to Texas. A workshop was conducted at the Center for Transportation Research (CTR) at the University of Texas, Austin and Austin District from the 5th to 7th of October 2010. It provided a forum for the Director of Maintenance (DOM) from selected peer states to study the TxDOT Maintenance Program and provide their recommendations on potential areas for improvement.

The five focus areas 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

Six states' DOMs agreed to be a part of this project namely, California, Washington, North Carolina, Kansas, Missouri and Georgia. The primary purpose of the workshop was to capture the expert opinions of the peer state reviewers on TxDOT's maintenance program and practices. Several methods were used to enable this transfer of opinion including presentations and discussions, a road rally that included road condition evaluations, and a "Booklet of Questions" evaluation questionnaire.

The Booklet of 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. It consisted of 15 questions that addressed the five following areas of focus:

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

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. A Facilitated Consensus Meeting at the end of the

workshop was organized to get a unanimous response on these questions. The figure below represents the consensus reached by the peer reviewers for each topic in the questionnaire:
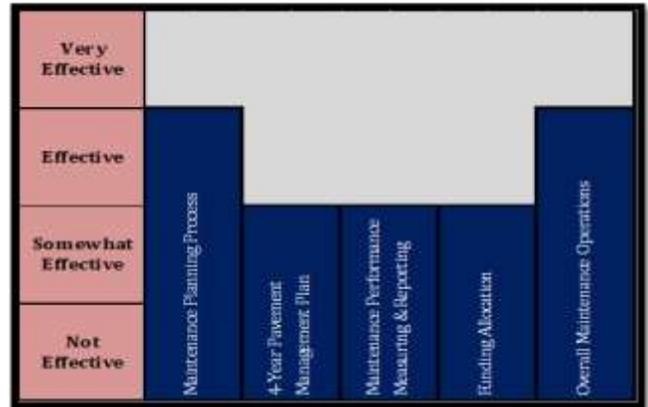

Figure 1: Group Consensus

Maintenance Planning Process

The general consensus reached during the Facilitated Consensus Meeting on Ratings was that the Maintenance Planning Process at TxDOT is "Effective". The Peers appreciated TxDOT's systematic approach to maintenance based on formulas and actual measured highway system needs. According to them the process seems to be working well overall.

The current process was considered 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. They 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. The system was praised as "well-established" and the four-year plan was appreciated. However improvements suggested included using a more holistic statewide approach for funding rather than the current district-based approach. It was 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.

Figure 2: Maintenance Planning Process

The two most important strengths of the TxDOT maintenance planning process selected unanimously during the Peer review process were cited as:

1. Excellent communication with the personnel working in the field, and

2. The TxTAP (Texas Traffic Assessment Program) and TxMAP (Texas Maintenance Assessment Program) 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.

Several other strengths were identified by the Peers individually. Caltrans' Steve Takigawa thought 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 on the field.

Roy Rissky from MoDOT responded that the two most important strengths of the TxDOT maintenance planning process were the PMIS, and the four-year planning process.

Eric Pitts from GDOT was of the opinion that the main strengths of TxDOT's approach to maintenance planning lay in the accountability of managers, and the managers' involvement in the planning process.

According to Jim Carney of KDOT the emphasis on pavement preservation, especially the use of a seal coat program, and the Central Office-led TxMAP and TxTAP inspection programs, which ensure statewide consistency were significant strengths of the TxDOT's maintenance planning program.

NCDOT's Jennifer Brandenburg considered the process' two main strengths to be the use of a 2030 Committee to evaluate the needs of the system, which she feels garners support from the industry, and 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.

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.

Among the weaknesses that were discussed, the peers agreed that the two main weaknesses of TxDOT's maintenance planning process were a lack of consideration for performance measures, and 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. Other weaknesses cited include TxDOT's lack of recorded pavement histories, the relatively poor quality of the work-zone devices, and the difficulties in maintaining consistency between districts and areas posed by the current plan to change the mowing width and number of cycles.

The length of TxDOT planning process, the four-year plan was also considered as a weakness. The plan was considered to be appropriate for operations like seal coats but too short for bigger construction and rehabilitation projects.

The peers indicated that though TxDOT's maintenance planning process is working reasonably well, yet a few improvements would make the performance even better. It was suggested that TxDOT should tie performance measures to the planning process, maintenance operations should be planned according to the needs of the entire state, and bridge maintenance should be made a higher priority.

Additional improvement measures discussed were formulation of a plan that will prepare the organization in case that reduced funding and building up the experience of the in-house personnel in case funding for contracted operations is ever decreased. It was also suggested that TxDOT expand its repertoire of treatments beyond seal coats and overlays, as sometimes more expensive treatments yield better results. Finally it was proposed that Level of Service (LOS) information should be incorporated into the planning process, condition data should be used to allocate resources, and district engineers should be held accountable for LOS.

4-Year Pavement Management Program Development

During the Facilitated Consensus Meeting on Ratings, the peers rated the 4-year pavement management program development process as effective which was a compromise between their varied opinions. Some of the peers stated that involving the districts in the development of the plan was an excellent way to begin the process and believed that the program would be effective because it provided a direction for TxDOT as a whole, although third and fourth years of the plan were still uncertain entities. However, a few of them felt that although the 4-year plan seemed to be effective at the current time, the assessment could be premature.

Peers recognized the need for the Four-year Pavement Management Plan to be very effective in the future as it would enable TxDOT to plan out future maintenance operations while allowing flexibility in the event of changing pavement conditions or levels of funding. The synchronization with which TxDOT's district offices worked

with the central office to develop the plan was appreciated. However, it was also felt by some that TxDOT should use deterioration curves developed from good cross-section measurements and consistent pavement condition measurements rather than just relying on assumptions. Overall, it was felt that consideration of long-term goals is a positive move for TxDOT. The plan effectively communicated roles and responsibilities to the field.

The individual ratings of the Four-year Pavement Management Plan are illustrated in the figure below:

Figure 3: 4-Year Pavement Management Plan

Several strengths of the 4-year pavement management program development process were identified by the Peers. The program's ability to provide the districts with a process to follow and manage and the flexibility it offers in the third and fourth years were recognized as obvious advantages. Additional strengths noted were the coordination between maintenance contracts with in-house maintenance efforts, the use of well-maintained cost records to support the budget, the peer exchange process between districts, the use of contract raters, which eliminated bias and the use of analysis tools like Mapzipper and ProviewLite, which provided district personnel with visual representations of their plans. Finally the ability of the system to communicate roles and responsibilities to the field, and the mapping process of the four-year plan itself were also noted as strengths.

Among the weaknesses identified, the top two weaknesses of TxDOT's Four-year Pavement Management Program were the use of visual condition ratings and opinions of expert staff members to make pavement decisions rather than the use of data and condition surveys or deterioration curves, and the current reporting system's inability to effectively communicate the financial needs of the DOT to legislatures. Additionally, some peers felt that the lack of deterioration curves and pavement substructure data was another weakness of the program. Thus, changes were suggested by the Peers to improve the efficiency of the program

The three most important changes suggested to improve the 4-year pavement management program development process selected unanimously during the Peer review process were cited as:

1. Shifting the plan to a statewide focus. The peers 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.

2. Increasing 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. Breaking down the plans into specific goals for each person in TxDOT, and then holding that person accountable for meeting those goals.

Additional improvements suggested include limiting the amount of control the districts had over the funding they received and to continue making efforts to improve the data for years three and four of the program, as the four-year plan would not be sustainable unless this data was improved.

It was also recommended that the pavement rating method be changed from one utilizing contract raters to one using in-house staff or technology, as the two latter methods would increase consistency.

Maintenance Performance Measurement and Reporting

The Maintenance performance measurement and reporting of TxDOT were considered effective only to a certain extent by the Peers. It was stated that the measurements used in this process were very effective, but the communication of what those measurements were and what they meant to the legislature and the public needed improvement. The peers expressed concern over the lack of consistency between the information reported using three different systems (PMIS, TxMAP and TxTAP). The need to compile the information from each system into one consistent message was stressed upon. It was perceived that the current system is too focused on collecting and reporting data, rather than using the data collected to make decisions.

The ratings are reflected in the graph below:
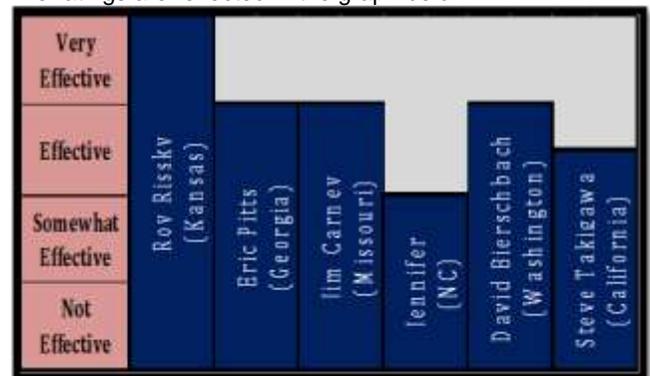
Figure 4: Maintenance Performance Measurement and Reporting

Roy Rissky 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. Jim Carney wrote that TxMAP was using 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. Jennifer Brandenburg clarified her rating by focusing on the problems with TxDOT's rating system. She pointed out that 4100 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 could be rating an unnecessarily high number of traffic features and should scale down to reduce redundancy. David Bierschbach wrote that the current process was effective in that it is well understood by the staff. According to Steve Takigawa, the system was measuring an unnecessary number of activities which made 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.

The two most important strengths of the TxDOT maintenance performance and reporting selected unanimously during the Peer review process were cited as:

1. The centrally-managed TxMAP and TxTAP systems, and

2. The year-round rating practices utilizing consistent raters.

Other advantages of TxDOT's maintenance performance and reporting system that were recognized include TxDOT's historical information, which allows system trends to be discovered that are supported by actual data, the statistical quality of TxDOT's historical data, limited number of people performing evaluations that allows increased control over the data, statewide quality control performed by central office staff and the high quality of the roadway and roadside condition assessments due to TxDOT's one mile drive-by samples. The practice of giving feedback to the districts immediately after the ratings were completed was highly appreciated.

The peers also identified certain weaknesses of the system. Roy Rissky identified the lack of data covering historical actions on the current pavement layers as the main weakness. This lack of data according to him would reduce TxDOT's ability to predict future actions using existing pavement performance records. According to Eric Pitts, the main strength of the system was also its primary weakness: a limited number of people performing the evaluations allowed for increased control over the data, but it also prevented 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. Jim Carney reported that the system's main weakness was the drive-by sampling process, which could not provide a comprehensive review

of features like pipe drainage, edge drop-off, or break-away signpost details. According to Jennifer Brandenburg, the weaknesses of TxDOT's maintenance performance and reporting were the statistical unreliability of the sample size used for TxTAP and the unnecessary level of detail in the TxTAP evaluations. Thus, changes were suggested by the peers to improve the efficiency of the system.

Eric Pitts suggested that the ratings would have been 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. He also highlighted the need for district involvement in the review process, especially in one's own areas. He commented that 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.

Jim Carney 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. He recommended switching traffic to 30% and roadside to 20%. 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.

Roy Rissky stressed the importance of collecting work history data in order to calculate service life for the treatments used. According to him, if TxDOT knew how long past actions have lasted, the maintenance performance would be much improved. He also 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.

Jennifer Brandenburg suggested that the data should be used to hold the districts accountable for the condition of the system.

David 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.

Steve Takigawa advised TxDOT to consider how performance measures could be more closely tied to allocations and pavement decisions. He found TxDOT's system to be too detailed and suggested defining the top five to ten activities and creating corresponding performance rating goals. He recommended making the priorities of the maintenance program clear. Additionally, he recommended using the system to take specific actions based on the results obtained as any item that was rated and not implemented was a wasted resource and should be eliminated.

Funding Allocation Process (Funding Levels and Allocation Formula)

The general consensus was that TxDOT's funding allocation process was effective. These results are represented in the graph below:
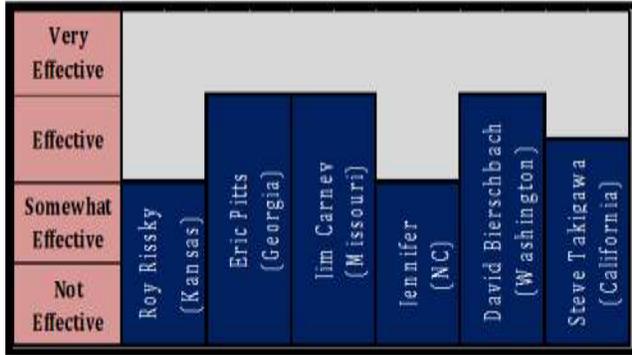
Figure 5: Funding Allocation

It was felt that the current system would be only somewhat effective in the future, although the system had been effective in the past. Pavement maintenance systems had a high dependency on the availability of funds. Given the recent downturn in the overall economy, the effectiveness of TxDOT's funding allocation system was doubtful.

The formulae for funding were perceived as being unnecessarily complex, as they used 56 specific functions in determining funds allocation. As a comparison, NCDOT's system was quoted that uses a more general formula in which funds were allocated throughout the state and the divisions are then accountable for achieving the desired Level of Service. Funds should only be used on the projects for which they were allocated.

The peers focused on the lack of improvements the current allocation process aimed to achieve in any activities or areas, suggesting that the current budget had not improved upon the previously derived budgets. However, the effectiveness of the current funding allocation approach with regards to the sustainability of the TxDOT maintenance program was noted.

The peers identified several strengths of the funding allocation. Eric Pitts responded that the primary strength of TxDOT's funding allocation process was that the formulae made the process easily repeatable and reportable. Steve Takigawa 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. David Bierschbach commented that TxDOT has a well-defined process for funding allocation that would facilitate districts in planning for a consistent budget each year based on inventory. Roy Rissky considered the primary strength of the funding allocation program as its effectiveness for routine maintenance needs. According to Jim Carney, separation of preservation cycles by traffic volume and average rainfall and the high level of detail in the pavement selection criteria were the two main strengths of the process. Jennifer Brandenburg listed that

separate funding allocation for pavement rehabilitation was the program's main strength.

However, the peers also identified the weaknesses of the funding allocation process. Eric Pitts responded that the main weakness of the funding allocation process was the lack of a state-wide approach. He also identified that the process relied on historical funding data to distribute funds rather than the current known needs of the system. Jennifer Brandenburg found the process' primary weakness to be the lack of connection between funding and pavement condition and David Bierschbach seconded this conclusion. She also reported that the complexity involved with funding to the function level and the lack of connection between the desired level of service (LOS) and the funding formulae were disadvantageous. Roy Rissky felt that the practice of allocating funds without considering the actual needs of the district was its major drawback. He suggested that some districts might 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. He also considered the process' reliance on contracted maintenance as a weakness as he believed that the amount of funding TxDOT would receive in the future would not be sufficient to fund all of the maintenance needs as contract work. Jim Carney opined that the two main weaknesses of the process were the unnecessarily high number of roadside factors included in the formulae and the lack of emphasis on bridge maintenance. Steve Takigawa felt that the two most significant weaknesses of the process were the freedom districts had over how funds are utilized and the practice of inventory-based funds allocation. He stressed the importance of allotting funds where it was really needed and then ensuring the funds were used on those identified needs. Thus, changes were suggested by the peers to improve the efficiency of the process.

The peers agreed that the single most important change TxDOT could make to the funding and allocation process was moving from inventory-based funding to condition-based funding. They stressed the importance of tying funding allocation to the condition of the roadway and the system.

The peers recommended generalizing the formulae instead of tracking features in granular detail. It was also suggested that the language used to communicate funding requests to the legislature be changed. The general consensus from the peers was that asking for funding for either a "tolerable" or "desirable" LOS was not the most politically effective means of expressing the department's needs. Everyone's definition of "tolerable" was different, and therefore, the department should be more precise when asking for funding. It was also advised that the allocations should be moved from a historical data-based model to a predictive model derived from pavement condition surveys. Creating a performance-based funding allocation process that considered the priorities of the entire state rather than the current formula-based process was considered to be more useful. The maintenance priorities should be clearly defined to enable statewide monitoring.

The peers expressed concern over funding districts with the lowest condition ratings which according to them was essentially rewarding poor decision-making. They suggested that the districts should be held accountable for making the improvements for which they were given funding and the contract pavement funds should be distributed on a statewide needs basis rather than district-by-district. A few suggested factoring the roadway condition data into the funding allocation process to ensure that funds were supplied where they were most needed.

Overall Maintenance Operations

Overall the peers rated TxDOT's maintenance operations as effective.
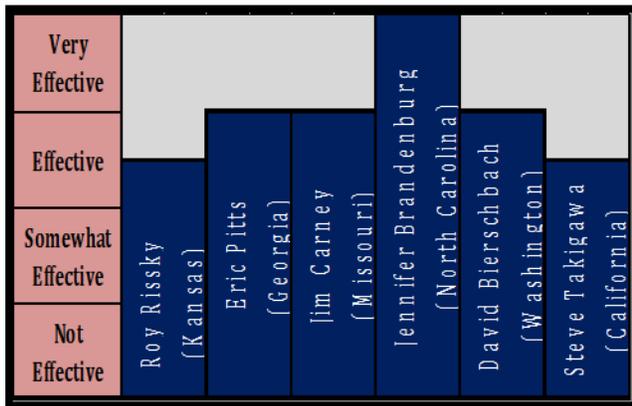
Figure 6: Overall Maintenance Operations

According to Mr. Rissky, 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.

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 believed would 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 six corridors in lieu of ten districts and considering regional concepts for bridge maintenance and striping operations.

North Carolina's Jennifer Brandenburg stated that TxDOT is a model for a lot of the contracting practices at NCDOT, such as the comprehensive contracts. She considered the peer review program as a very effective tool for communicating best practices across the organization. WSDOT's David Bierschbach appreciated the competency and dedication of the staff in particular and was impressed by the program overall.

Steve Takigawa of Caltrans was of the opinion that TxDOT's reporting is strong and very thorough and TxDOT's efforts to communicate with the field staff and develop mid-range plans for the system's pavement are excellent. However, he 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.

During the Facilitated Consensus Meeting on Ratings, the peers reached a consensus as to the three main strengths of TxDOT maintenance operations. The primary strength cited was TxDOT's knowledgeable staff, composed of people who take pride in their work. Next the peer review program was believed to be of considerable value and should be continued. Finally, TxDOT's willingness to evaluate and improve their program was considered a significant strength in itself.

Other notable strengths of TxDOT's maintenance program mentioned were the ability to supplement the workforce with contract work, the commitment to pavement preservation, the minimal amount of brush and undesirable vegetation on the roadsides, the contracting methods and the willingness of the department to seek new, more efficient and effective methods.

The peers also reached a consensus on the two main weaknesses of TxDOT's maintenance operations. The first weakness was the allocation of funding by district rather than condition. Second, 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.

Additional weaknesses cited include the high number of activities contracted out, which could potentially result in lost expertise among the in-house staff, the mowing height, and an excessive number of crack seals. It was felt that the mowing height of 30 inches was possibly too high.

Some improvements that were suggested are working toward a statewide pavement preservation plan and collecting historical data on pavement treatments through district records or pavement analysis. 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. Jim Carney of MODOT encouraged the continuation of the district peer exchanges, which he feels promotes consistency and the sharing of best practices. 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. David Bierschbach of WSDOT advised seeking new, more effective ways of communicating performance measures and their meanings to the legislature and the public. 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.